ARIZONA DEPARTMENT OF TRANSPORTATION

ADVERTISEMENT FOR BIDS

SPECIAL PROVISIONS

BIDDERS DOCUMENTS

TRACS/Proj. No.:

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

Contracts and Specifications Group
205 S. 17TH Ave., 2nd Floor, M/D 121F
Phoenix, Arizona 85007-3217

ARIZONA DEPARTMENT OF TRANSPORTATION

ADVERTISEMENT FOR BIDS

BID OPENING: FRIDAY, NOVEMBER 13, 2026, AT 11:00 A.M. (M.S.T.)

TRACS NO	010 CH 383 F0728 01C
PROJECT NO	010-F(238)T
TERMINI	BENSON-STEINS PASS HIGHWAY (I-10)
LOCATION	SAN SIMON PORT OF ENTRY

ROUTE NO.	MILEPOST	DISTRICT	ITEM NO.
I-10	383.07 to 383.40	SOUTHEAST	104462

The amount programmed for this contract is $11,614,000. The location and description of the proposed work are as follows:

The proposed project is located in Cochise County at the San Simon Port of Entry (POE) on Interstate 10 (I-10) eastbound (EB), just west of the New Mexico border between mileposts 383.07 to 383.40. The proposed work consists of constructing a new inspection building, new static scale, new Portland cement concrete pavement, parking areas a new remote access-controlled gate, a new water well and a new hazmat containment facility. Additional work includes reconstructing sewer, CCTV security systems, water and roadway lighting systems, constructing drainage features, new pavement markings, new well, signing, and other miscellaneous work.

A site visit will be held on Tuesday, October 20, 2026. The site visit will begin from 10:30 am at the San Simon Port of Entry. The meeting location will be at the west end of the Canopy. Contractors can enter the port from WB I-10 and instead of going over the scale veer left under the overhead canopy. There is vehicle parking west of the canopy and the meeting location will be at the west end of the Canopy. An ADOT representative will be on site to unlock buildings for contractors. All questions shall be submitted through the Bid Express (Bidx) website, as specified herein.

The time allowed for the completion of the work included in this contract will be 445 working days.

The Arizona Department of Transportation, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to §§ 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

Contract documents, and other project documents, if applicable, are available as electronic files, at no charge, from the Department's website through the ADOT Contracts and Specifications Group (https://azdot.gov/business/contracts-and-specifications/current-advertisements).

Documents will be available within one week following the advertisement for bids.

To submit a valid bid, the bidder must (1) have prequalification from the Department as necessary for the project, and (2) be included on the project Plansholder List as a Prime.

The Application for Contractor Prequalification may be obtained from the Contracts and Specifications website.

This project requires electronic bidding. If a request for approval to bid as a Prime Contractor is received less than five working days prior to bid opening, the Department cannot guarantee the request will be acted on.

This contract is subject to the provisions of Arizona Revised Statutes Section 42-5075 -- Prime contracting classification; exemptions; definitions.

No award will be made to any contractor who is not a duly licensed contractor in accordance with Arizona Revised Statutes 32-1101 through 32-1170.03.

All labor employed on this project shall be paid in accordance with the minimum wage rates shown in the General Wage Decision. These rates have been determined in accordance with the requirements of the law and issued by the Secretary of Labor for this project. The wage scale is on file in Contracts and Specifications Section and copies may be obtained at all reasonable times.

Persons that require a reasonable accommodation based on language or disability should contact ADOT's Contracts and Specifications Office by phone (602) 712-7221. Requests should be made as early as possible to ensure the State has an opportunity to address the accommodation.

Las personas que requieran asistencia (dentro de lo razonable) ya sea por el idioma o discapacidad deben ponerse en contacto con ADOT (602) 712-7221.

The bidder shall provide an electronic proposal guaranty payable to the Arizona Department of Transportation for 10 percent of the amount of the bid.

Prior to the bid opening date, any questions pertaining to the project documents shall be submitted to the Department in a written format through the Bid Express (Bidx) website at https://www.bidx.com/az/lettings. Questions shall be submitted through the Questions and Answers (Q&A) link located within the corresponding letting date and project proposal number links. The Department may not answer all questions, and any decision on whether a question is answered will be within the sole discretion of the Department. Any questions received less than three working days prior to the bid opening date may not be answered.

The Engineering Specialist assigned to this project is: Brandon Campbell, bcampbell2@azdot.gov, any correspondence with the Engineering Specialist is subject to posting onto Bidx through the project's Q&A link. Answers to questions will not be given verbally, but will be posted exclusively to the Bidx website.

Brahama Singh, PE,
Group Manager,
Contracts & Specifications

Project Advertised on: 9/18/26

SPECIAL PROVISIONS

FOR

ARIZONA PROJECT

010 CH 383 F0728 01C

010-F(238)T

BENSON-STEINS PASS HIGHWAY (I-10)

SAN SIMON PORT OF ENTRY

SITE IMPROVEMENTS

PROPOSED WORK:

The proposed project is located in Cochise County at the San Simon Port of Entry (POE) on Interstate 10 (I-10) eastbound (EB), west of the New Mexico border between mileposts 383.07 to 383.40. The proposed work consists of constructing an inspection building, a static scale, Portland cement concrete pavement, parking areas, a remote access-controlled gate, a water well and a hazmat containment facility. Additional work includes reconstructing sewer, CCTV security systems, water and roadway lighting systems, constructing drainage features, new pavement markings, signing, and other miscellaneous work.

PROFESSIONAL ENGINEERS SEALS

These Special Provisions represent the combined efforts of the following organizations:

(1) Kimley-Horn and Associates, Inc.
(2) Ethos Engineering, LLC
(3) Y2K Engineering
(4) Clear Creek Associates

A representative of each organization has affixed their seal below, which attests that portions of these Special Provisions were prepared under their direction.

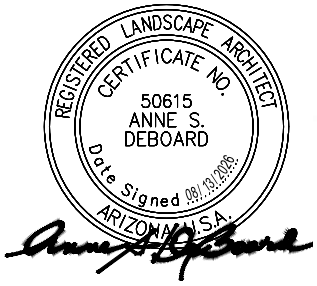
Kimley-Horn and Associates
(Civil)

Kimley-Horn and Associates
(Traffic)

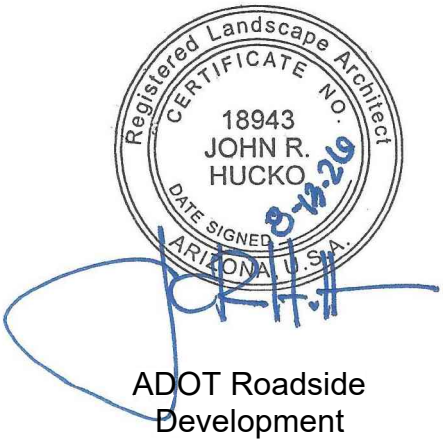
Kimley-Horn and Associates
(Electrical)

Expires 12/31/27

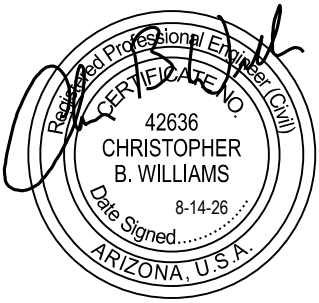
Kimley-Horn and Associates
(Water/Wastewater)



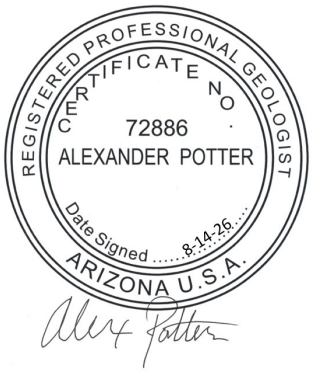
Kimley-Horn and Associates
(Erosion Control)



ADOT Roadside Development
(Seeding)



Y2K Engineering
(Signage & Utilities)



Clear Creek Associates
(Water Facilities)

Ethos Engineering
(Geotechnical)

Kimley-Horn and
Associates
(Drainage)

(SPC00FA, 03/19/26)

SPECIFICATIONS:

The work embraced herein shall be performed in accordance with the requirements of the following separate documents:

Arizona Department of Transportation, Standard Specifications for Road and Bridge Construction, Edition of 2021,

Arizona Department of Transportation, Roadway Engineering Group, Construction Standard Drawings, listed in the project plans, and available on the Department's website,

Arizona Department of Transportation, Traffic Engineering Group, Manual of Approved Signs, available on the Department's website,

Arizona Department of Transportation, Traffic Engineering Group, Temporary Traffic Control Design Guidelines, dated April, 2025, available on the Department's website,

Manual on Uniform Traffic Control Devices for Streets and Highways, 2023 edition and Arizona Supplement to the 2023 edition, dated January, 2026,

The Proposal Pamphlet which includes the following documents:

These Special Provisions,

Appendix A Section 33 32 16.01 Packaged Wastewater Grinder Pump Assemblies

Appendix B Steel Casing Specification (Adapted from Maricopa Association of Governments (MAG) Standard Specifications for Public Works Construction, Section 602)

Appendix C Arizona Department of Water Resources (ADWR) Well Abandonment Handbook

Appendix D Subgrade Acceptance Chart

Appendix E Slump Loss Test of Portland Cement Concrete

Appendix F Section 920 Architectural Specifications

Required Contract Provisions Federal-Aid Construction Contracts (Form FHWA 1273 Revised October 23, 2023),

Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246), July 1, 1978, Revised November 3, 1980 and Revised April 15, 1981,

Title VI / Non-Discrimination Assurances,

Appendix A

Appendix E,

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246), July 1, 1978, Revised November 3, 1980 and Revised April 15, 1981,

Equal Employment Opportunity Compliance Reports, Federal-Aid Projects, February 1, 1977, Revised July 1, 1978, Revised November 3, 1980, Revised April 15, 1981, Revised September 7, 1983, Revised October 15, 1998, Revised January 1, 2005, Revised August 1, 2005, and Revised March 1, 2015,

Wage Determination Decision,

Bidding Schedule,

Proposal,

Surety (Bid) Bond, 12-1303,

Certification With Regard to the Performance of Previous Contracts or Subcontracts Subject to the Equal Opportunity Clause and the Filing of Required Reports, Federal Aid Projects, April, 1969, Rev. July, 2003,

Certification With Respect to the Receipt of Addenda,

Participation in Boycott of Israel Certification Form,

Forced Labor of Ethnic Uyghurs Ban Certification Form, Rev. November 2022.

BID SUBMISSION:

In submitting a bid, the bidder shall completely execute the following documents:

Proposal,

Bidding Schedule,

Surety (Bid) Bond, 12-1303,

Certification With Regard to the Performance of Previous Contracts or Subcontracts Subject to the Equal Opportunity Clause and the Filing of Required Reports, Federal Aid Projects, April, 1969, Rev. July, 2003,

Certification With Respect to the Receipt of Addenda,

Participation in Boycott of Israel Certification Form, and

Forced Labor of Ethnic Uyghurs Ban Certification Form, Rev. November 2022.

PROPOSAL GUARANTY:

Each bidder is advised to satisfy itself as to the character and the amount of the proposal guaranty required in the Advertisement for Bids.

CONTRACT DOCUMENTS:

The bidder to whom an award is made will be required to execute a Performance Bond and a Payment Bond, each in 100 percent of the amount of the bid, an Insurance Certificate and the Contract Agreement.

A copy of these documents is not included in the Proposal Pamphlet; however, each bidder shall satisfy itself as to the requirements of each document.

The documents, approved by the Department of Transportation, Highways Division, are identified as follows:

Statutory Performance Bond, 12-1301, September, 1992

Statutory Payment Bond, 12-1302, September, 1992

Contract Agreement, 12-0912, August, 2000

Certificate of Insurance, 12-0100, June, 1998

A copy of each document may be obtained by making a request to Contracts & Specifications.

MATERIAL AND SITE INFORMATION:

Projects requiring materials, excavation, or site investigation may have additional information available concerning the material investigations of the project site and adjacent projects. This information, when available and applicable, may be examined in the Office of the Bridge Group-Geotechnical Services, located at 205 S. 17th Avenue, Phoenix, AZ 85007-3212. The contractor may contact Bridge Group at (602) 712-7481 to schedule an appointment to examine the information. This information will not be attached to the contract documents.

(EPRISENGL-IFR)

DISADVANTAGED BUSINESS ENTERPRISES:

1.0 Policy:

The Arizona Department of Transportation (hereinafter the Department) has established a Disadvantaged Business Enterprise (DBE) program in accordance with the regulations of the U.S. Department of Transportation (USDOT), 49 Code of Federal Regulation Part 26 (49 CFR Part 26), as revised by the USDOT DBE Interim Final Rule (IFR) issued October 3, 2025 (hereinafter referred to as IFR).

The Department has received Federal financial assistance from the U.S. Department of Transportation and as a condition of receiving this assistance, the Department has signed an assurance that it will comply with 49 CFR Part 26, as revised by the IFR.

It is the policy of the Department to ensure that DBEs (hereinafter DBE or DBE firm), as defined in Part 26, have an equal opportunity to receive and participate in USDOT-assisted contracts. It is also the policy of the Department:

(A) To ensure nondiscrimination in the award and administration of USDOT-assisted contracts;

(B) To create a level playing field on which DBEs can compete fairly for USDOT-assisted contracts;

(C) To ensure that the DBE program operates in a nondiscriminatory manner and without regard to race or sex, while maximizing efficiency of service;

(D) To ensure that only firms that fully meet 49 CFR Part 26 eligibility standards are counted as DBEs;

(E) To help remove barriers to the participation of DBEs in USDOT-assisted contracts,

(F) To assist in the development of firms that can compete successfully in the market place outside the DBE program; and

(G) To promote the use of DBEs in all types of federally-assisted contracts and procurement activities.

It is also the policy of the Department to facilitate and encourage participation of Small Business Concerns (SBCs), as defined herein, in USDOT-assisted contracts. The Department encourages contractors to take reasonable steps to eliminate obstacles to SBCs' participation and to utilize SBCs in performing contracts.

2.0 Assurances of Non-Discrimination:

The contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, sex or national origin in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 as revised by the IFR in the award and administration of USDOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the State deems appropriate, which may include, but are not limited to:

(A) Withholding monthly progress payments;

(B) Assessing sanctions; and/or

(C) Disqualifying the contractor from future bidding as non-responsible.

The contractor, subrecipient, or subcontractor shall ensure that all subcontract agreements contain this non-discrimination assurance.

3.0 Definitions:

(A) Commercially Useful Function (CUF): Commercially Useful Function is defined in 49 CFR Part 26.55. That definition is incorporated herein by reference.

(B) Disadvantaged Business Enterprise (DBE): A DBE, as defined in 49 CFR Part 26.5, is a for-profit small business concern which meets both of the following requirements:

(1) Is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged; and,

(2) Whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

(C) Joint Check: a two-party check between a subcontractor, DBE and/or non-DBE, a prime contractor and the regular dealer of material supplies.

(D) Joint Venture: an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

(E) NAICS Code: The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the US business economy.

(F) Non-DBE: any firm that is not a DBE.

(G) DBE Conscious: a measure or program that is focused specifically on assisting only DBEs.

(H) DBE Neutral: a measure or program that is, or can be, used to assist all small businesses.

(I) Small Business Concern: a business that meets all of the following conditions:

1. Operates as a for-profit business.

2. Operates a place of business primarily within the U.S. or makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials, or labor.

3. Is independently owned and operated.

4. Is not dominant in its field on a national basis; and

5. Does not have annual gross receipts that exceed the Small Business Administration size standards average annual income criteria for its primary North American Industry Classification System (NAICS) code.

(J) Socially and Economically Disadvantaged Individuals: Socially and Economically Disadvantaged Individuals is defined in 49 CFR Part 26.5, as revised by the IFR. That definition is incorporated here.

(1) Any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who a certifier finds to be socially and economically disadvantaged on an individual basis.

(2) A determination that an individual is socially and economically disadvantaged must not be based in whole or in part on race or sex. For that reason, all applicants shall qualify as socially and economically disadvantaged if they can demonstrate that they can meet the relevant criteria described in 49 CFR Part 26.67.

(3) Being born in a particular country does not, standing alone, mean that a person is necessarily socially and economically disadvantaged.

4.0 Working with DBEs:

The Department works with DBEs and assists them in their efforts to participate in the highway construction program. All bidders should contact the Department's Small Business and Workforce Development (SBWD) by phone, through email, or at the address shown below, for assistance in their efforts to use DBEs in the highway construction program of the Department. SBWD contact information is as follows:

Arizona Department of Transportation
Small Business and Workforce Development
1801 W. Jefferson Street, Ste. 101, Mail Drop 154A
Phoenix, AZ 85007
Phone (602) 712-7761
Email: ContractManagement@azdot.gov
Website:www.azdot.gov/business/small-business-and-workforce-development

4.01 Business Development Program:

The Department has established the Business Development Program as an initiative to encourage and develop disadvantaged businesses in the highway construction industry. The Department is committed to providing new, emerging, developmental and transitional DBEs with general and firm-specific training and technical assistance. The Department intends for this assistance to aid DBEs to become competitive within the heavy highway and construction industry market places. In particular, the Department's Small Business Services(SBS) is

designed to work in collaboration with stakeholder organizations (including departments and agencies of State and Federal Governments, small business organizations, tribal governments, profit and nonprofit corporations) to help DBEs to successfully compete for highway construction projects and become self-sufficient. The program provides educational opportunities for DBEs regarding current market conditions, Federal regulatory compliance, and best business practices. These efforts are reinforced with one-on-one business counseling for DBEs certified in areas that directly support Federal-aid highway projects, small group workshops, conferences, business expositions, regular in-person training opportunities, and regular virtual training opportunities. For guidance regarding this program, refer to the Business Development Program Guidelines available on the SBWD website at https://azdot.gov/business/small-business-and-workforce-development/dbe-supportive-services/business-development-program/disadvantaged-business-enterprise-dbe-program/dbe

The Business Development Program is intended to increase legitimate DBE activities. The program operates in conformity with the Federal DBE rules and regulations. The Department's DBE/SS participants may not circumvent the Federal DBE rules or regulations.

5.0 Applicability:

During the transition period, the IFR provides that until the Arizona Unified Certification Program (UCP) completes the recertification process, the Department may not 1) set any DBE contract goals or 2) count any participation towards its overall DBE goal.

The Department has established an overall annual goal for DBE participation on Federal-aid contracts. The Department intends for the goal to be met with a combination of DBE conscious efforts and DBE neutral efforts once the DBE recertification process is completed in accordance with the IFR. DBE conscious participation occurs where the contractor uses a percentage of DBEs, as defined herein, to meet the contract-specified goal. DBE neutral efforts are those that are, or can be, used to assist all small businesses or increase opportunities for all small businesses. The regulation, 49 CFR 26, as revised by the IFR describes DBE neutral participation as when a DBE wins a prime contract through customary competitive procurement procedures or is awarded a subcontract on a prime contract that does not carry a DBE contract goal.

The provisions are applicable to all bidders.

6.0 Certification and Registration:

6.01 DBE Certification:

Certification as a DBE shall be predicated on:

(A) The completion and execution of an application for certification as a "Disadvantaged Business Enterprise".

(B) The submission of documents pertaining to the firm(s) as stated in the application(s), including but not limited to a statement of social disadvantage and a personal financial statement.

(C) The submission of any additional information which the Department or the applicable Arizona Unified Certification (UCP) agency may require to determine the firm's eligibility to participate in the DBE program.

(D) The information obtained during the on-site visits to the offices of the firm and to active job-sites.

Application Submission. Applications for Disadvantaged Business Enterprise (DBE) certification may be filed with the Department or the applicable UCP agency at any time through the Arizona Unified Transportation Registration and Certification System (AZ UTRACS) website at https://utracs.azdot.gov/Home.

Implementation of Revised Federal Standards. Effective October 3, 2025, all certification applications and renewals shall be reviewed and processed in accordance with the 49 CFR Part 26 as revised by the IFR. The revised rule modifies certification standards, documentation, and evidentiary requirements applicable to determinations of social and economic disadvantage, business size, ownership, and control.

Transition Period. During the transition period in which the Department and participating UCP agencies are updating internal procedures and the AZ UTRACS system to implement the revised rule, certification applications may continue to be submitted through the existing online platform. Applicants submitting applications during this period may be required to furnish additional or supplemental documentation consistent with the revised certification criteria upon system update or upon request by the certifying agency.

All applicants, whether filing initial or renewal applications, shall comply with any new or amended federal documentation requirements that become effective under 49 CFR Part 26 as revised by the IFR, including but not limited to personal narrative statements, financial disclosures, and supporting affidavits required to demonstrate eligibility under the revised standards.

The Department is a member of the AZ Unified Certification Program (AZUCP). During the transition period, the list of firms listed in AZ UTRACS were certified prior to October 3, 2025, not in accordance with the IFR, and therefore do not count for DBE credit, unless otherwise noted in AZ UTRACS. The list indicates contact information and specialty for each DBE firm and may be sorted in a variety of ways. However, the Department does not guarantee the accuracy and/or completeness of this information, nor does the Department represent that any licenses or registrations are appropriate for the work to be done.

The Department’s certification of a DBE is not a representation of qualifications and/or abilities only that the firm has met the criteria for DBE certification as outlined in 49 CFR Part 26, as revised by the IFR. The contractor bears all risks of ensuring that DBE firms selected by the contractor are able to perform the work.

6.02 SBC Registration:

To comply with 49 CFR Part 26.39, the Department’s DBE Program incorporates contracting requirements to facilitate participation by Small Business Concerns (SBCs) in federally

assisted contracts. SBCs are for-profit businesses registered to do business in Arizona that meet the Small Business Administration (SBA) size standards for average annual revenue criteria for its primary North American Industry Classification System (NAICS) code.

While the SBC component of the DBE program does not require utilization goals on projects, the Department encourages contractors to utilize small businesses that are registered in AZ UTRACS on their contracts, in addition to DBEs meeting the certification requirement in accordance with the IFR. However, SBCs that are not DBEs will not be counted toward DBE participation.

SBCs can register online at the AZ UTRACS website at http://utracs.azdot.gov/Home/. The Department's registration of SBCs is not a representation of qualifications and/or abilities. The contractor bears all risks of ensuring that SBC firms selected by the contractor are able to perform the work.

7.0 DBE Financial Institutions:

The Department thoroughly investigates the full extent of services offered by financial institutions owned and controlled by socially and economically disadvantaged individuals in its service area and makes reasonable efforts to use these institutions. The Department encourages prime contractors to use such institutions on USDOT assisted contracts. However, use of DBE financial institutions will not be counted toward DBE participation.

The Department encourages prime contractors to research the Federal Reserve Board website at www.federalreserve.gov to identify minority-owned banks in Arizona derived from the Consolidated Reports of Condition and Income filed quarterly by banks (FFIEC 031 and 041) and from other information on the Board's National Information Center database.

8.0 Time is of the Essence:

TIME IS OF THE ESSENCE IN RESPECT TO THE DBE PROVISIONS.

9.0 Computation of Time:

In computing any period of time described in this DBE special provision, such as calendar days, the day from which the period begins to run is not counted. When the last day of the period is a Saturday, Sunday, or Federal or State holiday, the period extends to the next day that is not a Saturday, Sunday, or Federal or State holiday. When the Department's offices are closed for all or part of the last day, the period extends to the next day on which the Department's offices are open.

10.0 Contractor and Subcontractor Requirements:

10.01 General:

The contractor shall establish a DBE program that will ensure nondiscrimination in the award and administration of contracts and subcontracts.

Agreements between the bidder and a DBE in which the DBE promises not to provide subcontracting quotations to other bidders are prohibited.

10.02 Blank:

11.0 Bidders/Proposers List and AZ UTRACS Registration Requirement:

Under 49 CFR Part 26.11, DOTs are required to collect certain information from all contractors and subcontractors who seek to work on federally-assisted contracts in order to set overall and contract DBE goals. The Department collects this information through a Bidders/Proposers List when firms register their companies on the Arizona Unified Transportation Registration and Certification System (AZ UTRACS) web portal at http://utracz.azdot.gov/Home/ a centralized database for companies that seek to do business with the Department. This information will be maintained as confidential to the extent allowed by Federal and State law.

All prime contractors, subcontractors, and DBEs shall: 1) register in AZ UTRACS, and 2) maintain their profile with current and accurate firm information. Bidders may verify that their firm and each subcontractor is registered using the AZ UTRACS website.

Bidders may obtain additional information at the AZ UTRACS website or by contacting SBWD.

Bidders shall create the Bidders/Proposers List in the AZ UTRACS by selecting all subcontractors, service providers, manufacturers and suppliers that expressed interest or submitted bids, proposals or quotes for this contract. The Bidders/Proposers List form must be complete and must include the names for all subcontractors, service providers, manufacturers and suppliers regardless of the bidders' intentions to use those firms on the project.

All bidders must complete the Bidders/Proposers List online at AZ UTRACS whether they are the apparent low bidder or not. A confirmation email will be generated by the system. The bidders shall submit to SBWD a copy of the email confirmation no later than 4:00 p.m. on the fifth calendar day following the bid opening. Faxed copies are acceptable.

FAILURE TO SUBMIT THE REQUIRED BIDDERS/PROPOSERS LIST CONFIRMATION EMAIL TO SBWD BY THE STATED TIME AND IN THE MANNER HEREIN SPECIFIED SHALL BE CAUSE FOR THE BIDDER BEING DEEMED INELIGIBLE FOR AWARD OF THE CONTRACT.

12.0 DBE Goals:

During the transition period, the IFR provides that until the UCP completes the recertification process, the Department may not 1) set any DBE contract goals or 2) count any participation towards its overall DBE goal. The Department will not be counting any DBE conscious or DBE neutral efforts towards its overall DBE goal during this transitional period.

The Department has not established contract goals for DBE participation in this contract. Contractors are still encouraged to employ reasonable means to obtain DBE neutral efforts.

Contractors must retain records in accordance with these DBE specifications. The contractor is notified that this record keeping is important to the Department so that it can track DBE participation where only DBE neutral efforts are employed.

13.0 Payment Reporting:

The contractor shall report on a monthly basis indicating the amounts paid to all subcontractors, of all tiers, working on the project. Reporting shall be in accordance with Subsection 109.06(B)(5) of the specifications.

14.0 Crediting DBE Participation:

14.01 General Requirements:

During the transition period, the IFR provides that until the UCP completes the recertification process, the Department may not count any participation towards its overall DBE goal. This applies to both DBE conscious and DBE neutral efforts.

To count toward DBE participation, the DBE firm must be certified in each NAICS code applicable to the kind of work the firm will perform on the contract. NAICS for each DBE can be found on the AZ UTRACS under the Firm Directory. General descriptions of all NAICS codes can be found at www.naics.com.

The entire amount of a contract that is performed by the DBE's own forces, including the cost of supplies and materials purchased by the DBE for the work on the contract and equipment leased by the DBE will be credited toward DBE participation. Supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate will not be credited toward DBE participation.

The contractor bears the responsibility to determine whether the DBE possesses the proper contractor's license(s) to perform the work.

The Department's certification is not a representation of a DBE's qualifications and/or abilities. The contractor bears all risks that the DBE may not be able to perform its work for any reason.

A DBE may participate as a prime contractor, subcontractor, joint venture partner with either a prime contractor or a subcontractor, or as a vendor of materials or supplies. A DBE joint venture partner shall be responsible for a clearly defined portion of the work to be performed, in addition to meeting the requirements for ownership and control.
The dollar amount of work to be accomplished by DBEs, including partial amount of a lump sum or other similar item, shall be on the basis of agreements such as: subcontract, purchase order, hourly rate, and rate per ton.

With the exception of bond premiums, all work must be attributed to specific bid items. Where work applies to several items, the DBE contracting arrangement must specify unit price and amount attributable to each bid item. DBE credit for any individual item of work performed by the DBE shall be the lesser of the amount to be paid to the DBE or the prime contractor's bid price. If the amount bid by the DBE on any item exceeds the prime contractor's bid amount, the prime contractor may not obtain credit by attributing the excess to other items.

Where more than one DBE is engaged to perform parts of an item (for example, supply and installation), the total amount payable to the DBEs will not be considered in excess of the prime contractor's bid amount for that item.

Bond premiums may be stated separately, so long as the arrangement between the prime contractor and the DBE provides for separate payment not to exceed the price charged by the bonding company.

DBE credit may be obtained only for specific work done for the project, supply of equipment specifically for physical work on the project, or supply of materials to be incorporated in the work. DBE credit will not be allowed for costs such as overhead items, capital expenditures (for example, purchase of equipment), and office items.

If a DBE performs part of an item (for example, installation of materials purchased by a Non-DBE), the DBE credit shall not exceed the lesser of (1) the DBE's contract or (2) the prime contractor's bid for the item, less a reasonable deduction for the portion performed by the Non-DBE.

When a DBE performs as a partner in a joint venture, only that portion of the total dollar value of the contract which is clearly and distinctly performed by the DBE's own forces can be credited.

The contractor may credit second-tier subcontracts issued to DBEs by non-DBE subcontractors. Any second-tier subcontract to a DBE must meet the requirements of a first-tier DBE subcontract.

A prime contractor may credit the entire amount of that portion of a construction contract that is performed by the DBE's own forces. The cost of supplies and materials obtained by the DBE for the work of the contract can be included so long as that cost is reasonable. Leased equipment may also be included. No credit is permitted for supplies purchased or equipment leased from the prime contractor or its affiliate(s).

When a DBE subcontracts a part of the work of its contract to another firm, the value of the subcontract may be credited towards DBE participation only if the DBE's subcontractor is itself a DBE and performs the work with its own forces. Work that a DBE subcontracts to a non-DBE firm does not count towards DBE participation.

A prime contractor may credit the entire amount of fees or commissions charged by a DBE firm for providing a bona fide service, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a USDOT-assisted contract, provided the fees are reasonable and not excessive as compared with fees customarily allowed for similar services.

14.02 Effect of Loss of DBE Eligibility:

If a DBE or a DBE prime contractor is deemed ineligible, decertified, or suspended by the Department in accordance with 49 CFR Part 26.87 and 49 CFR Part 26.88, the following provisions shall apply:

(A) If a DBE firm loses its DBE eligibility because the DBE firm was acquired by a non-DBE firm, no work performed by the DBE firm after the Decision Date will be counted toward DBE participation.

(B) If a subcontract, contract, or supplier arrangement has been executed before the Decision Date, work performed by the DBE firm will be counted toward DBE participation.

(C) If neither paragraph (A) nor paragraph (B) above applies, the work performed by the DBE firm after the Decision Date will be counted toward DBE participation.

(D) If the contractor extends or adds work to the DBE firm's subcontract, that work will not be counted towards DBE participation unless the contractor has obtained prior approval from the Department for DBE credit. Any requests to extend or add work to the DBE firm's subcontract to count towards DBE participation shall be submitted using the request form, made available on SBWD's website at https://azdot.gov/business/small-business-and-workforce-development/dbe-contract-compliance/contract-specs-and-forms

(E) The Department will consent to such DBE credit only if the added work is within the foreseeable range of added work, given the circumstances of the original DBE contract.

(F) For the purposes of this subsection, "Decision Date" means the date the Department notifies the DBE that it has become ineligible, decertified, or suspended under 49 CFR Part 26.87(c)(4), (g).

14.03 Notifying the Contractor of DBE Certification Status:

Each DBE contract of any tier shall require any DBE subcontractor or supplier that is either decertified or certified during the term of the contract to immediately notify the contractor and all parties to the DBE contract in writing, with the date of decertification or certification. The contractor shall require that this provision be incorporated in any contract of any tier in which a DBE is a participant.

14.04 Police Officers:

DBE credit will not be permitted for procuring DPS officers. For projects on which officers from other agencies are supplied, DBE credit will be given only for the broker fees charged, and will not include amounts paid to the officers. The broker fees must be reasonable.

14.05 Commercially Useful Function:

A prime contractor can credit expenditures to a DBE subcontractor only if the DBE performs a commercially useful function (CUF) on the contract.

In conformity with 49 CFR Part 26.55(c), a DBE performs a CUF when it is responsible for execution of the work of a contract and carries out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the DBE must also be responsible, with respect to materials and supplies on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself that it uses on the project. To determine whether a DBE is performing a commercially useful function, the Department will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and other relevant factors.

A DBE will not be considered to perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation. In determining whether a DBE is such an extra participant, the Department will examine similar transactions, particularly those in which DBEs do not participate.

If a DBE does not perform or exercise responsibility for at least 30 percent of the total cost of its contract with its own work force, or if the DBE subcontracts a greater portion of the work of a contract than would be expected within normal industry practice for the type of work involved, the Department will presume that the DBE is not performing a commercially useful function.

When a DBE is presumed not to be performing a commercially useful function as provided above, the DBE may present evidence to rebut this presumption. The Department will determine if the firm is performing a CUF given the type of work involved and normal industry practices.

The Department will notify the contractor, in writing, if it determines that the contractor's DBE subcontractor is not performing a CUF. The contractor will be notified within seven calendar days of the Department's decision.

Decisions on CUF may be appealed to the State Engineer. The appeal must be in writing and personally delivered or sent by certified mail, return receipt requested, to the State Engineer. The appeal must be received by the State Engineer no later than seven calendar days after the decision of SBWD. SBWD's decision remains in effect unless and until the State Engineer reverses or modifies SBWD's decision. The State Engineer will promptly consider any appeals under this subsection and notify the contractor of the State Engineer's findings and decisions. Decisions on CUF matters are not appealable to USDOT.

The Department will conduct project site visits on the contract to confirm that DBEs are performing a CUF. The contractor shall cooperate during the site visits and the Department's staff will make every effort not to disrupt work on the project.

14.06 Trucking:

In conformity with 49 CFR Part 26.55(d), the Department will use the following factors in determining whether a DBE trucking company is performing a commercially useful function. The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract.

The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract on every day that credit is to be given for trucking.

The contractor will receive credit for the total value of transportation services provided by the DBE using trucks it owns, insures and operates, and using drivers it employs.

The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services.

The DBE may also lease trucks from a non-DBE firm, including an owner-operator. The DBE who leases trucks with drivers from a non-DBE is entitled to credit for the total value of the transportation services provided by non-DBE leased trucks with drivers not to exceed the value of transportation services on the contract provided by DBE-owned trucks or leased trucks with DBE employee drivers. Additional participation by non-DBE owned trucks with drivers receives credit only for the fee or commission paid to the DBE as a result of the lease agreement.

Example: DBE Firm X uses two of its own trucks on contract. It leases two trucks from DBE Firm Y and six trucks from non-DBE firm Z. DBE credit would be awarded for the total value of transportation services provided by Firm X and Firm Y, and may also be awarded for the total value of transportation services provided by four of the six trucks provided by Firm Z. In all, full credit would be allowed for the participation of eight trucks. DBE credit could be awarded only for the fees or commissions pertaining to the remaining trucks Firm X receives as a result of the lease with Firm Z.

The DBE may lease trucks without drivers from a non-DBE truck leasing company. If the DBE leases trucks from a non-DBE leasing company and uses its own employees as drivers, it is entitled to credit for the total value of these hauling services.

Example: DBE Firm X uses two of its own trucks on a contract. It leases three additional trucks from non-DBE Firm Z. Firm X uses its own employees to drive the trucks leased from Firm Z. DBE credit would be awarded for the total value of the transportation services provided by all five trucks.

For purposes of this section, a lease must indicate that the DBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE. DBE participation will be allowed only for those lease costs related to the time each truck is devoted to the project.

DBE credit for supplying paving grade asphalt and other asphalt products will only be permitted for standard industry hauling costs, and only if the DBE is owner or lessee of the equipment and trucks. Leases for trucks must be long term (extending for a fixed time period and not related to time for contract performance) and must include all attendant responsibilities such as insurance, titling, hazardous waste requirements, and payment of drivers.

14.07 Materials and Supplies:

In conformity with 49 CFR Part 26.55(e), the Department will credit expenditures with DBEs for material and supplies towards DBE participation as follows:

(A) If the materials or supplies are obtained from a DBE manufacturer, 100 percent of the cost of the materials or supplies is credited.

(1) A DBE manufacturer is defined as: a firm that owns, or leases, and operates a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract, and of the general character described by the specifications.

(2) Manufacturing includes blending or modifying raw materials or assembling components to create the product to meet contract specifications. When a DBE makes minor modifications to the materials, supplies, articles, or equipment, the DBE is not a manufacturer. Minor modifications are additional changes to a manufactured product that are small in scope and add minimal value to the final product.

(B) If the materials or supplies are purchased from a DBE regular dealer, 60 percent of the cost of the materials or supplies, (including transportation costs), is credited.

(1) A DBE regular dealer is defined as: a firm that owns, or leases, and operates, or maintains a store or warehouse or other establishment in which the materials, supplies, articles, or equipment of the general character described by the specifications and required under the contract are bought, kept in sufficient quantities, and regularly sold or leased to the public in the usual course of business.

(a) To be a regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.

(b) Items kept and regularly sold by the DBE are of the “general character” when they share the same material characteristics and application as the items specified by the contract.

(2) A firm may be a DBE regular dealer in such bulk items as petroleum products, steel, concrete or concrete products, stone or asphalt without owning and operating a place of business, as provided above, if the person both owns and operates distribution equipment used to deliver the products. Any supplementing of regular dealers’ own

distribution equipment must be by a long-term operating lease, and not on an ad-hoc or contract-by-contract basis.

(3) A DBE supplier performs a CUF as a regular dealer and receives credit for 60 percent of the cost of materials or supplies, including transportation cost, when all, or at least 51 percent of, the items under a purchase order or subcontract are provided from the DBE's inventory, and when necessary, any minor quantities delivered from and by other sources are of the general character as those provided from the DBE's inventory.

(4) A DBE supplier of items that are not typically stocked due to their unique characteristics (e.g., limited shelf life or items ordered to specification) should be considered in the same manner as a regular dealer of bulk items as described above. If the DBE supplier of these items does not own or lease distribution equipment, as described above, it is not a regular dealer.

(5) Packagers, brokers, manufacturers' representatives, or other persons who arrange, facilitate or expedite transactions are not regular dealers within the meaning of this paragraph and the paragraph above.

(C) If the materials or supplies are purchased from a DBE distributor that neither maintains sufficient inventory nor uses its own distribution equipment for the products in question, 40 percent of the cost of materials or supplies (including transportation costs) count for credit.

(1) A DBE distributor is defined as: an established business that engages in the regular sale or lease of the items specified by the contract. A DBE distributor assumes responsibility for the items it purchases once they leave the point of origin (e.g., a manufacturer's facility), making it liable for any loss or damage not covered by the carrier's insurance.

(2) A DBE distributor performs a CUF when it demonstrates ownership of the items in question and assumes all risk for loss or damage during transportation, evidenced by the terms of the purchase order or a bill of lading (BOL) from a third party, indicating Free on Board (FOB) at the point of origin or similar terms that transfer responsibility of the items in question to the DBE distributor.

(3) If paragraph (1) and paragraph (2), above, are met, DBE distributors may receive 40 percent for drop-shipped items.

(4) Terms that transfer liability to the distributor at the delivery destination (e.g., FOB destination), or deliveries made or arranged by the manufacturer or another seller do not satisfy this requirement.

(D) With respect to materials or supplies purchased from a DBE which is neither a manufacturer, a regular dealer, nor a distributor, the following standards shall apply:

(1) The Department will credit the entire amount of the fees or commissions charged by the DBE for: (1) assistance in the procurement of the materials and supplies, or

(2) fees or transportation charges for the delivery of materials or supplies required on a job site, toward DBE participation.

(2) The Department will only credit the fees or commissions charged by the DBE if the Department determines the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services.

(3) The cost of the materials and supplies themselves may not be counted toward DBE participation.

(E) The Department will credit expenditures with DBEs for material and supplies (e.g. whether a firm is acting as a regular dealer, distributor or a transaction facilitator) towards DBE participation on a contract-by-contract basis.

(F) The fact that a DBE firm qualifies under a classification (manufacturer, regular dealer, distributor or supplier) for one contract does not mean it will qualify for the same classification on another contract.

(G) The bidder shall be responsible for verifying whether a DBE qualifies as a DBE manufacturer, regular dealer, distributor or supplier.

(1) For each DBE firm listed as a regular dealer or distributor, the bidder must assess a DBE firm's eligibility for 60 or 40 percent credit, respectively, of the cost of materials and supplies based on its demonstrated capacity and intent to perform as a regular dealer or distributor.

(2) To receive credit toward DBE participation, the bidder shall use and submit the form made available on SBWD's website at https://azdot.gov/business/small-business-and-workforce-development/dbe-contract-compliance/contract-specs-and-forms, to affirm the DBE firm's capacity and intent to perform as a regular dealer or distributor.

15.0 Joint Checks:

15.01 Requirements:

A DBE subcontractor and a material supplier (or equipment supplier) may request permission for the use of joint checks for payments from the prime contractor to the DBE subcontractor and the supplier. Joint checks may be issued only if all the conditions in this subsection are met.

(A) The DBE subcontractor must be independent from the prime contractor and the supplier, and must perform a commercially useful function. The DBE subcontractor must be responsible for negotiating the price of the material, determining quality and quantity, ordering the materials, installing (where applicable), and paying for the material. The DBE subcontractor may not be utilized as an extra participant in a transaction, contract, or project in order to obtain the appearance of DBE participation.

(B) The use of joint checks will be allowed only if the prime contractor, DBE subcontractor, and material supplier establish that the use of joint checks in similar transactions is a commonly recognized business practice in the industry, particularly with respect to similar transactions in which DBE's do not participate.

(C) A material or supply contract may not bear an excessive ratio relative to the DBE subcontractor's normal capacity.

(D) There may not be any exclusive arrangement between one prime and one DBE in the use of joint checks that may bring into question whether the DBE is independent of the prime contractor.

(E) Any arrangement for joint checks must be in writing, and for a specific term (for example, one year, or a specified number of months) that does not exceed a reasonable time to establish a suitable credit line with the supplier.

(F) The prime contractor may act solely as the payer of the joint check, and may not have responsibility for establishing the terms of the agreement between the DBE subcontractor and the supplier.

(G) The DBE must be responsible for receiving the check from the prime contractor and delivering the check to the supplier.

(H) The prime contractor cannot require the DBE subcontractor to use a specific supplier, and the prime contractor may not participate in the negotiation of unit prices between the DBE subcontractor and the supplier.

15.02 Procedure and Compliance:

(A) The SBWD must approve the agreement for the use of joint checks in writing before any joint checks are issued. The prime contractor shall submit a DBE joint check request form, available from the SBWD website, along with the joint check agreement, to SBWD through email within seven calendar days from the time the subcontract is executed.

(B) After obtaining authorization for the use of joint checks, the prime contractor, the DBE, and the supplier must retain documentation to allow for efficient monitoring of the agreement.

(C) Copies of canceled checks must be submitted, with the payment information for the period in which the joint check was issued, electronically through email to SBWD, and made available for review at the time of the onsite CUF review. The prime contractor, DBE, and supplier each have an independent duty to report to the Department in the case of any change from the approved joint check arrangement.

(D) Any failure to comply will be considered by the Department to be a material breach of this contract and will subject the prime contractor, DBE, and supplier to contract remedies and, in the case of serious violations, a potential for termination of the

contract, reduction or loss of prequalification, debarment, or other remedies which may prevent future participation by the offending party.

16.0 Certification of Final DBE Payments:

DBE participation on the contract is measured by actual payments made to the DBEs. The contractor shall submit the "Certification of Final DBE Payments" form for each DBE firm working on the contract. This form shall be signed by the contractor and the relevant DBE, and submitted to the Engineer no later than 30 days after the DBE completes its work.

The contractor will not be released from the obligations of the contract until the "Certification of Final DBE Payments" forms are received and deemed acceptable by the Engineer and SBWD.

17.0 False, Fraudulent, or Dishonest Conduct:

In addition to any other remedies or actions, the Department will bring to the attention of the USDOT any appearance of false, fraudulent, or dishonest conduct in connection with the DBE program, so that USDOT can take steps such as referral to the Department of Justice for criminal prosecution, referral to the USDOT Inspector General for possible initiation of suspension and debarment proceedings against the offending parties or application of "Program Fraud and Civil Penalties" rules provided in 49 CFR Part 31.

(TITLEVI, 08/19/21)

STANDARD TITLE VI SPECIFIC ASSURANCES:

The Arizona Department of Transportation, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

GENERAL REQUIREMENTS:

Use of Prohibited Products:

The contractor shall not commit any of the following actions:

(1) Deliver, install, or include any prohibited product under this contract.
(2) Propose to deliver, install, or include any prohibited product under this contract.
(3) Enter into a new contract to procure or obtain any prohibited product.

For the purpose of this Section, "Prohibited Product" is defined as any telecommunication or video surveillance equipment, systems, or services produced by:

(1) Huawei Technologies Company.
(2) ZTE Corporation.
(3) Hytera Communications Corporation.
(4) Hangzhou Hikivision Digital Technology Company.
(5) Dahua Technology Company.
(6) Any subsidiary or affiliate of the entities mentioned in this Section.

The contractor shall identify the known subsidiaries and affiliates of the aforementioned from the following Website: https://umd.service-now.com/itsupport?id=kb_article_view&sysparm_article=KB0014132&sys_kb_id=28015b70dbe0e3849382f1a51d96193f

BLM Material Sources:

If the contractor elects to pursue the use of material sources on BLM land under Title 30 Code of Federal Regulations, it is at the contractor's sole risk, and the Department bears no responsibility for any delays or costs associated with the request to use material sources on BLM Land.

The Department will not request or pursue any "free-use permit" under Title 23 Code of Federal Regulations or any other arrangement with BLM on this project.

No extension in contract time or compensation will be granted for any attempt by the contractor to utilize BLM land.

Access Requirements:

The contractor shall maintain access to all side streets, access roads, driveways, alleys, parking lots, and adjacent businesses during their hours of operations. Access to adjacent private driveways shall be provided during all non-working hours. Where property has more than one point of access, no more than one access may be restricted or closed at a time.

The contractor shall coordinate through the Engineer to inform all property and business operators that may be affected by any restrictions at least 72 hours in advance as a result of construction activities of the scope of work, duration of construction activities, and the possible interference with their day to day activities. Any business or residential access restrictions shall be coordinated in writing through the Engineer with the affected businesses or residents at least one week in advance of the restriction.

The contractor shall coordinate with the Engineer to make a good faith effort to make personal contact with affected property owners or business operators. If primary access cannot be maintained, the contractor shall coordinate through the Engineer provide an alternative that will be pre-determined with the business prior to instituting the closure or restriction. If the property owner or business operator cannot be contacted, then the Engineer shall be the sole judge for the approval of any closures or restrictions.

The contractor shall include temporary "Business Access" signs for affected businesses.

No separate measurement or payment will be made for providing alternatives to maintaining access or maintaining accesses, the cost being considered as included in the price of the contract items.

Access For and Protection of Pedestrians:

Pedestrian access shall be maintained across the construction work zone at all times where pedestrian facilities are present. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features.

At all times the contractor shall conduct operations to safeguard pedestrians within the vicinity of the project. Any holes or trenches left open overnight shall be protected with 6-foot temporary chain link fence. For holes and trenches left open during working hours, the contractor shall provide Type II barricades and Type A flashing lights connected by warning tape, ribbon rope, a plywood covering or other protection over the holes.

No measurement or direct payment will be made for work site protection measures, the cost being considered as included in price of the contract items.

Transition of Select AASHTO Standard Test Method to Arizona Test Method Equivalent:

Whenever reference is made in the specifications to an AASHTO Test Method, the reference shall be construed to mean it's equivalent Arizona Test Method as listed in the table below.

TEST METHOD TRANSITION TABLE	
AASHTO Standard	**Equivalent Arizona Test Method**
R 66	103
R 97	104
R 90	105
T 11, T 27	201
T 85	210
T 84	211
T 335	212
T 99	225
	226
T 224	227
T 191	230
T 272	232
T 310	235
T 288, T 289	236
T 176	242
T 99	245
T 272	246
T 304 Method A	247
T 24	317
T 329	406
R 68, T 245	410
T 355	412

T 166	415
R 47	416
T 209	417
T 287	421
T 269	424
T 308	427
	428

Maintenance of Project Site:

The contractor shall be responsible for maintaining a clean project site within the project limits including the removal and disposal of all trash, debris and litter during the construction period. No measurement or direct payment will be made for this maintenance, the cost being considered as included in the price of other contract items.

The contractor shall be responsible for maintain existing plant material not identified for removal within the project limits, including crossroads, at all times in accordance with Subsection 806-2.11 of the specifications.

Existing Storm Drains:

The contractor shall be responsible for keeping all existing storm drains open, clean and operational during the construction period. No measurement or direct payment will be made for this maintenance, the cost being considered as included in the price of other contract items.

Temporary Shoring:

Temporary shoring or underpinning of existing structures may be required for drainage and wall installations. If excavations extend into soils which are within imaginary lines extending downward and outward from the edges of existing footings at a 45-degree angle, the existing foundation shall either be underpinned or shoring shall be designed and installed to prevent loss of support and/or settlement of the existing structure. Existing structures shall be surveyed and monitored for movement during construction. When temporary shoring or underpinnings are no longer required, they shall be removed and disposed of by the contractor. No additional measurement or payment will be made for the design and installation of temporary shoring or underpinning, including surveying and monitoring, and removal and disposal of shoring or underpinning, the cost being considered as included in the price of contract items.

Verification of Existing Features:

The locations and dimensions of existing roadway features shown on the plans are based on as-built plans, aerial photographs, and field surveys. It shall be the contractor’s responsibility to field-verify the information given on the plans wherever that information affects the new work. Significant differences between the measured and plan information shall be submitted to the Engineer prior to proceeding with the work. Minor adjustments to curb staking, catch basin locations, and other elements, to the extent they are required to match existing

construction and do not affect the disposition of other project features, will not require review or approval by the Engineer.

Coordination between Control of Noxious Plants and Seeding:

All unpaved construction disturbed project areas shall ultimately be stabilized with Class II Seeding unless otherwise stabilized by equivalent permanent stabilization measures approved by the Engineer. As part of Integrated Vegetation Management, the contractor shall re-establish diversified native vegetation through seeding after successfully controlling noxious plants as approved by the Engineer in accordance with an ADOT Construction PLA evaluation. The well-established diversified plant community through seeding of desirable native species will be able to effectively compete and resist the spread of non-native invasive weed species from re-invasion / re-infestation.

The contractor shall avoid herbicide persistence in subsequent desirable seeding establishment. Pre-emergent herbicide shall NOT be applied on all project seeding areas during Control of Noxious Plants. The time period and length of an herbicide product that remains active in the soil, which is the acceptable herbicide Soil Persistence or Soil Residual Life, shall be approved by the Engineer in accordance with an ADOT Construction PLAs evaluation. As herbicides vary in their length of time to persist in the soil, the contractor shall demonstrate information / methods on how the application of herbicide(s) will NOT harm the expected desirable seed species germination and establishment as specified in Items 9240181 and 9240182 of these Special Provisions.

Erosion, Sediment Control and Stormwater Quality Protection:

The contractor shall pay attention to the impact of the construction operations on the natural landscape and shall take care to maintain the natural surroundings undamaged. The contractor shall minimize soil disturbance by implementing Low Impact Development (LID) methods to control erosion as close as possible to the source of disturbance.

The contractor shall use all means necessary to significantly reduce impacts by staging/stockpiling and conducting project activities in such a way as to minimize the potential for erosion and discharge of pollutants from the project site.

In addition to what is shown in the plans and/or details, when required, the contractor shall apply perimeter/containment control Best Management Practices (BMPs) or temporary stormwater quality Control Measures (CMs) on the downslope perimeter of construction-disturbed areas, unpaved on-site staging/storage, and unpaved on-site stockpiling at no additional cost to the Department. The contractor shall also apply perimeter/containment control BMPs/CMs parallel to the slope contours and beyond the toe of new guardrail end treatment pad disturbed slopes. To prevent sediment from bypassing the perimeter control BMP/CM end, the end of the BMP/CM shall be turned up the slopes for a minimum of three (3) feet to form an “L” shape. No portion of the BMPs/CMs shall be installed within six (6) feet from the edge of the pavement. BMPs/CMs shall not be placed over any driveways or access roads that intersect with the roadway mainline. Unless otherwise called out in the plans/details and approved by the Engineer, such BMPs/CMs shall not be placed on the flow path of inlets and outlets of drainage facilities. All BMPs/CMs shall be installed in accordance with the manufacturer’s instructions. Moreover, perimeter/containment control BMPs/CMs shall be

applied outside and above adjacent wetlands, as well as water courses. The contractor shall adjust the field layout of erosion control and sediment prevention elements according to the actual limits of soil/ground disturbance as approved by the Engineer. The contractor shall also observe ADOT traffic safety standards when installing perimeter/containment control BMPs/CMs in the traffic clear zone/recovery area.

Wattles/logs, silt fences, bio-socks, filter socks, compost socks, or compost tubes shall be deemed as temporary stormwater quality CMs/BMPs. The non-biodegradable and/or non-photodegradable components of such temporary CMs/BMPs shall be removed when the project site has achieved stabilization as approved by the Engineer. Rock materials used for temporary stormwater quality protection CMs/BMPs may be left on-site to cover unpaved disturbed soil areas for permanent stabilization as approved by the Engineer. If approved, on-site rock materials shall be flattened and re-graded to match the final unpaved finished grade.

The contractor shall propose the locations and install the temporary STABILIZED CONSTRUCTION ENTRANCE/EXIT GRAVEL PADs (ITEM 8101018) as approved by the Engineer in accordance with project plans and site conditions.

All Rock Mulch and Rock Riprap used for erosion/sediment control shall be placed and shaped as shown on the CMs/BMPs' plans/details. Rock Mulch/Riprap materials shall be fractured/crushed rocks in angular shape for effective erosion/sediment control and energy/velocity dissipation as defined in Section 810 / 913 of the Standard Specifications. Unless otherwise called out in the plans/details/estimates, or as directed by the Engineer, natural river-run materials, especially rounded natural river rocks/cobblestones, and pebbles are not acceptable. The color of Rock Mulch and Rock Riprap shall harmonize with the natural surrounding rock/inert artificial existing ground cover material as approved by the Engineer in accordance with the ADOT Construction PLA's evaluation.

The contractor is responsible for maintaining the functional longevity and good working conditions of all stormwater quality protection CMs/BMPs during the entire contract time. No separate measurement or direct payment will be made for the maintenance and/or replacement of such CMs/BMPs to ensure manufacturer-specified functionality; the cost is included in the price of the respective contract items.

The contractor is also responsible for protecting Storm Drain Inlets within the project limits from pollutants/contaminants discharged by construction at no additional cost to the Department.

Fine particles including minor miscellaneous dirt, dust, rock fragments, milled asphaltic concrete (AC), or construction debris that may be associated with stormwater discharges into catch basins / Storm Drain Inlets shall be prevented and controlled to the maximum extent practicable (MEP) at no additional cost to the Department. Such compliance measures may include frequent dry vacuuming and/or pavement sweeping during construction to ensure that no debris, dirt, dust, and material fragments will build up within twenty-five (25) feet from catch basins / Storm Drain Inlets. On-site staging, material storage, and stockpiling shall not be allowed within fifty (50) feet from catch basins / Storm Drain Inlets.

During construction, the contractor shall minimize vehicular travel or equipment operation on unpaved soil areas to the MEP. The contractor shall develop and implement procedures to

avoid earth disturbance, soil compaction, and damage to vegetative cover from vehicular travel or equipment operation during inclement weather or unsuitable soil conditions. The contractor shall stabilize all construction-disturbed soil areas at no additional cost to the Department. Furthermore, the contractor shall minimize off-site sedimentation including minor miscellaneous dirt, dust, rock fragments, or construction debris by eliminating the tracking of such contaminants from construction sites.

No grout, concrete or wash water shall be disposed of within the project limits or its vicinity. The contractor shall install a concrete washout CM/BMP as needed and under the direction of the Engineer at no additional cost to the Department. This CM/BMP shall include the proper disposal of all excess grout, concrete, and wash water.

The contractor shall not use unpaved areas within the project limits for staging or stockpiling without first installing erosion control and sediment prevention CMs/BMPs and as directed and approved by the Engineer. Staging and stockpiling on the unpaved areas shall be avoided to the MEP.

Erosion and Sediment Control beyond the Project Limits:

The contractor shall apply erosion/sediment and water quality protection CMs/BMPs as required by the commercial material source owner and environmental permit standards at no additional cost to the Department.

The contractor shall apply erosion/sediment and water quality protection CMs/BMPs for off-project-site staging, material storage, maintenance yard, disposal spots, and stockpiling areas as required by the facility owner and environmental permit standards at no additional cost to the Department.

If the contractor elects to obtain off-project site for staging, stockpiling, material storage, maintenance yard, or waste disposal, the contractor shall meet the requirements for erosion control, sediment prevention, and stormwater quality protection measures within the written agreements with the facility and/or the landowner, as well as environmental permits for such operations.

Environmental Mitigation Measures:

The contractor’s commitments are identified in the Environmental, Permits, Issue, and Commitments (EPIC) Plan Sheet 1F. The contractor shall follow the requirements specified in the EPIC Plan Sheet 1F, Subsection 104.16 of the specifications and these Special Provisions. In addition, the contractor shall pay attention to the project specific environmental commitments that are specified in Section 10 of the EPIC Plan Sheet 1F.

State Fire Marshall Permit:

The Department will submit the architectural plans for the approval from the State Fire Marshall within three weeks from the date of the contract award. No work shall take place on the architectural plans (shown on Project Plans Sheets 73 through 184 of 200, except for any demolition work called out in the Project Plans Sheets) until the State Fire Marshall permit has been obtained. It is anticipated that the permit will be available approximately six weeks from the date of submittal and this approval time has already been accounted for in the contract time. No changes to the contractual provisions are anticipated through this approval process. However, if there are any changes to the existing contractual provisions resulting from the approval process including delay in acquiring approval beyond 6 weeks from the date of submittal, those revisions will be handled in accordance with the requirements of Subsection 104.02 of the specifications.

(101DEFN, 04/21/22)

SECTION 101 DEFINITIONS AND TERMS:

101.02 Definitions:

Acceptance: of the Standard Specifications is hereby deleted:

Characteristic: of the Standard Specifications is revised to read:

A measurable or an observable property of a material, product, or item of construction.

City, County, Township, or Town: of the Standard Specifications is hereby deleted:

Contract Bonds (Performance Bond and Payment Bond): the title and text of the Standard Specifications is revised to read:

Contract Bonds:

Surety Bonds that include Performance Bond and Payment Bond.

Highway, Street, or Road: of the Standard Specifications is revised to read:

A general term denoting a public way for purposes of travel, vehicular, pedestrian or by other means, including the entire area within the right-of-way.

Roadbed: of the Standard Specifications is revised to read:

The graded portion of a highway, prepared as a foundation for the pavement structure and shoulders.

Roadside Development: of the Standard Specifications is revised to read:

Activities which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; or such planting and other

improvements as may increase the effectiveness and enhance the appearance of the highway.

State: of the Standard Specifications is revised to read:

The State of Arizona, acting through its authorized representatives.

(102BID, 03/19/26)

SECTION 102 BIDDING REQUIREMENTS AND CONDITIONS: of the Standard Specifications is revised to read:

102.01 Contract Documents:

(A) General:

The Contract Documents, including but not limited to, Advertisement for Bids, Project Plans, and Proposal Pamphlets will be available in electronic format, on the ADOT Contracts and Specifications Group website. Any interested party may access the advertised Contract Documents.

(B) Advertisements for Bids:

The advertisement for bids may contain the following information:

- Programmed Amount,
- Project number and name of highway,
- Route number and mileposts,
- Date and time of opening of bids,
- Location of the project,
- General description of work,
- Specified contract time for completion of contract work,
- Statement of proposal requirements,
- Manner in which project plans and specifications may be obtained,
- Type and amount of proposal guaranty.

(C) Proposal Pamphlet:

The Proposal Pamphlet will include the location and general description of the contemplated construction, an approximate estimate of the quantities and types of work to be performed and/or materials to be furnished, a schedule of bid items for which unit prices are invited, the specified time for completion, any applicable Special Provisions or supplemental requirements, and all necessary bidding documents.

102.02 Prerequisites for Bidding:

(A) General:

To submit a valid bid, the bidder shall:

(1) Have prequalification from the Department as necessary for the project, in accordance with Subsection 102.02(B) of the specifications; and

(2) Be included on the project Plansholder List as a Prime in accordance with Subsection 102.02(C) of the specifications.

(B) Prequalification of Bidders:

Prior to submitting a bid, the bidder will (unless waived by the Department) be required to be prequalified with the Department to bid on the project. The submission of Prequalification information and determination of Prequalification shall be in accordance with the requirements of the Rules for Prequalification of Contractors as approved and adopted by the Department.

(C) Plansholder List:

It is the bidder's responsibility to ensure that their firm is on the Plansholder List as a Prime prior to submitting a bid.

Firms may register electronically requesting placement on the project Plansholder List as a Prime contractor as follows:

(1) Go to the ADOT Contracts and Specifications Group Website;

(2) Select "Current Advertisements";

(3) Identify the project of interest;

(4) Click on the "Register" icon;

(5) Select the "Bidder" radio button;

(6) Complete all required fields;

(7) Click "Save". This submits the request to the Department; and

(8) If all required information is provided, the "ADOT C&S Advertisement Registration Confirmation" Screen will appear. An email will also be sent to the email address provided acknowledging the receipt of the request.

Requests to be included on the Plansholder List as a Prime will be evaluated by the Department to determine whether the bidder is prequalified for the project. The Department cannot guarantee that requests to be on the Plansholder List will be considered if the request is submitted less than five working days prior to the bid opening. The Department will send an email to the email address provided notifying the contractor of the results of their request.

The Department's email will state whether the request was approved or denied. More information regarding the Department's decision may be obtained by contacting the ADOT Contracts and Specifications Group.

If an individual from a firm submits a duplicate request to be placed on the Plansholder List, the request will be denied. The Department will register the contact person listed on the duplicate request to receive email notices of updates to the project. The Department will send an email to the email address provided notifying the contractor of the results of their request.

(D) Registration for Notifications:

Subcontractors, Vendor and other interested parties may electronically register to receive email notifications regarding updates or changes to specific advertised contracts.

To register:

(1) Go to the ADOT Contracts and Specifications Group Website;

(2) Select "Current Advertisements";

(3) Identify the project of interest;

(4) Click on the "Register" icon;

(5) Select the "Other" radio button, as applicable;

(6) Select the "Yes" in response to the prompt "Are you interested in registering to be notified about any changes made to this advertisement?";

(7) Complete all required fields;

(8) Click "Save". This submits the request to the Department; and

(9) If all required information is provided, the "ADOT C&S Advertisement Registration Confirmation" Screen will appear and a confirmation email will be sent to the email address provided.

All registered parties will receive notifications when changes are made to the associated contract advertisement.

102.03 Suspension from Bidding:

The Department may suspend any person and any subsidiary or affiliate of any person from further bidding to the Department and from being a subcontractor or a supplier or otherwise participating in the work:

(A) If that person or any officer, director, employee or agent of that person is convicted, in this State, or any other jurisdiction, of a crime involving any of the following elements or actions:

(1) Entering into any contract, combination, conspiracy or other unlawful act in restraint of trade or commerce;

(2) Knowingly and willfully falsifying, concealing, or covering up a material fact by trick, scheme, or device;

(3) Making false, fictitious, or fraudulent statements or representations;

(4) Making or using a false writing or document knowing it to contain a false, fictitious, or fraudulent statement or entry;

(5) Misrepresentation or false statement on any application for bonding;

(6) Misrepresentation or false statement on any application for prequalification;

(B) If the Department makes a finding of any of the above or finds that the contractor is not a Responsible Bidder or a Responsible Contractor; or

(C) If the Department determines that a contractor, subcontractor, or supplier has repeatedly or willfully failed to comply with federal or state immigration laws.

Under this subsection, a person means any individual, partnership, joint venture, corporation, association, or other entity formed for the purpose of doing business as a contractor, subcontractor, or supplier.

102.04 Availability of Documents:

The following documents, if applicable, will be available in electronic format on the ADOT Contracts and Specifications Group website:

A. Project Plans.
B. Advertisement for Bids.
C. Proposal Pamphlet.
D. Cross Sections.
E. Earthwork Report.
F. Other Available Reports.
G. Existing Ground Digital Terrain Model (DTM).
H. Design Ground Digital Terrain Model (DTM).
I. Survey Control Sheet.

The project plans, proposal pamphlet, cross sections, earthwork report, survey control sheet, and any applicable reports are provided in PDF format. The Department makes no representation or warranties as to the compatibility, usability, or readability of the PDF documents with any system, software, hardware, or application package other than that on which the files were originally saved. The contractor bears the sole risk of any modifications, manipulations, or alterations to the plans, proposal pamphlet, and any applicable reports.

The existing ground DTM and the design DTM, if applicable, are provided in either DTM or DGN files for informational purposes only. The DTMs are not part of the contract documents. The contractor’s use of the information in the DTMs is at the contractor’s sole risk. The

Department makes no representation or warranties as to the compatibility, usability, or readability of the DTMs with any system, software, hardware, or application package other than that on which the files were originally prepared. The version of Microstation used to save the DTMs is indicated at https://azdot.gov/business/engineering-and-construction/computer-aided-design-and-drafting-cadd.

The Department is providing the available electronic project documents to bidders for informational purposes in conjunction with work or services to be provided to the Department under the contract. Any use of the electronic files for any purposes other than for this project is prohibited.

102.05 Plansholder Eligibility:

The Department reserves the right to disqualify a prequalified contractor from being a Plansholder for any of the following reasons:

(A) Lack of competency or adequate machinery, plant and other equipment, as revealed by the financial statement and experience questionnaires required under Subsection 102.02 of the specifications.

(B) Incomplete work which, in the judgment of the Department, might hinder or prevent the prompt completion of additional work if awarded.

(C) Failure to pay, or settle satisfactorily, all bills due for work on other contracts.

(D) Failure to comply with any qualification regulations of the Department.

(E) Default under previous contracts.

(F) Unsatisfactory performance on previous work.

(G) Entering into any contract, combination, conspiracy, or other unlawful act in restraint of trade or commerce.

(H) Knowingly and willfully falsifying, concealing, or covering up a material fact by trick, scheme, or device.

(I) Making false, fictitious, or fraudulent statements or representations.

(J) Making or using a false writing or document knowing it to contain a false, fictitious, or fraudulent statement or entry.

(K) Misrepresentation or false statement on any application for bonding.

(L) Misrepresentation or false statement on any application for prequalification.

(M) Lack of sufficient ability or integrity to complete the contract.

102.06 Interpretation of Quantities in Bidding Schedule:

The quantities appearing in the bidding schedule, except as provided elsewhere, are approximate only and are prepared for the comparison of bids. Payment to the contractor will be made only for the actual quantities of work performed and accepted or materials furnished in accordance with the requirements of the contract. The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted as hereinafter provided in Subsection 104.02 of the specifications.

102.07 Examination of Plans, Specifications and Site of Work:

The bidder shall examine the site of the proposed work and the contract before submitting a Proposal. If no site investigation is performed, the bidder is responsible for all site conditions that should have been discovered had a reasonable site investigation been performed. The submission of a Proposal will be considered conclusive evidence that the bidder is satisfied with the conditions to be encountered in performing the work and as to the requirements of the proposed contract.

The bidder shall take no advantage of any apparent error or omission in the plans, bid schedule items, estimated quantities, specifications, or other contract documents. In the event the bidder discovers such an error or omission, the bidder shall immediately notify the Department. The Department will then make such corrections and interpretations as may be deemed necessary.

Any request for explanation of the meaning or interpretations of the contract shall be submitted in adequate time to allow a reply to reach all bidders before submission of their Bid Proposal. If the Department determines interpretations or explanations are warranted, the response will be issued, if necessary, through an addendum to the contract documents, and will be made available to all prospective bidders before the time set for opening of Proposals.

The Department will not be bound by any statement or representation concerning conditions or description of the work unless they are included in the contract. Oral explanations, interpretations, or instructions given before the opening of the bids by Department employees or agents are not binding.

102.08 Preparation of Proposal:

(A) General:

The bidder shall prepare and submit its proposal using Department-approved bid preparation software.

Proposals shall be prepared and submitted in accordance with the requirements of Subsection 102.08(B) of the specifications.

The bidder shall submit its proposal using the electronic bid process described herein.

(B) Electronic Submittal:

(1) General:

In order to submit a bid electronically, a firm shall have obtained a bidder identification number from the Department, at the office of ADOT Contracts and Specifications Group, 205 South 17th Avenue, Maildrop 121F, Phoenix, AZ 85007, phone (602) 712-7221.

In addition, bidders shall subscribe to Info Tech, Inc., doing business as Infotech's Bid Express® service at www.bidx.com, an online bidding service, and obtain an online Digital ID. Bid Express can be reached at www.bidx.com, phone (888)-352-2439 and/or customer.support@bidx.com. The bidder shall also download and install a copy of the AASHTOWare Project Bids Bid Component from the internet at the Bid Express website. The version of the software currently used by ADOT can then be located by selecting the ADOT tab and the "AASHTOWare Project Bids" link under Downloads.

In order to obtain a Digital ID, bidders shall name at least one authorized signatory, as approved by the Department to commit the firm to the terms and conditions specified in the Proposal and the contract documents.

The bidder shall download the electronic copy of the project EBSX file, listed as an AASHTOWare Project Bids Data File on the Bid Express website. The file includes a schedule of items folder containing the bid schedule, a miscellaneous data folder containing the proposal and attachments, contractor authorization folder containing bidders's contact information, and a bid bond folder. The bidder shall review the proposal and complete the bidding schedule, as specified herein, and the attachments.

The bidder shall include with its bid an email address and recipient name as its contact information for the purpose of receiving the notice of award or other notices related to the bidding. The Department will send the notice of award, executed contract and other notices to the requested email address and recipient name.

It is the contractor's responsibility to provide the updated contact information to the Department if there are any changes to the above requested email address or recipient name prior to the award of the contract.

The bidder shall specify a unit price for each pay item for which a quantity is given in the bidding schedule. The software will automatically produce the extended amount, as the product of the quantity given and the specified unit price.

The bidder shall also download all addenda files issued and update the project file accordingly. The bidder shall be responsible for the successful submission of its electronic bid prior to the time specified for submission of bids. The bidder agrees that the Department bears no liability resulting from the bidder's failure to successfully submit an electronic bid.

(2) Procedure for Missing Bids:

If a bidder believes that its electronically submitted bid should have been read at the bid opening but was not read, the bidder shall notify the Department at CSGroup@azdot.gov of

the apparent irregularity and provide its bid receipt for the bid in question no later than three hours after the time specified for submission of bids.

Upon proper notification of a missing bid by a bidder, the Department will notify all bidders that a missing bid has been reported. The Department will begin an investigation to determine the status of the bid, and will review all electronic bids received from Bid Express service.

The Department will direct Infotech to review their records and determine whether the missing bid was submitted. Infotech will make a determination about receipt of the bidder's missing bid.

If requested by the Department, Infotech will attempt to retrieve a copy of the encrypted bid from the bidder's computer.

The Department will partner with Infotech and implement best practices to configure the Bid Express service to decrypt the bid.

If the Department determines that a bid cannot be recovered, the Department will notify all bidders of its determination.

If a missing bid is recovered, the Department will determine the validity of the bid, and may recommend award of the contract to the bidder submitting the missing bid if appropriate. The Department will notify all bidders.

102.09 Non-Collusion Certification:

By submission of its bid electronically, the bidder makes the certification stated in the following paragraph, binding as if it had been signed by the bidder.

The bidder certifies that, pursuant to Subsection 112(c) of Title 23, United States Code and Title 44, Chapter 10, Article 1 of the A.R.S, neither it nor anyone associated with the company, firm, corporation, or individual has, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the submitted bid.

102.10 Irregular Proposals:

(A) Proposals may be considered irregular and may be rejected for any of the following reasons:

(1) If there is a submission of any kind which may tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.

(2) If the bid is mathematically unbalanced.

(3) If the bid is materially unbalanced.

(B) Proposals will be considered irregular and will be rejected for any of the following reasons:

(1) If the bidder or surety fails to provide a proposal guaranty as specified in Subsection 102.11 of the specifications.

(2) If the bidding schedule does not contain a unit price for each pay item listed.

(3) If the bidder fails to meet the required goal for Disadvantaged Business Enterprises (DBE) established in the Special Provisions or show good faith effort as determined by the Department.

102.11 Proposal Guaranty:

The bidder shall provide an electronic proposal guaranty payable to the Arizona Department of Transportation for 10 percent of the amount of the bid.

The surety (bid) bond shall be executed by the bidder and a surety company or companies holding a certificate of authority to transact surety business in this State issued by the Director of the Department of Insurance. The agent for the surety shall be licensed to act as an insurance agent in Arizona.

Bidders shall provide an electronic proposal guaranty as described herein.

Two companies have established web-based surety processing procedures with Bid Express: Surety 2000 (https://surety2000.com/) and Sure Path Network (http://web.insurevision.com/). Bidders may contact these companies for additional information and requirements on electronic proposal guaranty.

102.12 Withdrawal of Proposals:

(A) General:

A bidder may withdraw its electronic submittal at a minimum 30 minutes prior to the time specified for bid opening in writing to the Contracts and Specifications Manager through the Contract and Specifications Group email at CSGroup@azdot.gov------

(B) Conditional Withdrawal:

When proposals for more than one contract are to be publicly read on any one date, a bidder may request in the event it is the apparent low bidder on a given contract or contracts, that one or more subsequent bids be withdrawn.

The bidder shall submit a written request for conditional withdrawal to the Contracts and Specifications Group Manager via email at CSGroup@azdot.gov a minimum of 30 minutes prior to the specified bid opening time.

102.13 Combination or Conditional Proposals:

At the Department's discretion, proposals may be issued for projects either separately or in combination. Bidders may submit bids for the combination or for individual units within the

combination, as allowed in the proposal. The Department reserves the right to award contracts based on separate or combination bids, whichever is most advantageous to the state. Only combination bids specifically authorized in the Department's proposal will be considered.

102.14 Public Opening of Proposals:

Proposals will be opened and read aloud at the time indicated in the advertisement for bid.

Bidders, their authorized agents and other interested parties may attend the bid opening while they are read aloud. After the completion of the bid opening, the as-read bid results will then be made available through the ADOT Contracts and Specifications Group website.

102.15 Licensing:

It is the responsibility of the bidder to determine whether it has the appropriate contracting licenses to perform the work. For all projects except Federal-aid funded projects, the bidder shall have the proper licenses at the time of bid opening. The successful bidder's failure to meet with the necessary license requirements at the time of bid opening will result in the rejection of the bid.

On Federal-aid funded projects, the bidder is not required to have the licenses at the time of bidding, but it must procure the licenses from the State Registrar of Contractors, in accordance with A.R.S. 32 1101 et seq. before award can be made, and no later than 60 days after the date bids are opened. The bidder's failure to get the necessary licenses within 60 days after the bid opening date will result in rejection of the bid.

Licensing information is available from:
Arizona Registrar of Contractors
1700 W. Washington St. Suite 105
Phoenix, AZ 85007-2812
Phone: (602) 542-1525
Email: Webmaster@azroc.gov
www.roc.az.gov

102.16 Boycott of Israel:

All bidders are required to certify in their bid proposal on the "Participation in Boycott of Israel Certification" form either:

(A) The bidder does not participate in, and agrees not to participate in during the term of the contract, a boycott of Israel in accordance with ARS 35-393.01; or

(B) The bidder does participate in a boycott of Israel as defined in ARS 35-393.01.

The Department will not recommend award of the contract unless the bidder makes the certification described in subparagraph (A) of this Subsection.

102.17 Forced Labor of Ethnic Uyghurs Ban:

All bidders are required to certify in their bid proposal on the "Forced Labor of Ethnic Uyghurs Ban Certification Form" either:

(A) The bidder does not use the Forced labor of Ethnic Uyghurs as described in A.R.S. 35-394; or

(B) The bidder does use the Forced labor of Ethnic Uyghurs as described in A.R.S. 35-394.

The Department will not recommend award of the contract if the bidder makes the certification described in subparagraph (B) of this Subsection, unless the bidder uses an exempt contractor.

For the purposes of this subsection, a contractor is defined as an exempt contractor if it is a sole proprietorship; has fewer than 10 employees; and/or is a non-profit organization.

(102NOBID, 09/19/12)

SECTION 102 BIDDING REQUIREMENTS AND CONDITIONS:

102.03 Suspension from Bidding: of the Standard Specifications is modified to add:

The signature of the bid proposal by a bidder constitutes the bidder's certification, under penalty of perjury under the laws of the United States, that the bidder, or any person associated therewith in the capacity of owner, partner, director, officer, principal investor, project director, manager, auditor, or any position involving the administration of federal funds, has not been, or is not currently, under suspension, debarment, voluntary exclusion or been determined ineligible by any federal agency within the past three years. Signature of the bid proposal also certifies, under penalty of perjury under the laws of the United States, that the bidder does not have a proposed debarment pending. In addition, signature of the bid proposal certifies that the bidder has not been indicted, convicted, or had a civil judgment rendered against (it) by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Any exceptions to the above paragraph shall be noted and fully described on a separate sheet and attached to the bid proposal.

(102LOBY, 01/21/21)

SECTION 102 BIDDING REQUIREMENTS AND CONDITIONS:

102.09 Non-Collusion Certification: of the Standard Specifications is modified to add:

(A) Lobbying:

The bidder certifies, by signing and submitting this bid or proposal, to the best of its knowledge and belief, that:

(1) No Federally appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract grant, loan, or cooperative agreement.

(2) If any funds other than Federally appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions. Copies of Form-LLL, "Disclosure Form to Report Lobbying", are available at ADOT Contracts and Specifications Group, 205 South 17th Avenue, Room 121F, Phoenix, AZ 85007.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The bidder also agrees, by submitting the bid or proposal, that it shall require that the language of this certification be included in all subcontracts and lower tier subcontracts which exceed $100,000 and that all such subcontractors and lower tier subcontractors shall certify and disclose accordingly.

The Department will keep the prime contractors' certifications on file as part of their original bid proposals. Each prime contractor shall keep individual certifications from all subcontractors and lower tier subcontractors on file.

Certifications shall be retained for three years following completion and acceptance of any given project.

Disclosure forms for the prime contractor shall be submitted to the Engineer at the pre-construction conference. Disclosure forms for subcontractors and lower tier subcontractors shall be submitted to the Engineer by the prime contractor along with the submittal of each subcontract or lower tier subcontract, as required under Subsection 108.01, when said subcontracts exceed $100,000.00. During the performance of the contract the prime contractor and any affected subcontractors shall file revised disclosure forms at the end of each calendar year quarter in which events occur that materially affect the accuracy of any previously filed disclosure form. Disclosure forms will be submitted by the Engineer to the Federal Highway Administration for further processing.

(103AWARD, 09/17/20)

SECTION 103 - AWARD AND EXECUTION OF CONTRACT:

103.04 Award of Contract: of the Standard Specifications is modified to add:

The Department will make the award to the lowest responsible bidder who has the proper licenses.

When a contract is funded, either wholly or in part, by federal funds, an award of contract may be made contingent upon the successful bidder obtaining an appropriate license in accordance with the requirements of Subsection 102.16 of the specifications. The license must be obtained within 60 calendar days following opening of bid proposals. No adjustment in proposed bid prices or damages for delay will be allowed as a result of any delay caused by the lack of an appropriate license.

Failure to acquire the necessary licensing within the specified period of time shall result in either award to the next lowest responsible bidder, or re-advertisement of the contract, as may be in the best interests of the Department.

(104TPDDC, 08/21/25)

SECTION 104 SCOPE OF WORK:

104.04 Maintenance of Traffic: of the Standard Specifications is modified to add:

Prior to construction, alterations to contract phasing, detours, and Maintenance and Protection of Traffic plans shall be reviewed by the Engineer at the preconstruction conference or a pre-activity meeting based on the contractor’s preliminary schedule and proposed contract phasing.

SECTION 104 SCOPE OF WORK:

104.04 Maintenance of Traffic: of the Standard Specifications is modified to add:

(D) General Traffic Control Information:

The contractor shall develop traffic control plans within the site during construction for the three construction phases. Traffic control measures shall allow vehicle access through the port at all times to maintain truck permitting and minor inspection operations during regular port business hours. Traffic control plans shall be submitted and approved by the Engineer in advance of implementation.

The contractor shall maintain the existing water service line until the new system is installed and operational. The contractor shall maintain the lighting system until the new system is installed and operational. The contractor shall maintain the existing video surveillance system until the new system is installed, except at the locations being demolished by the new administration building construction.

The project traffic control shall be constructed in accordance with Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) 2023 Edition with Arizona Supplement to the 2023 Edition, the Arizona Department of Transportation Traffic Control Design Guidelines (TCDG) 2025, and the project plans. The contractor shall establish the traffic control necessary to provide a safe and efficient work zone without unduly delaying traffic.

Changes or revisions to the Traffic Control Plan (TCP) and specifications shall be submitted and approved by the Engineer in advance of implementation.

The temporary removal or covering of existing signs shall be in accordance with Section 701-3.11 and 701-5.10 of the specifications.

Signing for double fines in work zones, when allowed by the Engineer, shall generally conform to Figure SA-12 of the 2025 TCDG. Such signing shall only be in place during work periods when workers are present in accordance with the guidelines for signing for double fines in work zones. If the contractor violates the guidelines for signing for double fines in work zones, the contractor shall forfeit the ability to include double fines signing as part of the traffic control.

Where there is construction alongside the I-10 off-ramp into the POE, the contractor shall place 48 in. x 48 in. “ROAD WORK AHEAD” (W20-1) and “SHOULDER WORK AHEAD” (W21-5c) signing as directed by the Engineer to alert the public to the construction activities.

While traffic control items are not in use, the contractor shall remove these items to a location at least 30 ft. from the edge of the paved roadway or behind guardrail or concrete barrier. This includes sign supports without sign panels. Any signs which are not in use, but which cannot be moved at least 30 ft. from the roadway or behind guardrail or concrete barrier, shall be covered so the public cannot read the legends. Traffic control devices shall not be permitted to remain stockpiled on the shoulder until the next closure.

The retroreflective sheeting on all traffic control signs, barricades, vertical panels, and other work zone traffic control devices except orange signs and delineation for impact attenuators shall meet the criteria established for Type IV, Type VIII, Type IX, or Type XI sheeting in

ASTM D4956. All orange signs and delineation for impact attenuators shall have fluorescent reflective sheeting and shall meet the criteria established for Type VIII, Type IX, or Type XI sheeting in ASTM D4956. Except as otherwise permitted by the Engineer, all warning signs used for this project shall be 48 in. x 48 in. Each sign in place at night shall have an affixed Type A flashing warning light. Each sign shall have 2 warning flags.

The contractor shall be required to check on all traffic control barricades, signs, and variable message boards twice daily and maintain as needed.

At all times, the contractor shall conduct the construction activities to safeguard pedestrians and vehicular access in the vicinity of the project.

Temporary traffic control devices shall not be set up in advance of a closure unless approved by the Engineer.

For each changeable message board used on the project but not located in a protected location behind guardrail or another barrier, the contractor shall position ten Type I or ten Type II barricades – but not vertical panels —– around the changeable message board. Each barricade shall have an affixed Type C steady-burning light for nighttime use. The contractor shall position changeable message boards and the barricades surrounding them only where and when approved by the Engineer. Changeable message boards shall be placed a minimum of seven calendar days prior to start of work. All messages shall be approved by the Engineer prior to being displayed.

(E) Schedules for Daily Traffic Control Activities:

The contractor shall provide a schedule of daily activities and corresponding traffic control schemes. The information shall be provided in advance or during the weekly construction meeting in accordance with the requirements of Subsection 108.03 of the specifications and shall specify the limits of the work activities and related traffic control plan by location, direction, and time. The contractor shall coordinate with the Engineer to determine regular hours of operation with the port staff prior to the start of construction.

Lane or shoulder closures on I-10 will not be allowed at any time.

I-10 off-ramp and on-ramp in and out of the POE shall remain open at all times during regular hours of operation.

During summer months (June through September) regular hours of operation are 6:00 AM to 4:00 PM on Mondays, Tuesday, Wednesdays, Thursdays and Fridays. Regular hours of operation during non-summer months are 7:00 AM to 5:00 PM on Monday, Tuesday, Wednesday, Thursday and Friday. No work shall occur on weekends. If requested by the contractor to aid the construction process, and if approved by the Engineer, the POE may adjust operating hours to four days per week with longer hours and can adjust which days of the week the POE is open for construction.

<u>Holiday Restrictions</u>

No work will be allowed during recognized holidays unless otherwise directed by the Engineer.

Holidays are from 12:00 PM of the last working day prior to the holiday until 6:00 AM of the first working day following the holiday. When the holiday falls on a Tuesday, the Monday before the holiday is considered part of the holiday. When the holiday falls on a Thursday, the Friday after the holiday is considered part of the holiday.

The recognized holidays are:

Holiday	**Start Day (12 p.m.)**	**End Day (6 a.m.)**
MLK Day	January 15, 2027	January 19, 2027
Presidents' Day	February 12, 2027	February 16, 2027
Memorial Day	May 28, 2027	June 1, 2027
Independence Day	July 2, 2027	July 5, 2027
Labor Day	September 3, 2027	September 7, 2027
Columbus Day	October 8, 2027	October 12, 2027
Veterans Day	November 10, 2027	November 12, 2027
Thanksgiving Day	November 24, 2027	November 29, 2027
Christmas / New Year's	December 23, 2027	January 3, 2028
MLK Day	January 14, 2028	January 18, 2028
Presidents' Day	February 18, 2028	February 22, 2028
Memorial Day	May 26, 2028	May 30, 2028
Independence Day	June 30, 2028	July 5, 2028
Labor Day	September 1, 2028	September 5, 2028
Columbus Day	October 6, 2028	October 10, 2028
Veterans Day	November 10, 2028	November 13, 2028
Thanksgiving Day	November 22, 2028	November 27, 2028
Christmas / New Year's	December 22, 2028	January 1, 2029

(104SWDEQ, 02/10/20)

SECTION 104 SCOPE OF WORK:

104.09 Prevention of Landscape Defacement; Protection of Streams, Lakes and Reservoirs: the title and text of the Standard Specifications is revised to read:

104.09 Prevention of Stormwater Pollution:

(A) General:

The contractor shall follow the requirements of Section 402 of the Clean Water Act (CWA), 33 USC 1251 and other water quality regulations. The CWA regulates discharge of pollutants into the waters of the United States and provides quality standards for surface waters. Section 402 of the CWA provides stormwater pollution prevention regulations. ADEQ's Aquifer Protection Permit (APP) Program regulates temporary concrete washout facilities. The APP Type 1 Permit (APP 1.12) applies only when projects disturb one or more acres and are covered under the Arizona Department of Environmental Quality Construction General Permit.

The contractor shall minimize ground disturbance to the natural surroundings. No ground disturbing activities shall occur until all applicable permits have been obtained. The applicable permit requirements must always be met.

The contractor shall provide adequate information to the contractor's personnel, including employees of any subcontractors, to ensure that all personnel understand requirements of the applicable permits that are relevant to their job functions.

(B) Clean Water Act, Section 402, Arizona Pollutant Discharge Elimination System (AZPDES):

(1) General Requirements:

The contractor shall be responsible for preparing and processing all documents and implementing the requirements of the Arizona Pollutant Discharge Elimination System (AZPDES) "General Permit for Discharge from Construction Activities to the Waters of the United States," for pollution prevention issued by the Arizona Department of Environmental Quality (ADEQ). That document is hereinafter referred to as the Construction General Permit (CGP) and is available on ADEQ's website.

The work shall include providing, installing, and maintaining, temporary and permanent pollution prevention control measures and removing and disposing of temporary pollution prevention control measures. Control Measures, as hereinafter referenced, shall be deemed to include pollution prevention control as described in the CGP. Control Measures may be temporary or permanent.

The contractor's schedule shall allow sufficient time for the following submittal, review, and approval times:

Table 104-1 Submittal, Review, and Approval Timeframes	
Contractor submittal of Erosion Control Coordinator (ECC) qualifications	By the pre-construction conference
Department review and approval of ECC qualifications	within seven calendar days of receipt
Department review and approval of subsequent submittals (if required)	within seven calendar days of receipt
Contractor submittal of SWPPP to Engineer	By the pre-construction conference
Department review and approval of subsequent submittals (if required)	within seven calendar days of receipt
Engineer/contractor joint review of SWPPP	within 10 calendar days after contractor submittal of SWPPP with ADOT approval of the ECC
Approved Notice of Intent (NOI) submittal and review times	as described in the CGP

No increase in contract time will be granted for the contractor's failure to provide acceptable submittals within the specified timeframes.

(2) Stormwater Pollution Prevention Plan (SWPPP):

The SWPPP shall include all information and permit requirements specified in the CGP, and shall also be consistent with applicable state or local programs.

Unless otherwise approved by the Engineer and documented in the SWPPP, the contractor shall not expose a surface area of greater than 750,000 square feet to erosion through clearing and grubbing, or excavation and filling operations within the project limits until temporary or permanent Control Measures for that portion of the project have been installed and accepted by the Engineer.

The contractor shall indicate each 750,000 square-foot sub-area in the SWPPP, along with proposed Control Measures for each sub-area. The SWPPP shall also include the sequence of construction for each sub-area, and installation of the required temporary or permanent Control Measures.

The contractor shall give installation of permanent Control Measures priority over reliance on temporary measures. Permanent Control Measures and drainage structures shall be installed as soon as possible in the construction sequencing of the project, preferably concurrent with construction of the related sub-area or drainage device.

The project plans may include erosion/sediment control plans and details along with a Control Measure Index Sheet (CMIS) to assist the contractor in preparing the SWPPP. The contractor and the contractor's ECC, or other qualified designee, as described in Subsection 104.09(B)(3), shall review the contract documents, and prepare the SWPPP for review by the Engineer. The contractor shall use the Department's SWPPP Template to prepare the SWPPP. The template is available on the Department's Water Resources website.

The SWPPP shall specify the mechanism whereby revisions may be proposed by the contractor or the Engineer throughout the project and incorporated into the plan, including the review and approval procedure. The Engineer and contractor shall jointly approve and sign each revision to the SWPPP before implementation. Any revisions made by the contractor to amend the approved SWPPP will require two to seven calendar days for review**.**

The contractor shall prepare the SWPPP for the Engineer's review including all information specified herein. The contractor shall submit the SWPPP to the Engineer at the preconstruction conference.

Within 10 calendar days of the SWPPP submittal, the Engineer and contractor will jointly review the contractor's SWPPP. The contractor shall include any additional revisions directed by the Engineer. The SWPPP shall meet the terms and conditions of the CGP and be compatible with construction sequencing and maintenance of traffic plans.

When agreement has been reached, the Engineer and contractor's ECC will sign the SWPPP. The Engineer's signature will constitute approval of the SWPPP. Upon approval of the SWPPP, the contractor and the Engineer shall each file a Notice of Intent (NOI) as specified in Subsection 104.09(B)(6). The Engineer will provide a copy of the Department's NOI to the contractor to be included in the SWPPP.

The SWPPP shall be maintained in accordance with the CGP. A current copy shall be maintained at a location approved by the Engineer and amended as necessary from the time the contractor files its NOI until the NOT is submitted. The SWPPP shall be available for inspection by entities identified in the CGP, and for use by the Engineer.

No condition of the CGP or the SWPPP shall release the contractor from any responsibilities or requirements under other environmental statutes or regulations.

In accordance with the CGP, the Engineer and the contractor shall confirm the frequency of inspections appropriate for the project. The contractor shall identify the frequency in the SWPPP. The contractor shall inform the Engineer when each inspection will be performed a minimum of 72 hours in advance so the Engineer can jointly perform the inspection if desired.

The contractor shall monitor rainfall on the site with a commercially manufactured rain gauge accurate to within 0.10 inches of rain. Rainfall records shall be maintained in the SWPPP.

(3) Erosion Control Coordinator (ECC):

The contractor shall designate an erosion control coordinator (ECC) to be responsible for approval and implementation of the SWPPP, as well as all other applicable requirements of the CGP. The contractor's ECC shall have the qualifications described in Subsection 104.09(B)(4).

The contractor shall not assume that the person proposed as ECC will be accepted by the Department merely because the experience and education requirements listed herein have been met.

After approval, the contractor shall designate the ECC as a duly authorized representative of the contractor in accordance with, and as defined in, the CGP. Documentation of the delegation of a duly authorized representative shall be included as part of the SWPPP.

The ECC shall be capable of identifying existing and predictable effects of the contractor's operations, and shall have complete authority to direct the contractor's personnel and equipment to implement the requirements described herein, including prompt placement of corrective measures to minimize or eliminate pollution and damage to downstream watercourses. Corrective measures shall be completed in the timeframe required by the CGP and included in the SWPPP as required by the CGP.

The ECC shall at all times be aware of the contractor's work activities, schedule, and effect of the work on the environment. Should the ECC not be present at the project site on a full-time basis, the contractor shall establish procedures to ensure that its ECC is promptly notified of any damage or displacement of the required erosion control measures, whether from construction, vandalism, or other causes.

The contractor bears all risks and liabilities for the failure of its ECC to properly implement the requirements of the CGP.

Failure of the contractor to properly maintain the Control Measures required in the approved SWPPP may be cause for the Engineer to reject the ECC and issue a stop work order, as specified in Subsection 104.09(B)(7).

(4) ECC Certification Requirements:

The ECC shall have successfully completed the mandatory two-day (16 hour) "Erosion Control Coordinator" training class (hereinafter referred to as the training class) provided by the Associated General Contractors (Arizona Chapter), phone (602) 252-3926. No other training can be substituted.

The training class certification is valid for three years. Within 60 days of the end of the three year period, in order to maintain the training class certification, the ECC shall successfully complete either a six-hour "Erosion Control Coordinator Refresher" class (hereinafter referred to as the refresher class), also provided by the Associated General Contractors (Arizona Chapter), or the two-day training class specified above. The refresher class will be required every three years thereafter, prior to the expiration date listed on the previous certificate. Should more than three years (and 60 day grace period) elapse from completion of either the training class or refresher class, the contractor's ECC will be required to successfully complete the two-day training class in order to again be eligible for consideration.

In addition, the contractor's ECC shall have documented experience equal to a minimum of one year from either of the following two categories:

(a) Experience in the implementation of SWPPPs. The ECC's experience shall demonstrate full-time responsibility for directly supervising construction personnel in the installation, inspection, and maintenance of pollution prevention measures.

(b) Experience in stabilization of disturbed areas in environments similar to those on the project.

The contractor's documentation shall provide details indicating the types of relevant experience and shall provide the number of months of each type of experience to be considered for approval.

The contractor's documentation shall also indicate that the proposed ECC has completed the training class or refresher class. To be considered for approval, the contractor's documentation shall include a copy of the proposed ECC's certification.

(5) Acceptance of ECC and SWPPP:

The contractor shall submit documentation indicating the qualifications of the ECC to the Engineer for approval no later than the pre-construction conference. The Engineer will review the proposed candidate's information within seven calendar days. The contractor may begin development of the SWPPP prior to approval of the ECC. However no clearing, grubbing, earthwork, or other work elements that may be subject to the requirements of the CGP shall be started until the ECC has been approved, the SWPPP finalized and implemented, the NOI completed and filed, and the CGP authorization received by the contractor and the Engineer. If sampling is required, the SWPPP and SAP shall also be reviewed and approved by ADEQ prior to ground disturbance by the contractor.

(6) Notice of Intent:

After the project SWPPP has been approved by the Engineer, the Engineer and the contractor will each complete separate Notice of Intent (NOI) forms for the project. The contractor shall submit the NOI to ADEQ as required by the CGP.

Unless notified otherwise by ADEQ, the contractor will be authorized to begin implementation of the approved SWPPP seven calendar days after acknowledgement of receipt of both NOIs by ADEQ or whenever an authorization certificate is issued by ADEQ, whichever occurs first.

(7) Non-Compliance:

The Engineer may reject the contractor's ECC if, in the opinion of the Engineer, the conditions of the CGP or the SWPPP are not being fulfilled. Rejection of the contractor's ECC shall be for failure to complete any of the following:

(a) Should the Engineer determine that the SWPPP is not being properly implemented; the contractor will be notified in writing of such deficiencies. The contractor's ECC shall fully implement, to the satisfaction of the Engineer, the requirements of the approved SWPPP within three working days.

(b) Should any corrective measures required in the CGP not be completed within the time periods specified therein, the Engineer will notify the contractor in writing. The contractor's ECC shall complete all required corrective measures within two calendar days of such notification,

except that direct inflows of sediment into a watercourse shall be corrected within 24 hours.

(c) Should the Engineer determine that routine maintenance of the project's Control Measures is not being adequately performed; the contractor will be notified in writing. Within three working days, the contractor's ECC shall demonstrate, to the satisfaction of the Engineer that such steps have been taken to correct the problem.

In the event of the ECC's failure to comply with the CGP or any of the above requirements, the Engineer will direct the contractor to stop all affected work and propose a new ECC as soon as possible. However, all Control Measures specified in the SWPPP shall be maintained at all times. No additional work on construction items affected by the SWPPP will be allowed until a new ECC has been approved by the Engineer. The contractor will not be allowed compensation or an extension of contract time for any delays to the work because of the failure of the contractor's ECC to properly fulfill the requirements of the SWPPP.

(8) Notice of Termination:

Upon written approval of the Engineer, the contractor shall complete and submit a Notice of Termination (NOT) to the Engineer for approval. After approval by the Engineer, the contractor shall submit the NOT to ADEQ.

The NOT shall be submitted as described in the CGP.

A copy of the SWPPP and the NOT shall be provided to the Engineer within seven days of the contractor receiving acknowledgement from ADEQ. The copies may be either electronic or hard copies.

(C) Aquifer Protection Requirements (Concrete Washout Facilities):

If the contractor's work requires the use of temporary concrete washout facilities, the contractor shall comply with the requirements of ADEQ's APP Type 1 Permit (APP 1.12). APP 1.12 covers wastewater to an impoundment from washing concrete from trucks, pumps, and ancillary equipment. The contractor shall address concrete washout activities in the project SWPPP.

(D) Measurement and Payment:

Measurement and payment for work specified in the SWPPP will be made in accordance with the requirements of Section 810. Control Measures specified in the contract which are to be accomplished under any of the other various contract items will be paid for as specified under those items.

If a force account pay item for Control Measures is included in the bidding schedule, the contractor may be reimbursed for such additional Control Measures proposed by the contractor but not included with the plans or specifications. Such additional Control Measures must be approved in writing by the Engineer before use. Items for Control Measures approved by the Engineer will be paid in accordance with Subsection 109.04(D). No

measurement or payment will be made for such additional items not approved by the Engineer.

No measurement or payment will be made to the contractor for time spent in preparing, reviewing, and revising the SWPPP, the SAP, or providing other required documentation, the cost being considered as included in the price of contract items. No measurement or payment will be made for inspections, training of personnel, the contractor's erosion control coordinator, the contractor's pollution prevention practices and requirements, or maintenance of the Control Measures during a suspension of work, the costs being considered as included in contract items.

No measurement or payment will be made, except as specified below for external laboratory testing, for labor, equipment, and materials required in the SAP, the cost being considered to be included in contract items.

If an item is included on the bidding schedule for Construction Monitoring (Laboratory Testing), the contractor will be reimbursed for those samples tested, as required in the approved SAP, by an accredited laboratory approved by the Arizona Department of Health Services. The contractor will be reimbursed for the invoice amount of each required test, plus an additional markup of ten percent of the invoice amount. No measurement or payment will be made for in-field testing and related equipment, the cost being considered to be included in contract items.

No measurement or payment will be made for temporary concrete washout facilities, the cost being considered to be included in contract items.

Unless otherwise specified, no measurement or payment will be made for maintenance of temporary and permanent Control Measures, the cost being considered as included in contract items.

104.10 Contractor's Responsibility for Work: of the Standard Specifications is revised to read:

The contractor shall implement the requirements of the CGP for pollution prevention due to stormwater runoff during construction, as specified above in Subsection 104.09, Prevention of Stormwater Pollution.

Until final written acceptance of the project by the Engineer, the contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part thereof by the action of the elements, or from any other cause, whether arising from the execution or from the nonexecution of the work. The contractor shall rebuild, repair, restore and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance. No reimbursement shall be made for work necessary due to the contractor's failure to comply with the requirements of the SWPPP.

Except as specifically provided under Subsection 104.04, in case of suspension of work from any cause whatever, the contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the project and provide for normal drainage. The contractor shall maintain Control Measures in working order during any stoppage of work. Based on the nature of the work stoppage, the contractor and the Engineer

shall determine the maintenance requirements. The contractor shall comply with the CGP including inspection of the project.

(104STORM, 11/01/95)

SECTION 104 SCOPE OF WORK:

104.11 Damage by Storm, Flood or Earthquake: Item (D), Idled Equipment and Remobilization, of the Standard Specifications is hereby deleted.

104.11 Damage by Storm, Flood or Earthquake: Items (E) and (F) of the Standard Specifications are revised to read:

(D) Payment for Repair Work:

The State will pay the cost of the repair work as determined in Subsection 109.04.

(E) Termination of Contract:

If the Department elects to terminate the contract, the termination and the determination of the total compensation payable to the contractor shall be governed by the provisions of Subsection 108.11, Termination of Contract for Convenience of the Department.

(104ENVIR, 06/17/21)

SECTION 104 SCOPE OF WORK:

104.12 Environmental Analysis: the fifth and sixth paragraphs of the Standard Specifications are revised to read:

If the contractor elects to do an environmental analysis and use any site, source, or access for the reasons listed above, they choose to do so at their own risk. It is the contractor's responsibility to exercise due diligence when selecting these sites and areas. The contractor shall bear all costs associated with the use of proposed sites, sources, and accesses.

The contractor shall promptly advise the Engineer that it is preparing the environmental analysis and shall submit to the Engineer for review and consultation. The Department will review the submittal and send it to the appropriate agencies and/or jurisdictions for consultation or return it to the contractor for revision. The contractor shall allow a minimum of 60 calendar days after submittal, or subsequent resubmittals, to the Department for the Department to review the environmental analysis and to consult with the appropriate jurisdictions and/or agencies. At the end of the review period, the Engineer will notify the contractor whether or not the environmental analysis is acceptable.

If the approval of the environmental analysis causes a delay to a controlling activity of the project due to the Department's actions in the aforementioned review process, the contractor may seek, and the Engineer may grant, an extension of time in accordance with the terms of Subsection 108.08 of the specifications. The time extension shall not exceed 30 working days for a working-day contract, or 45 calendar days for a calendar-day project. The time extension

will not be considered unless the contractor can show evidence of the delay resulting due to the Department's actions in the review process. A time extension request will not be considered or granted for any other reason. No time extension will be granted for a fixed completion date contract.

104.12 **Environmental Analysis:** the items (G) and (O) of the seventh paragraph of the Standard Specifications is revised to read:

(G) The archaeological survey of the proposed source prepared by a person who meets the Secretary of the Interior's Professional Qualification Standards (48 FR 44716) and possesses a current permit for archaeological survey issued by the Arizona State Museum (ASM). The survey shall be prepared in a State Historic Preservation Office (SHPO) standardized format. The survey shall identify all historic properties within the area of potential effect (APE), as defined by the National Historic Preservation Act (36 CFR 800.4). This includes the materials source, processing area, and the haul road. Additionally, the survey report shall identify the effects of the proposed source on any historic properties within the APE, and recommend measures to avoid, minimize, or mitigate those effects. The survey report shall be prepared by the contractor in accordance with SHPO and ASM formatting style for the Historic Preservation Specialist's initial review. After the initial review, the Department will consult with the landowner, SHPO, and Tribes for a minimum of 35 days for the final approval of the survey report.

(O) A description of the impact on federally or state protected or other agency-specific special status wildlife and plants and their habitat, as defined in ADOT's consultant biological procedures on the Department's website. Compliance with the Arizona Native Plant Law shall be coordinated through the Arizona Commission of Agriculture and Horticulture.

104.12 **Environmental Analysis:** the eighth paragraph of the Standard Specifications is revised to read:

Guidance and forms for preparing the environmental analysis are available on the Department's website through the Environmental Planning Group, or by calling Environmental Planning Group at 602-712-7767.

(104VEPC, 03/20/25)

SECTION 104 SCOPE OF WORK:

104.13 **Value Engineering Proposals by The contractor:** the third paragraph of the Standard Specifications is revised to read:

Any cost savings generated to the contract as a result of VEP offered by the contractor and approved by the Department will be shared between the contractor and the Department, with the contractor receiving 60 percent and the Department receiving 40 percent, as specified in Subsection 104.13(D) of the specifications.

104.13(C) Conditions: of the Standard Specifications is modified to add:

(13) The contractor may submit a previously approved VEP from another project.

104.13(D) Acceptance, Rejection and Payment: the seventh paragraph of the Standard Specifications is revised to read:

(6) The executed supplemental agreement shall provide that the contractor be paid 60 percent of the net savings amount as reflected by the difference between the cost of the revised work and the cost of the related construction required by the original contract computed at contract bid prices. The net savings will take into account the contractor's cost of developing the VEP and implementing the change, and reducing this amount by the Department's cost for investigating and evaluating the VEP, including any ascertainable collateral costs to the Department. Such collateral costs may include increased costs for maintenance, operation, related work items, additional work items, or elements of related or additional work items.

(104ENVST, 09/19/24)

SECTION 104 SCOPE OF WORK:

104.16 Environmental Standard Work: of the Standard Specifications is hereby modified as follows:

(F) Specific Vegetation Protection Program: is hereby added to the Standard Specifications:

The contractor shall control noxious and invasive plant species throughout the duration of the project in accordance with the requirements of these special provisions.

All disturbed soils that are not landscaped or otherwise permanently stabilized by construction shall be seeded in accordance with the requirements of Item 8050003 of these special provisions.

The contractor shall not disturb unpaved areas without the approval of the Engineer or as stated in the Environmental, Permits, Issues, and Commitments (EPIC) plan sheet 1F of the project plans. If any unpaved areas are disturbed as a result of the contractor's operation and without the approval of the Engineer, the contractor shall seed the areas with species native to the project vicinity. All seeded areas shall be covered by straw mulch with tacking agent. The contractor shall provide the seed mix to the Engineer for approval prior to placing any seeding. No measurement or payment will be made for seeding, the cost being considered as included in the price of contract items.

SECTION 105 CONTROL OF WORK:

105.09 Cooperation between Contractors: of the Standard Specifications is modified to add:

In the event of other adjoining projects happening near the limits of the project, the contractor shall coordinate all its work activities to not adversely conflict with such adjoining projects. The contractor shall coordinate its work with that of any other contractor of the adjoining projects to the benefit of all contractors, public and the Department.

The following Project(s) is (are) anticipated to be under construction during the same time as this project.

TRACS No: F0842 01C
Project No: 040 CH 377
Termini: MP 377.0 – 391.23
Location: San Simon – New Mexico State Line

This pavement rehabilitation project will be under construction within the same timeframe as this project. This ADOT project begins at MP 377.0 (San Simon) and extends east along I-10 to MP 391.23, at the New Mexico state line. The construction is being administered by ADOT's Southeast District, and consists of milling and replacing asphalt concrete pavement, guardrail installation, drainage, and other miscellaneous work.

The contractor, through the Engineer, shall invite the contractor of the adjoining project to the preconstruction conference to discuss schedules and impacts of adjoining project in accordance with the requirements specified in Subsection 108.03 of the specifications.

The Engineer may require the contractor from each project to attend weekly construction coordination meetings to keep the construction teams updated in progress of each project.

(105TPDDC, 08/21/25)

SECTION 105 CONTROL OF WORK:

105.18 Opening Sections of Project to Traffic: of the Standard Specifications is modified to add:

Damage to the project resulting from a third-party shall be reported to the Engineer. Damages to permanent project features, determined by the Engineer as eligible for payment in accordance with the requirements of Subsection 104.04 of the specifications, will be paid for in accordance with Subsection 109.04 of the specifications.

(106DMAT, 12/18/25)

SECTION 106 CONTROL OF MATERIALS:

106.15 Blank: of the Standard Specifications is revised to read:

106.15 Domestic Materials and Products:

Steel and iron materials and products used on this project shall comply with the current "Buy America" requirements of 23 CFR 635.410.

All manufacturing processes to produce steel and iron products used on this project shall occur in the United States. Raw materials used in manufacturing the steel and iron products may be foreign or domestic. Steel or iron not meeting these requirements may be used in products on this project provided that the invoiced cost to the contractor for such steel products incorporated into the work does not exceed either 0.1 percent of the total (final) contract cost or $2,500 whichever is greater.

Any process which involves the application of a coating to iron or steel shall occur in the United States. These processes include epoxy coating, galvanizing, painting, or any other coating which protects or enhances the value of covered material.

The requirements specified herein shall only apply to steel and iron products permanently incorporated into the project. "Buy America" provisions do not apply to temporary steel items, such as sheet piling, temporary bridges, steel scaffolding and falsework, or to materials which remain in place at the contractor's convenience.

The contractor shall furnish the Engineer with Certificates of Compliance, conforming to the requirements of Subsection 106.05, which state that steel or iron products incorporated in the project meet the requirements specified. Certificates of Compliance shall also certify that all manufacturing processes to produce steel or iron products, and any application of a coating to iron or steel, occurred in the United States.

Convict-produced materials may not be used unless the materials were produced prior to July 1, 1991 at a prison facility specifically producing convict-made materials for Federal-aid construction projects.

(106CMATLS, 12/18/25)

SECTION 106 CONTROL OF MATERIALS: of the Standard Specifications is modified to add:

106.17 Construction Materials:

A construction material shall comply with the requirements of Build America, Buy America (BABA) Act specified in Title IX, Subtitle A, Part 1, Sections 70901 and 70911-70917 (Pub. L. No. 117-58 §§ 70901; §§ 70911-70917) of the Infrastructure Investment and Job Act (IIJA).

A "construction material" that is permanently incorporated on the project shall include an article, material, or supply that is or consists primarily of the following:

1. Non-ferrous metals;

2. Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
3. Glass (including optic glass);
4. Fiber optic cable (including drop cable);
5. Optical fiber;
6. Lumber;
7. Engineered wood; or
8. Drywall.

Items manufactured through a combination of either two or more materials listed above, or at least one of the materials listed above and a material not listed shall be considered as a manufactured product, rather than as a construction material.

Construction materials shall not include cement and cementitious materials; bituminous materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives.

All construction materials shall be produced in the United States. This means, all manufacturing processes to produce the construction materials shall occur in the United States. All manufacturing processes for construction materials shall mean the final manufacturing process and the immediately preceding manufacturing stage for the construction material.

The contractor shall furnish the Engineer with Certificates of Compliance, conforming to the requirements of Subsection 106.05 of the specifications, which shall state that the construction materials incorporated in the project meet the requirements specified herein. Certificates of Compliance shall also certify that all manufacturing processes to produce construction materials occurred in the United States.

If the total cost of construction materials incorporated in the project is no more than 5% of the original contract amount or $1,000,000, whichever is lesser, the requirements specified herein will not apply for such construction materials.

Convict-produced materials are prohibited in accordance with the requirements of 23 CFR 635.417.

(106MAPR, 12/18/25)

SECTION 106 CONTROL OF MATERIALS: of the Standard Specifications is modified to add:

106.18 Manufactured Products:

Manufactured products used on all projects shall comply with the current “Buy America” requirements of 23 CFR 635.410.

A “manufactured product” is defined as an article, material, or supply that has been processed into a specific form and shape, or combined with other articles, materials, or supplies to create a product with different properties than the individual article, material, or supply. Items manufactured through a combination of two or more materials, or at least one listed construction material and a material not listed, shall be classified as manufactured products.

An item classified as iron or steel product in accordance with the requirements specified in Subsection 106.15 of the specifications or excluded materials such as cement and cementitious materials; bituminous materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives is not considered a manufactured product. However, manufactured product may include components that are iron or steel products or excluded materials.

Mixtures of excluded materials delivered to a work site without final form for incorporation into a project are not considered manufactured products.

Precast concrete products, components of precast concrete products that consist wholly or predominantly of iron or steel or a combination of both, will be considered iron and steel product and shall meet the requirements specified in Subsection 106.15 of the specifications.

The intelligent transportation systems and other electronic hardware systems that are installed in the highway right of way or other real property, the cabinets or other enclosures of such systems that consist wholly or predominantly of iron or steel or a combination of both will be considered iron and steel product and shall meet the requirements specified in Subsection 106.15 of the specifications.

The contractor shall furnish the Engineer with Certificates of Compliance, conforming to the requirements of Subsection 106.05 of the specifications, which shall state that the manufactured products incorporated in the project meet the requirements specified herein. Certificates of Compliance shall also certify that all manufactured products used in the project are manufactured in the United States.

Convict-produced materials are prohibited in accordance with the requirements of 23 CFR 635.417.

(107UINSLMTS, 02/20/25)

SECTION 107 LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

107.14 Insurance: the sixth paragraph of the Standard Specifications is revised to read:

Without limiting any liabilities or any other obligations of the contractor, the contractor shall provide and maintain, if commercially available, the minimum insurance coverage listed below until all obligations under this contract are satisfied:

(A) General Liability insurance with a minimum combined single limit of $1,000,000 each occurrence applicable to all premises and operations, and a minimum general aggregate limit of $2,000,000. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including coverage for contractual and employee acts), blanket contractual, independent contractors, products and completed operations. Further, the policy shall include coverage for the hazards commonly referred to as XCU (explosion, collapse and underground). The products and completed operations coverage shall extend for one year past acceptance, cancellation or termination of the work. The policy shall contain a severability of interests provision.

(B) Comprehensive Automobile Liability insurance with a combined single limit for bodily injury and property of not less than $1,000,000 each occurrence with respect to contractor's owned, hired, or non-owned vehicles, assigned to or used in performance of the work.

(C) Workers' Compensation insurance to cover obligations imposed by Federal and State statutes having jurisdiction of its employees engaged in the performance of the work, and Employers' Liability insurance with a minimum limit of $1,000,000. Evidence of qualified self-insured status will suffice for this subsection.

(107UTIL, 04/17/25)

SECTION 107 LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

107.15 Contractor's Responsibility for Utility Property and Services: of the Standard Specifications is modified to add:

Copies of existing ADOT permits, subject to availability, may be obtained from the ADOT Area Permit Supervisor as listed below:

SOUTHEAST DISTRICT

Safford Area:
(928) 432-4916 2082 E. US Hwy. 70
Safford, AZ 85546

Email address:
southeastpermit@azdot.gov

The following agencies and utility companies have facilities in the area but are not anticipated to be in conflict:

ADOT
Pat Terry
Office - 520-838-2850
Cell - 520-349-1651
pterry@azdot.gov

ADOT has underground sewer, gas, water, intercommunication, power, street lighting, and lighting conduit facilities located within the project limits but will not be in conflict.

Sewer/septic upgrades are being performed as part of the project. Both Cochise County and Arizona Department of Environmental Quality were contacted concerning the sewer/septic modifications for the project, and both noted that for the modifications within the plans, no permit will be required.

The contractor shall coordinate with the Engineer to request that the aforementioned ADOT representative be invited to the Preconstruction Partnering and Weekly Construction Meetings. No separate measurement or payment will be made for coordination with the utility company.

Southwest Gas (Gas)
Oswaldo Lopez
520-576-2460
Oswaldo.Lopez@swgas.com

Southwest Gas has underground gas facilities located within the project limits but will not be in conflict.

The contractor shall coordinate with the Engineer to request Southwest Gas be invited to the Preconstruction Partnering and Weekly Construction Meetings. No separate measurement or payment will be made for coordination with the utility company.

Sulphur Springs Valley Electric Co-operative
Ryan Reese
520-678-8368
rreese@ssvec.com

Christa Crowell
520-515-3465
ccrowell@ssvec.com

Sulphur Springs Valley Electric Co-operative has electric facilities located within the project limits but will not be in conflict.

Adjustments to accommodate a new electrical panel required for building upgrades will be performed by Sulphur Springs Valley Electric Co-operative. The Department will credit the entire amount of the fees charged by Sulphur Springs Valley Electric Co-operative to install the panel, complete and in place. The contractor shall coordinate with Sulphur Springs Valley Electric Co-operative for the service connection work. See Item 9240023.

The contractor shall coordinate with the Engineer to request Sulphur Springs Valley Electric Co-operative be invited to the Preconstruction Partnering and Weekly Construction Meetings. No separate measurement or payment will be made for coordination with the utility company.

Valley Telephone Cooperative
Quentin Dunlap
O: 520-384-8984
C: 520-507-0497
quentin.dunlap@teamvtg.net

Valley Telephone Co-operative has copper and fiber optics facilities within the project limits but will not be in conflict.

The contractor shall coordinate with the Engineer to request Valley Telephone Co-operative be invited to the Preconstruction Partnering and Weekly Construction Meetings. No separate measurement or payment will be made for coordination with the utility company.

It shall be the contractor's responsibility to determine the exact location of the utilities prior to any construction operations and to notify the above-mentioned utility companies at least two working days prior to commencing any work on the project unless stated otherwise by utility company.

The contractor shall contact Prepass, Drivewyze, and IRD 3 weeks prior to any construction for them to relocate their equipment to a temporary location. Contractor shall contact Prepass, Drivewyze, and IRD again once construction is complete to relocate their equipment to the ultimate location.

Prepass Contact:
Jennifer Brown
Regional Director
520-249-9293
jennifer@prepassalliance.org

Drivewyze Contact:
Todd James
Drivewyze Infrastructure Services
Program Manager | fleetworthy.com
719-466-0478

todd.james@fleetworthy.com

IRD Contact:
Richard Maynard
Project Manager
916-712-6444
rmaynard@quarterhill.com

There is a railroad within ½ mile of the project limits. There is no railroad work on this project. The Railroad was notified.

107.15(F) Sewage Discharge Damage Assessments: of the Standard Specifications is revised to read:

The Department will assess sanctions in accordance with the Table 107.15-1 below for each 24-hour period, or portion thereof, for each unplanned breakage that occurs in an active sanitary sewer line as a result of the contractor's operation. The rate of these sanctions is based on the type and quantity of effluent discharged as determined by the Engineer.

These sanctions do not relieve the contractor from any of its responsibilities under the contract, including any liquidated damages that may be assessed under Subsection 108.09 of the specifications for late completion of the project.

The sanctions specified in this subsection will be independent of any penalties imposed by others.

The contractor acknowledges that Regulatory agencies may assess or impose civil or criminal penalties on the contractor resulting from sewer discharges.

The Department will not be responsible for any civil or criminal penalties, fines, damages, or other charges imposed on the contractor by any regulatory agency or court for sewage discharges that are a result, directly or indirectly, of the contractor's work performed under this contract.

TABLE 107.15-1
SANCTIONS
(EACH 24-HOUR PERIOD, OR PORTION THEREOF)

Volume of Discharge	Raw Sewage or Industrial Wastewater	Treated Effluent
Less than 10,000 gallons	$5,000	$1,000
10,000 to 99,999 gallons	$10,000	$2,000
100,000 to 1 million gallons	$25,000	$3,000
Greater than 1 million gallons	$40,000	$5,000

These sanctions will be assessed for each 24-hour period, or portion thereof, until the contractor has completed all of the following tasks:

(1) Stopped the discharge;
(2) Repaired the damaged pipe;
(3) Restored normal service; and
(4) Fully cleaned and disinfected the site to the satisfaction of the Engineer.

Upon completion of tasks (1), (2), and (3) above, and prior to completion of Task (4), the sanctions for the current 24-hour period will be at the rate shown in Table 107.15-1. However, for each subsequent 24-hour period, the assessment will be 1/2 of the rate shown in Table 107.15-1.

The sanctions will continue at the reduced rate until the site has been fully cleaned and disinfected to the satisfaction of the Engineer.

As an example, the amounts assessed each 24-hour period for an unplanned discharge of 20,000 gallons of raw sewage, in which the contractor completes tasks (1), (2), and (3) within the second 24-hour period but does not complete full cleanup until the third 24-hour period, will be as follows:

First 24-hour period:	$10,000
Second 24-hour period:	$10,000
Third 24-hour period:	$5,000

For this example, the total sanction will be $25,000 ($10,000 + $10,000 + $5,000).

(108SUBLT, 10/20/22)

SECTION 108 PROSECUTION AND PROGRESS:

108.01 Subletting of Contract: the thirteenth paragraph of the Standard Specifications is revised to read:

If a subcontractor, of any tier, begins work on the contract prior to the contractor submitting the required documentation and receiving consent from the Engineer, the Department will retain $1,000 from monies due or becoming due the contractor. The money retained will be for each subcontractor, of any tier, that starts work without the consent of the Engineer. These sanctions will be in addition to all other retention or liquidated damages provided for elsewhere in the contract.

(108PRCN, 08/19/21)

SECTION 108 PROSECUTION AND PROGRESS:

108.03 Preconstruction Conference: the second paragraph of the Standard Specifications is revised to read:

At the preconstruction conference the contractor shall submit a progress schedule showing

the order in which the contractor proposes to carry out the work, the dates on which the contractor and its subcontractors will start the work, including procurement of materials, equipment, etc.; the ordering of articles of special manufacture; the furnishing of drawings, plans and other data required under Subsection 105.03 of the specifications for the review and approval of the Engineer; the inspection of structural steel fabrication; and the contemplated dates for the completion.

108.04 **Prosecution and Progress:** the third paragraph of the Standard Specifications is revised to read:

At a mutually convenient location and time, the contractor shall meet weekly with the Engineer to discuss construction activities; however, a meeting may be waived if mutually agreed to, due to weather conditions, work progress, or for other reasons. At the meetings, the contractor shall provide the Engineer with a detailed, written schedule of construction activities and phases of work for the current week, forthcoming three week period as well as the construction activities which were performed during the previous week. This schedule shall detail the anticipated start dates and anticipated completion dates of work activities. The weekly schedule should reflect, at a minimum, all activities from the most recently updated project schedule. For work which was completed during the previous week, this schedule shall detail the actual start and completion dates of work activities as well as indicate the status of major ongoing activities. Upon the second occurrence of the contractor failing to provide an accurate schedule as describe herein and after written notification by the Engineer of the first occurrence, the Department will deduct $500 from the contractor’s progress payment per each occurrence thereafter. Minutes of the weekly meetings will be kept by the Engineer and a copy given to the contractor for review and acceptance.

(108TIME, 10/15/20)

SECTION 108 PROSECUTION AND PROGRESS:

108.08 **Determination and Extension of Contract Time:** the first paragraph of the Standard Specifications is revised to read:

The time allowed for the completion of the work included in the contract will be 445 working days, and will be known as the "Contract Time."

(108RSLD, 06/19/2025)

SECTION 108 PROSECUTION AND PROGRESS:

108.09 Failure to Complete the Work on Time: the Schedule of Liquidated Damages table of the Standard Specifications is revised to read:

SCHEDULE OF LIQUIDATED DAMAGES			
Original Contract Amount		**Liquidated Damages Per Day**	
From More Than:	**To and Including:**	**Calendar Day or Fixed Date:**	**Working Day:**
$ 0	$ 500,000	$ 300	$ 1,000
$ 500,000	$ 1,000,000	$ 850	$ 1,700
$ 1,000,000	$ 2,000,000	$ 1,250	$ 2,650
$ 2,000,000	$ 5,000,000	$ 2,100	$ 3,800
$ 5,000,000	$ 10,000,000	$ 3,300	$ 6,850
$ 10,000,000	$ 30,000,000	$ 7,300	$ 10,550
$ 30,000,000	$ 60,000,000	$ 9,350	$ 17,750
$ 60,000,000	$ 90,000,000	$ 19,900	$ 27,850
$ 90,000,000	-------	$ 27,450	$ 38,400

(108SCHLVL2, 08/19/21)

SECTION 108 PROSECUTION AND PROGRESS: of the Standard Specifications is modified to add:

108.12 Schedules:

(A) Definitions:

Activity:

A discrete, identifiable task or event that contributes to completing the project and can be used to schedule and monitor the work.

Activity ID:

A unique alphanumeric identification code permanently assigned to an activity.

Baseline Schedule:

A Critical Path Method (CPM) schedule illustrating the contractor's committed plan to complete the work within the contract time and used to compare the progress of the work.

Constraint:

A limitation placed on a scheduled activity that affects the start or end date of an activity.

Critical Path:

The longest continuous chain of activities which establishes the minimum overall project duration.

Critical Path Method (CPM):

A network-based planning technique that uses activity durations and relationships to calculate a schedule for the project.

Data Date:

The date from which a schedule is calculated, where all activities occurring earlier than the data date are complete and all activities occurring on or after the data date are planned.

Duration:

The estimated time required to complete an activity as recorded on the Project Schedule.

Float Suppression/Sequestering:

The process of utilizing zero free float techniques that allows an activity to start as late as possible by using all available free float of that activity, by the utilization of overly generous activity durations, or by using overly restrictive calendar non-working periods.

Free Float:

The amount of time an activity may be delayed without delaying the early start date of its successors.

Longest Path:

The longest continuous path of activities through a project, which controls project early completion.

Look-Ahead Schedule:

A computer-generated schedule that shows the previous week's work and the work planned for the current and next three weeks.

Milestone:

An activity, with no duration, that is typically used to represent the beginning, end, interim stages and significant events of the project, or contractually required dates.

Monthly Progress Schedule:

A monthly update to the approved baseline schedule.

Narrative:

A written report explaining the Project Schedule in detail, as specified in Subsection 108.12(F) of the specifications.

Predecessor:

An activity that affects the start or finish date of another activity with a logically tied relationship.

Preliminary Schedule:

A CPM schedule that shows the Baseline Schedule for the first 60 calendar days of contract time and, the work breakdown structure and milestones for the entire contract.

Project Schedule:

A logic-based critical path for all work leading up to and including substantial completion or final acceptance that is used for tracking the performance of the work. The term "Project Schedule" will refer to one or more of the following:

(a) Baseline Schedule,

(b) Monthly Schedule, or

(c) Recovery Schedule.

Record Schedule:

A CPM schedule that shows the actual start and finish date of each activity, durations, and all changes.

Recovery Schedule:

A CPM schedule that shows the activity changes to recover the time lost due to incompletion of the work within the contract time as specified in the Monthly Progress Schedule.

Scheduler:

An individual, who creates, maintains and revises the Project Schedule using applicable software.

Successor:

An activity whose start or finish date is affected by the logically tied relationship with another activity.

Time Impact Analysis (TIA):

A forward-looking, prospective schedule analysis developed to demonstrate the impact of a change to the current schedule on its longest path.

Total Float (Float):

The cumulative duration of time an activity may be delayed without delaying the contract time or a contractual milestone.

Work Breakdown Structure (WBS):

A framework for organizing and ordering the work activities into hierarchical groups.

(B) General:

The contractor shall prepare, furnish, and use the Project Schedule to plan, monitor, and report the progress of the work. The schedule shall demonstrate a detailed plan to complete the work in accordance with the contract time and be used in communication to coordinate activities among all affected parties.

The contractor shall provide a Scheduler to create and maintain all schedules, updates, Narratives, reports, and TIA related to this project. The Scheduler shall be proficient in CPM schedule development, analysis of resources applicable to the required detail of the Project Schedule, and shall be able to perform the required tasks using the specified software.

The Scheduler shall be present at all schedule meetings, in person or via teleconference, and made available for discussion or meetings when requested by the Engineer. The contractor project management personnel, subcontractors, and suppliers shall actively communicate with the Scheduler to develop and maintain accurate updates of progress and schedule revisions throughout the duration of the contract.

The Department’s review and comment on a schedule for compliance with this specification does not do the following:

(1) Imply or constitute approval of particular construction methods or relieve the contractor of its responsibility to provide sufficient materials, equipment, and labor to complete the project in accordance with the contract;

(2) Attest to the validity of assumptions, activities, relationships, sequences, resource allocations, or other aspects of the schedule;

(3) Imply the contractor is entitled to a Supplemental Agreement extending the contract time or adjusting the contract price;

(4) Relieve the contractor from compliance with the requirements of the contract or result in the approval of a deviation, exception to or other variation from the contract. Failure to include an element of work required by the contract in the schedule does not release or relieve the contractor from responsibility to perform such work.

In preparing, developing and updating the Project Schedule the contractor shall not utilize:

(1) Float suppression techniques in the schedule, including interim dates imposed by the contractor other than project milestone(s);

(2) The inclusion of activities or constraints in a path or chain leading to a project milestone which are unrelated to the work as specified in the contract;

(3) Activity durations or sequences determined by the Department to be unreasonable in whole or in part.

The contractor shall not use preferential sequencing, whereby activities that could be performed concurrently and are established in the Project Schedule as sequential simply to consume float. The contractor shall not indicate artificial activity durations by inflating activities in the schedule to consume float and influence the Critical Path. Sequestering of float is cause for rejection of the contractor's schedule submittal. If float sequestering is identified, the contractor shall revise the schedule appropriately.

Total Float is a commodity available to both the Department and the contractor for sequential use until depleted and not for the exclusive use or financial benefit of either party. A schedule showing an early completion date shall show the time between the scheduled completion date(s) and the required contract completion deadline(s) as Total Float.

The Department will not be liable to the contractor for delays by any party when the contractor completes the work prior to expiration of contract time.

If a delay in performing the work is caused by the Department, the contractor shall immediately notify the Department in writing that a revision to the contract is necessary in accordance with Subsection 104.02 and Subsection 104.03 of the specifications. The contractor shall include a description of the cause of delay, the projected amount of Total Float to be used, and the revised Monthly Progress Schedule showing the use of the Total

Float in the Monthly Progress submittal. The contractor shall work cooperatively with the Department, other contractors, and third parties to identify and implement, to the maximum extent possible, no-cost measures to recover all schedule delays, regardless of the cause of the delays.

The contractor shall coordinate with the Department, local governmental entities, utility companies, railroad companies, and any third party entities when developing and maintaining the Project Schedule. The contractor shall coordinate its planning and scheduling efforts as required to address conflicts and comments received from adjacent projects and other entities.

(C) Preliminary Schedule:

Before the preconstruction conference the contractor shall prepare and submit a Preliminary Schedule for the Engineer's review and approval. The Preliminary Schedule shall comply with Subsection 108.12(D) of the specifications for the first 60 calendar days of contract time and includes the WBS and milestones for the complete contract.

Along with the Preliminary Schedule, the contractor shall include its calendar for the contract period which shall show work days, calendar days, non-work days, and dates. The contractor shall not begin work until the Engineer has approved the Preliminary Schedule.

(D) Baseline Schedule:

The contractor shall submit a Baseline Schedule within 30 calendar days after the acceptance of the Preliminary Schedule for Engineer’s review and approval.

The Baseline Schedule shall be in the following format:

(1) Project ID: The schedule project ID shall match the filename format in Subsection 108.12(K) of the specifications. The project name shall be the route number followed by the project description.

(2) Activity ID: Each activity shall be assigned a unique identification number. Activity ID numbers shall not be changed or reassigned for the duration of the contract. Within each group of the WBS, activity ID’s shall be numbered sequentially in increments of 10 in the order of their start date or by finish date of a finish milestone. Milestone activities shall begin with “M”. Use 10 characters or less.

(3) Activity Name: Each activity shall be defined with a unique name that contains the description of work. Each name shall at a minimum consist of a verb or work function (i.e. remove, excavate, form, install), an object (i.e. curb, pipe, footing) and a location (i.e. street, station, bridge number). For example, “Install Barrier Dtl C – S1 120+25 Lt”. The activity quantity may be included after location.

The contractor shall create an activity name using the following:

a) Use 50 characters or less;

b) Use “S1, S2, …” for stage naming if applicable;

c) Do not use all capital letters;

d) Keep names readable, but use abbreviations as needed. Do not use periods when abbreviating. All abbreviations shall be consistent; and

e) Location is not required if object name is specific, such as “CMP #201”.

The contractor shall provide a list of abbreviations and acronyms. The work related to each activity shall be limited to one stage, one area, one traffic control phase, and one responsible party of the contract.

(4) Activity Code: Activities shall be assigned with project activity codes that will be used to classify, categorize and organize activities for reporting. Only use project level activity codes and not global or enterprise codes. At a minimum, all activities shall have an activity code for responsible party, stages, and phases. Additional activity codes shall be added if requested by the Department.

(5) Milestones: The contractor shall separately identify each project milestone, conforming to the scheduling requirements set forth in the contract.

(6) Constraints: The contractor shall not use date constraints to logically begin or complete a project activity unless specific calendar dates are shown in the contract. Specific contract dates may only be applied as a constraint to a milestone activity and input as either a “Start on or After” or “Finish on or Before” date. No other constraint types shall be allowed.

(7) Duration: Activity duration shall not exceed 20 calendar days unless approved by the Engineer. Activity durations shall be at least one calendar day. Durations shall represent the anticipated productivity rates that factor in all limitations to the productivity. Long lead activities such as procurement and Level of Effort activities may exceed 20 calendar days.

(8) Relationships: All activities shall have at least one predecessor and one successor except for the project start and project end milestones. Negative lags or negative floats shall not be allowed. Predecessors and successors shall not be linked to the same activity with different relationship types. The start of an activity shall have a Start-to-Start or Finish-to-Start relationship with preceding activities. The completion of an activity shall have a Finish-to-Start or Finish-to-Finish relationship with succeeding activities. Do not use Start-to-Finish relationships. Do not use Finish-to-Start relationships with a lag or overlap.

(9) If applicable, the schedule shall include but not be limited to all activities below:

(a) Mobilization/Demobilization;

(b) Right of Way Acquisition;

(c) Submittal development;

(d) Submittal review and acceptance;

(e) Submittal and approval of material samples and mix designs;

(f) Submittal and approval of shop drawings;

(g) Long lead items, material and equipment procurement;

(h) Procurement of permits;

(i) Environmental commitments and mitigation activities;

(j) Equipment and plant setup;

(k) Fabrication of special items;

(l) Erection and removal of falsework and shoring;

(m) Utility and railroad relocations;

(n) Cure times for concrete;

(o) Cure times for pavement before striping;

(p) Landscape and seeding establishment periods;

(q) Test periods;

(r) Major traffic stage changes;

(s) Substantial completion;

(t) Punchlist completion; and

(u) Final cleanup;

(10) The schedule shall be in detail to allow day-to-day monitoring and review of the contractor's operations. It shall show the order and interdependence of activities and the sequence of work.

(11) The contractor shall detail the Critical Path activities and logic ties in the schedule to show the work sequencing. The contractor shall use the CPM software to determine the controlling activities in the critical path. The critical activities shall be prominently distinguished on all reports by the use of color or pattern.

(12) The contractor shall provide the number of activities to assure adequate project planning and allow for monitoring and evaluation of work progress.

(13) The contractor shall provide activities as necessary to depict third-party work related to the contract. Third-party work activities may include but is not limited to railroads, utilities, real estate, and government agencies.

(14) Seasonal, winter shutdown, traffic, special event, environmental, or other contract restrictions shall be considered and included in the schedule for all work. These restrictions shall be addressed with project calendars and shown as non-work days for each major work type. Global calendars shall not be used. Examples of major work types are earthwork, concrete paving, structures, asphalt, drainage, landscaping, etc. The contractor shall include project calendar for curing time if applicable.

(15) The duration for each activity shall include the anticipated production rate and the time for anticipated weather stoppages. The contractor shall not reserve random non-work days in a project calendar to account for weather stoppages.

(16) The schedule shall have a Data Date of the start date shown in the Notice of Award letter.

(17) When processing the schedule in the software, the contractor shall use the following options:

(a) When scheduling progressed activities use Retained Logic;

(b) Calculate start-to-start lag from Early Start;

(c) Define critical activities as Longest Path;

(d) Compute Total Float as Finish Float = Late Finish – Early Finish; and

(e) Calendar for scheduling relationship lag as predecessor activity calendar.

(18) The bar chart schedule plot shall be accompanied by a schedule report of the network with a tabulation of the following data for each activity:

(a) Activity ID;

(b) Activity name;

(c) Original duration;

(d) Early start date;

(e) Early finish date;

(f) Late start date;

(g) Late finish date;

(h) Predecessors;

(i) Successors;

(j) Free float;

(k) Total float;

(l) Primary constraint date;

(m) Calendar; and

(n) Responsibility for activity - e.g., prime contractor, subcontractor, supplier, etc.

(E) Monthly Progress Schedule:

After the approval of the Baseline Schedule, the contractor shall submit a Monthly Progress schedule until the substantial completion of the project. The Monthly Progress Schedule and Narrative shall be prepared and submitted by the 15th day of the month. The Monthly Progress Schedule shall reflect progress up to the data date, forecast finish for in-progress activities and re-forecast early dates for activities planned in the next update period. The Monthly Progress Schedule shall meet all format requirements specified in Subsection 108.12(D) of the specifications and shall include the following:

(1) Actual start and finish dates for completed activities;

(2) Actual start dates, percentage complete, and remaining duration for activities in progress;

(3) All proposed activities, logic, and date revisions required to:

(a) Implement changes in the work;

(b) Detail all impacts on preexisting activities, sequences, and dates;

(c) Reflect the contractor’s current approach for work remaining;

(d) Incorporate delays that have been agreed upon between the Department and the contractor; and

(e) Incorporate accepted substitution proposals.

(4) Planned start and finish dates for activities that have not started.

The contractor shall show actual progress based on actual percentage completion of the activity addressed as “Percent Complete” with adjustments to remaining duration and non-calculated progress in the Monthly Progress Schedule. The contractor shall incorporate logic changes and work changes into the Monthly Project Schedule. Percent complete types shall be set to “physical”. Each Monthly Project Schedule submittal shall clearly and individually define the progression of the work within the applicable timeframe by updating the current and planned project activities.

If work is performed out of sequence, the contractor shall implement logic changes to allow the out of sequence work to proceed. The contractor shall exclude all revisions for the contractor’s convenience when reconciling an extension to a milestone. The contractor shall document changes, which shall be highlighted or identified, in the Monthly Progress Schedule.

The contractor shall impose no other date restrictions in the Monthly Project Schedule, unless the contractor provides an explanation of the basis for such date restrictions and such explanation is acceptable to the Department.
The contractor shall provide additional, separate, filtered reports of the project activities including the following:

(1) Bar chart schedule plot showing all critical path activities, long-term lane closures, and the status of these activities as of the date of the update.

(2) Bar chart schedule plot that compares the contractor’s progress to planned progress for each activity.

(3) 30-Day look-ahead report listing all design document submittals.

(4) Total Float report displaying float from least to greatest for all activities with 14 day or less of total float.

(5) 60-Day look-ahead report identifying all required Department and governmental approvals.

(6) 60-Day look-ahead bar chart schedule plot sorted by WBS and activity early start dates including the responsible party.

(7) Monthly expenditure table and cash flow expenditure curve for the project.

If the Engineer requests a revision or justification, the contractor shall provide a revision or justification to the satisfaction of the Engineer within seven calendar days. Failure to comply

with the schedule requirements specified herein, or provide revisions or justifications within seven calendar days for Engineer's approval will result in withholding $15,000 of the monthly estimate payments. The withheld money will be paid on the monthly estimate following the approval of the Monthly Progress Schedule with acceptable revisions or justifications.

Once the Monthly Progress Schedule is approved by the Engineer, the contractor shall use the approved Monthly Progress Schedule as the basis for the next Monthly Progress Schedule.

(F) Narrative:

With each Project Schedule submittal, the contractor shall prepare and submit a stand-alone schedule Narrative with details that explain the basis of the submitted Project Schedule. The schedule Narratives shall not be considered notification of delays, supplemental agreements, or other issues.

(1) For the Baseline Schedule, the Narratives shall include at a minimum:

(a) The contractor's site management plan and schedule of activities (e.g., lay down, staging, traffic, and parking);

(b) The use of construction equipment and resources for major items;

(c) The basis and assumptions for critical activity durations and logic;

(d) Compliance with temperature, weather and seasonal requirements. Show how and where this is applied and accounted for in the schedule;

(e) List all calendars used and describe their usage;

(f) Anticipated hours per shift, shifts per work day, and work days per week;

(g) Justification for all constraints used;

(h) Justification for an activity with a duration exceeding 20 Calendar Days;

(i) Contractor's approach used to apply relationships between activities, including a list of activity relationships with lags and the justification for the use of each lag (e.g., all ties are based on physical relationships between work activities [such as "rebar shall be placed before concrete is placed"] or relationships are used to show limited resources [such as "bridge two follows bridge one" because contractor has only one bridge crew]);

(j) A written construction phasing plan supporting the approach to the work outlined. The written construction phasing plan shall include

at a minimum each phase for the maintenance of traffic (MOT), changes in traffic control, and the construction activities and disciplines to be performed under each construction phase. The construction phasing plan shall show dates of MOT phase changes that are coordinated with the schedule;

(k) The reasons for the sequencing of work, including a description of all limited resources, potential conflicts, and other items that may affect the schedule and how they may be resolved;

(l) Anticipated production rates for major activities including but not limited to earthwork, hauling, drainage, asphalt paving, PCCP, curb and gutter paving, barrier walls paving, etc. Each activity shall be shown with its activity ID, activity name, production rate, equipment used to achieve the production rate (include quantity of pieces of equipment with all attachments), and duration of activity;

(2) For Monthly Progress Schedules, Recovery Schedules, and Supplemental Agreement and TIA Schedules, as part of the Narrative, in addition to the information above, if changes were made, the contractor shall provide a report that includes at a minimum:

(a) Recap and explain progress and days gained or lost versus the previous progress schedule.

(b) Discuss all actions and corrections to be taken to achieve Baseline Schedule milestones.

(c) Explain in detail all critical path activities behind schedule and challenges that may arise with planned critical path activities. Explain all activities that have changed from a non-critical path to the critical path. Identify near-critical path activities that could become critical path activities.

(d) Describe changes in resources and productivity rates to be used on remaining work.

(e) Identify all delays, their extent, responsible party, and explain their causes. Include the amount of weather related delays.

(f) List all activities that have been added or removed from the schedule and an explanation of those changes.

(g) List and explain all changes in activities, sequence, durations, and logic ties. Explain changes caused by each Supplemental Agreement, schedule recovery plans and grouping of related contractor initiated revisions.

(h) Describe all coordination with utility companies and accomplishing utility work.

(i) All negative float shall be explained in detail.

(G) Recovery Schedule:

If the Project Schedule indicates a late completion of the work by 28 or more calendar days, the contractor shall prepare a Recovery Schedule which demonstrates how the contractor intends to reschedule the activities to regain compliance with the contract.

Within ten working days of receipt of the Engineer's written direction, the contractor shall submit the Recovery Schedule to the Engineer. The contractor shall not be required to prepare a Recovery Schedule if the contractor requests and demonstrates, in writing, entitlement to extension of a completion deadline due to a Department caused delay, and the Engineer concurs that a Recovery Schedule is not required at that time. If the Engineer disputes the contractor's entitlement to a completion deadline adjustment, the contractor shall, within five working days, submit a Recovery Schedule that does not include a completion deadline adjustment.

Within five working days after a rejection by the Engineer of the Recovery Schedule, the contractor shall resubmit a revised Recovery Schedule incorporating the Department's comments. When the Engineer accepts the contractor's Recovery Schedule, the contractor shall, within five working days after the Engineer's acceptance, incorporate such schedule in the Project Schedule, deliver the same to the Department, and proceed in accordance with the approved Recovery Schedule.

All acceleration costs required to bring the contract work back into compliance with project milestones and the contract time due to a contractor caused delay shall be borne solely by the contractor. Whenever a Recovery Schedule is required, the contractor shall provide the following information:

(1) Transmittal letter;

(2) Bar chart schedule plot;

(3) Electronic copy of the file used for the proposed Recovery Schedule; and

(4) Narrative describing all proposed changes to the Project Schedule in detail, with justification for the changes, including the following:

(a) Changes to activity original durations;

(b) Changes to activity relationships and schedule logic;

(c) Cause of schedule slippage and actions taken to recover schedule within the shortest reasonable time (e.g., hiring of additional labor, use of additional construction equipment, and expediting of deliveries);

(d) Float consumption;

(e) Identification of activities that have been added, deleted, or modified; and

(f) Changes to the Project Schedule's Critical Path.

(H) Revisions to Contract:

If the contractor receives a request for extra work from the Department or submits a contract change request in accordance with Subsection 104.02 of the specifications asserting that an event, situation, or change affects a Critical Path of the Project Schedule, the contractor shall prepare and submit a TIA showing the cumulative effect of the change on the completion or fixed milestone date along with a written report describing the time impact in a form satisfactory to the Department complying to Subsection 104.03 of the specifications.

Each TIA shall include a fragmentary network (fragnet) demonstrating the following information:

(1) How the contractor proposes to incorporate a time extension provided for in a Supplemental Agreement;

(2) The impact to the Project Schedule;

(3) The sequence of new and/or existing activity revisions that are proposed to be added to the Project Schedule that is in effect when the change or delay is encountered;

(4) The proposed method for incorporating the delay and its impact to the Project Schedule; and

(5) The computation of two finish dates. The first finish date shall be computed without consideration of impacts by the proposed revision. The second finish date shall be computed with consideration of impacts by the proposed revision.

If a proposed change in planned work results in altering the Critical Path or extending the schedule completion date, the contractor shall submit a Revised Schedule and a TIA within 15 calendar days of the proposed change.

(I) Record Schedule:

The contractor shall prepare a Record Schedule that includes actual start and actual finish dates for all activities. The Record Schedule, once approved, serves as the final update of the Project Schedule. The contractor shall include a written certification with the Record Schedule submittal signed by the Project Manager of the contractor in accordance with the following:

"To the best of my knowledge, the enclosed final update of the project Schedule reflects the actual start and completion dates of the activities for the project contained herein."

The contractor shall submit the Record Schedule to the Engineer for review. Final acceptance will not be issued until the Record Schedule has been approved.

(J) Schedule Meetings and Three Week Look Ahead Schedule:

(1) Baseline Schedule Presentation Meeting:

At a time agreeable to the Engineer, the contractor shall conduct a Baseline Schedule presentation meeting within seven calendar days after submitting the proposed Baseline Schedule. The purpose of this meeting is for the contractor to present and explain the contractor's schedule and construction phasing plan. At a minimum, the following is to be covered at the joint review of the schedule:

(a) WBS;

(b) Sequence of work - step through the schedule activity by activity;

(c) Construction phasing including traffic control phasing and changes;

(d) Resources to include number of construction personnel and production rates used; and

(e) Critical Path review.

(2) Weekly Project Meeting and Look-Ahead Schedule:

At the weekly project meetings, the contractor shall provide the Engineer with a detailed, Look-Ahead Schedule. The Look-Ahead Schedule is a computer generated bar chart schedule plot that shows the previous week's work and the work planned for the current and next three weeks. The contractor shall base the Look-Ahead Schedule on the Project Schedule and provide a greater breakdown of the Project Schedule activities for the purpose of materials inspection and testing. The Look-Ahead Schedule shall clearly note and explain all departures from the Project Schedule. The contractor shall reference the Project Schedule activity ID numbers, WBS, and define subsequent specific daily operations for all work activities scheduled to be performed during the four-week period. The contractor shall identify work being performed by Disadvantaged Business Enterprise (DBE) firms as separate activities. At least one day before the weekly construction activity meetings, the contractor shall submit weekly Look-Ahead Schedules to the Engineer.

(3) Project Schedule Update Meeting:

The contractor shall schedule a joint Project Schedule update meeting to review the Monthly Progress Schedule update on the 15th day of the month or within three days, excluding weekends and holidays thereafter as coordinated with the Engineer. The contractor shall host the meeting and provide an agenda. At a minimum the following items shall be discussed:

(a) The actual progress made until the data date of the schedule update. The review of progress shall include dates for activities actually started and completed, and the duration percentage of work remaining on each activity started. The percentage of work completed shall be calculated by using the quantity and production rate information.

(b) All changes from previously approved schedules.

(c) Actual and potential schedule conflicts.

(d) Supplemental Agreement work and work identified that may lead to supplemental agreement work.

(K) Submittals:

Two 11 x 17 inch hard copies and one pdf copy of each schedule in color listed herein shall be provided to the Engineer. The contractor shall furnish to the Engineer for project use an electronic copy of the schedule. The electronic copy shall be Primavera P6 .xml file format prepared in Primavera software.

The filename of schedules shall be submitted in the following format:

SCHEDULE FILENAME FORMAT	
Preliminary Schedule	TTTTT-YYMM-PSVV
Baseline Schedule	TTTTT-YYMM-BSVV
Monthly Progress Schedule #1	TTTTT-YYMM-MPS01VV
Monthly Progress Schedule #2	TTTTT-YYMM-MPS02VV
Recovery Schedule	TTTTT-YYMM-RCYSVV
TIA Schedule	TTTTT-YYMM-TIASVV
Record Schedule	TTTTT-YYMM-RCDSVV
3 Week Lookahead Schedule	TTTTT-YYMM-LASVV
Schedule Narrative	TTTTT-YYMM-NARVV
Note: (1) TTTTT: First 5 digits of project TRACS number. (2) YYMM: Current 2 digit year and month. (3) VV: 2 digit version number (01, 02, etc.).	

All bar chart schedule plots shall be in color and have a size and scale acceptable to the Engineer. Include a title block and a legend on each page. The plot layout shall include a schedule activity table with corresponding bar chart. The activity table shall be grouped by the WBS and include the activity ID, activity name, duration, start date, finish date, and total float. All activities in the bar chart shall be plotted on their start and finish dates. Show relationship lines and data date line. The bar chart shall be time-scaled in two-line format with a date interval set to year/month and type set to calendar.

The contractor shall provide two 8.5 x 11 inch hard copies of the narrative and monthly report with an electronic pdf copy.

The contractor shall provide a schedule log file generated by the software in a .txt file format with all schedule submittals. The log file shall have the same filename as the schedule file. The contractor shall review the log file prior to submittal to verify that the electronic schedule is in compliance with this specification.

(L) Software:

The automated system software shall be Primavera P6.

(109RRBB, 04/18/24)

SECTION 109 MEASUREMENT AND PAYMENT:

109.04(D)(3) Equipment: the first paragraph of the Standard Specifications is revised to read:

Equipment which the Engineer considers necessary for the performance of work will be eligible for payment at the established rates only during the hours that it is operated except as otherwise allowed elsewhere in these specifications. Equipment hours will be recorded to the nearest one-half hour. For the use of equipment owned by the contractor and approved by the Engineer, the contractor will be paid the rental rates, as modified herein, outlined in the Rental Rate Blue Book® (RRBB) for Construction Equipment which is updated by EquipmentWatch™, a division of Fusable, 3200 Rice Mine Road NE, Tuscaloosa, Alabama 35406, phone (888) 307-1713. All rate determinations will be based on the RRBB quarterly rate revisions that are applicable at the time equipment is being used.

(109FAEU, 08/15/24)

SECTION 109 MEASUREMENT AND PAYMENT:

109.04(D)(3)(a) Rental Rates (Without Operators): the equation of the first paragraph of the Standard Specifications is revised to read:

The hourly equipment rental rate (HERR) will be determined by the following formula:

$$HERR = F \times \left[\frac{1.15 \times R}{176}\right] + HOC$$

Where: F= Adjustment Factor to R is 0.933

R= Current RRBB Monthly Rate

HOC= Hourly Operating Cost

(109WFADF, 05/15/25)

SECTION 109 MEASUREMENT AND PAYMENT:

109.04(D)(6) Statements: the title and text of the Standard Specifications is revised to read:

109.04(D)(6) Forms:

The contractor shall prepare the Weekly Force Account Detail form for each week of force account activity. The Weekly Force Account Detail form is a standardized, fillable form made available by the Department on the ADOT Construction Group's website.

The form shall detail the labor, equipment, and material charges utilized to accomplish the force account work along with all supporting documentation. The contractor shall furnish copies of original receipts (paid invoice cost) for materials, rental equipment cost, including freight and transportation charges, copies of rental rate blue book equipment sheets and certified payrolls.

If materials used on the force account work are not specifically purchased for such work but are taken from the contractor's stock, then instead of invoices, the forms shall contain or be accompanied by an affidavit of the contractor certifying that such materials were taken from stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the contractor.

Force account work shall be tracked daily; however, the contractor shall compile no more than one full week's worth of daily records into a Weekly Force Account Detail form. Each reporting period runs from Saturday through Friday. The contractor shall submit the form within 30 calendar days of the respective week's force account performance. The completed form shall be submitted to the Engineer for review and approval. The Engineer will review the form and supporting documentation against the ADOT Inspector's Daily Force Account Reports, and will verify that the form is timely, complete, and accurate. Payment will not be made until the contractor has furnished applicable forms, detailing the costs of the force account work, including but not limited to the following information:

(a) Labor: name, classification, date, daily hours, hourly rate and fringe rate, and certified payrolls for each foreman and laborer.

(b) Equipment: dates, equipment number, description, operator name, hours used, approved stand-by hours, monthly rental rate, hourly operating cost and rental rate blue book sheets for each unit of equipment.

(c) Rental Equipment (Third Party): invoice, dates used, vendor name, description of equipment, operator name, hours used, invoice rate, hourly operating cost and rental rate blue book sheets for each rental equipment.

(d) Materials: invoice, date used, supplier name, description, quantity, unit of measure and unit cost.

(e) Transportation: freight and express charges on materials, FOB jobsite.

(109FASUB, 05/21/26)

SECTION 109 MEASUREMENT AND PAYMENT:

109.04(D)(7) Force Account Work by Subcontractors: the first paragraph of the Standard Specifications is revised to read:

When force account work is determined by the Engineer to require specialized labor or equipment not normally utilized by the contractor, and such force account work is performed by subcontractors, the contractor will be allowed a supplemental markup of 5 percent of the subcontractor's costs plus the applicable tax and bond as specified in Subsection 109.04(D).

(109RET, 10/20/22)

SECTION 109 MEASUREMENT AND PAYMENT:

109.06(B)(3) Partial Payment: of the Standard Specifications is modified to add:

Notwithstanding any provision of Arizona Revised Statutes Section 28-6924, the parties may not agree otherwise.

109.06(B)(4) Final Payment: of the Standard Specifications is modified to add:

Notwithstanding any provision of Arizona Revised Statutes Section 28-6924, the parties may not agree otherwise.

109.06 Partial Payments and Retention: of the Standard Specifications is modified to add:

(C) Payroll Submittals:

The contractor shall submit payrolls electronically through the internet to the Department's web-based certified payroll tracking system. This requirement shall also apply to every lower-tier subcontractor that is required to provide certified payroll reports.

If, by the 15th of the month, the contractor has not submitted its payrolls for all work performed during the preceding month, the Engineer will provide a written notification of the discrepancies to the contractor. For each payroll document that the contractor fails to submit within 10 days after the written notification, the Department will retain $2,500.00 from the progress payment for the current month. The contractor shall submit each complete and correct payroll within 90 days of the date of notification. If the payroll is complete and correct within the 90-day time frame, the Department will release the $2,500.00 on the next monthly

estimate. For each payroll that is not acceptable until after the 90-day time frame, the Department will only release $2,000.00 of the $2,500.00 retained. The Department will retain $500.00 as sanctions. Such $500.00 retentions will not relieve the contractor of its responsibility to provide each required payroll, complete and correct, as specified above. These sanctions shall be in addition to all other retention or liquidated damages provided for elsewhere in the contract.

(109SUBPAY, 10/20/22)

SECTION 109 MEASUREMENT AND PAYMENT:

109.06(B)(5) Payment Reporting and Sanctions: the eighth paragraph of the Standard Specifications is revised to read:

For each month that the contractor fails to submit timely and complete payment information the Department will retain $5,000 as sanctions from the monies due to the contractor. After 90 consecutive days of non-reporting, the sanctions will increase to $10,000 for each subsequent month which the contractor fails to report until the information is provided. These sanctions will be in addition to all other retention or liquidated damages provided for elsewhere in the contract.

109.06(B)(8) Non-compliance: of the Standard Specifications is revised to read:

Failure to make prompt partial payment, or prompt final payment including any retention, within the time frames established above, will result in remedies, as the Department deems appropriate, which may include but are not limited to:

(a) Sanctions. These sanctions will be in addition to all other retention or liquidated damages provided for elsewhere in the contract:

(i) The Department will withhold two times the dollar amount not paid to each subcontractor;

(ii) If full payment is made within 30 days of the Department's payment to the contractor, the amount withheld by the Department will be released; and

(iii) If full payment is made after 30 days of the Department's payment to the contractor, the Department will release 75 percent of the funds withheld. The Department will retain the remaining 25 percent of the monies withheld as sanctions.

(b) Additional Remedies. If the contractor fails to make prompt payment for three consecutive months, or any four months over the course of one project, or if the contractor fails to make prompt payment on two or more projects within 24 months, the Department may, in addition, invoke the following remedies:

(i) Withhold monthly progress payments until the issue is resolved and full payment has been made to all subcontractors, subject to the sanctions described in paragraph (a) above;

(ii) Terminate the contract for default in accordance with Subsection 108.10 of the specifications; and/or

(iii) Disqualify the contractor from future bidding, temporarily or permanently, depending on the number and severity of violations.

In determining whether the sanctions will be assessed, the extent of the sanctions, or additional remedies assessed, the State Construction Engineer will consider whether there have been other violations on this or other contracts, whether the failure to make prompt payment was due to circumstances beyond the contractor's control, and other circumstances. The contractor may, within 15 calendar days of receipt of the decision of the State Construction Engineer, escalate the decision to the State Engineer. If the contractor does not escalate the decision of the State Construction Engineer, in writing to the State Engineer, within 15 calendar days of receipt of the decision, the contractor will be deemed to have accepted the decision and there will be no further remedy for the contractor. If the contractor escalates the decision to the State Engineer, and the contractor does not agree with the State Engineer's decision, the contractor may initiate litigation, arbitration or mediation pursuant to Subsection 105.21(D) and (E) of the specifications.

(109FUEL, 02/10/12)

SECTION 109 MEASUREMENT AND PAYMENT: of the Standard Specifications is modified to add:

109.12 Fuel Cost Adjustment:

(A) General:

The Department will adjust monthly progress payments up or down as appropriate for cost fluctuations in diesel fuel as determined in accordance with these special provisions.

A fuel cost adjustment will be made when fluctuations in the price of diesel fuel, in excess of 15 percent, occur throughout this contract. The Department will not provide such adjustments for fluctuations in the price of diesel fuel of 15 percent or less.

No adjustments will be made for fluctuations in the price of fuels other than diesel.

(B) Measurement:

The base index price of fuel will be determined by the Department from the selling prices of diesel fuel published by OPIS (Oil Price Information Service). The base index price to be used will be the price for Diesel fuel No. 2, Ultra Low Sulfur, PAD 5, City of Phoenix Rack. The reported average value for the Phoenix area will be used.

The base index price for each month will be the arithmetic average of the selling price for diesel fuel, as specified above, shown in the last four reports received prior to the last Wednesday of the month.

This price will be effective as of the last Wednesday of each month, and will be posted on the Department's website, at http://www.azdot.gov/Highways/cns/bitmat.asp, on or shortly after the last Wednesday of the month.

This price may also be obtained from Contracts and Specifications Services at (602) 712-7221.

This price will be deemed to be the "initial cost" (IC) for diesel fuel on projects for which bids are opened during the following month.

The current index price for diesel fuel in subsequent months will be the base index price, determined as specified above, for the current month. For example; an adjustment for diesel fuel used in May, if applicable, will be based on the "current price" (CP) for May as posted on the last Wednesday of May. The amount of adjustment per gallon will be the net difference between the "initial cost," adjusted by 15 percent, and the current index price. The monthly adjustment will be determined by the Engineer and included in the payment estimate as a fuel adjustment. For fluctuations in excess of 15 percent, fuel cost adjustments will only be made for current price index increases greater than 1.15 times the "initial cost" or for decreases less than 0.85 times the "initial cost." No calculation will be made for fluctuations in the current index price of 15 percent or less when compared to the "initial cost."

The number of gallons of diesel fuel used per month will be considered to equal 1.5 percent of the dollar amount of work reported by the contractor for each month. Such dollar amount will not include incentives earned by the contractor for pavement smoothness, thickness, or strength for Portland cement concrete pavements; for pavement smoothness or quality lots for asphaltic concrete pavements; for any other revenue derived from quality incentives; or for revenue accrued in the previous month for bituminous material cost fluctuations or diesel fuel price adjustments.

A monthly adjustment, if applicable, will be made on this quantity, as shown below:

$$S = \frac{0.015(Q)}{IC} \text{ x } (CP - AC)$$

Where; S = Monetary amount of the adjustment (plus or minus) in dollars
Q = Dollar amount of work completed for the month
CP = Current index price in dollars per gallon
AC = Adjusted "initial cost" (1.15 or 0.85 times IC) in dollars per gallon
IC = "Initial cost" as determined above, dollars per gallon

If adjustments are made in the contract quantities, the contractor shall accept any fuel adjustment as full compensation for increases or decreases in the price of fuel regardless of the amounts of overrun or underrun.

The value calculated above (plus or minus) will be adjusted to include sales tax and other taxes as applicable.

No additional compensation will be made for any additional charges, costs, expenses, etc., which the contractor may have incurred since the time of bidding and which may be the result of any fluctuation in the base index price of diesel fuel.

No adjustments will be made for work performed after Substantial Completion, as defined in Subsection 105.19, has been achieved.

(C) Payment:

Price adjustments will be shown on the monthly progress estimate, but will not be included in the total cost of work for determination of progress or for extension of contract time.

(109DRSCH, 02/10/20)

SECTION 109 MEASUREMENT AND PAYMENT: of the Standard Specifications is modified to add:

109.15 Draw Schedule:

At the preconstruction conference, the contractor shall submit a planned monthly Draw Schedule for the project. Payments reflected in the Draw Schedule shall be based on the value of the monthly work to be completed. No construction work shall begin and no payments will be made until the Draw Schedule is submitted and approved by the Engineer. Failure of the contractor to comply with this requirement constitutes a waiver of entitlement to additional compensation or a time extension.

Under no circumstances will the Department make payments to the contractor that exceed the actual value of the work completed.

(109BITUMADJ, 06/19/25)

SECTION 109 MEASUREMENT AND PAYMENT: of the Standard Specifications is modified to add:

109.16 Bituminous Price Adjustment:

(A) General:

The term "bituminous material" as used herein shall include asphalt binder, asphalt rubber and emulsified asphalt.

The Department will adjust monthly progress payments as appropriate for market fluctuations in the price of bituminous material.

A price for bituminous material will be determined monthly by the Department based on the selling prices published by the Asphalt Weekly Monitor, a publication of Poten & Partners, Inc. The price will be the arithmetic average of the high and low selling prices for bituminous material shown in the previous four reports for the Arizona/Utah and Southern California regions.

This value will be effective as of the last Wednesday of each month, and will be posted on the ADOT Contracts and Specifications Group website, on or shortly after the last Wednesday of each month.

This price will be deemed the “initial cost” (IC) for bituminous material for projects on which bids are opened during the following month. This price will also be deemed the "current price" (CP) for bituminous material for the following month for projects in construction.

(B) Measurement:

For each item of bituminous material for which there is a specific pay item, and for the bituminous material used in Asphaltic Concrete mixes, an adjustment will be made for each month that a quantity of bituminous material was used on the project.

The IC for the month in which the project was bid will be compared with the CP for the appropriate current month. The CP will be as posted on the Department’s website on the last Wednesday of each month, and will be used to adjust costs for bituminous material incorporated into the job during the following month (for example; bituminous material used in May will be adjusted, as specified herein, based on the CP for May as posted on the last Wednesday of April). Any difference in price between these two values will be applied to the quantity of eligible bituminous material incorporated into the work.

Determination of the eligible quantities of bituminous material for adjustment will be based on contractor-furnished invoices, except as described herein.

The tons of emulsified products to which the adjustment will be applicable will be the tons of the emulsified asphalt prior to dilution.

Adjustments in compensation for emulsified asphalts will be made at 60 percent of either the increase or decrease of IC. For emulsified asphalts containing polymer, adjustments in compensation will be made at 66 percent of either the increase or decrease.

The tons of Bituminous Material (Asphalt-Rubber) to which the adjustment is applicable will be 80 percent of the total quantity of the item used. The adjustment is not applicable to the 20 percent of the material which constitutes the crumb-rubber additive.

The tons of Bituminous Material (TR+) to which the adjustment is applicable will be 92 percent of the total quantity of the item used. The adjustment is not applicable to the 8 percent of the material which constitutes the crumb-rubber additive.

The tons of bituminous material in Asphaltic Concrete mixes, subject to price adjustment shall be calculated as follows, based on the approved mix design target values and the quantity of Asphaltic Concrete placed—regardless of the actual percentage of binder incorporated:

A monthly adjustment, if applicable, will be made on this quantity, as shown below:

$$PA = (CP - IC) \times ACP \times F$$

Where: PA = Price Adjustment monetary amount (plus or minus in dollars)

CP = Current index price (dollars per ton)
IC = Initial Cost at time of bid (dollars per ton)
ACP = Asphaltic Concrete Placed (tons)
F = Eligible Asphalt Cement %

The value calculated above (plus or minus) will be adjusted to include sales tax and other taxes as applicable.

(1) For mixes without reclaimed asphalt pavement (RAP):

F = Approved Mix Design Target Asphalt Cement %

(2) For mixes with RAP:
F = Approved Mix Design Target Asphalt Cement % – Mix Design RAP Asphalt Cement contribution %

(3) For mixes using PG TR+ Terminal Blend (8 % Crumb Rubber):
F = 0.92 x (Approved Mix Design Target Asphalt Cement %)

(4) For mixes using Asphalt-Rubber Blend (20 % Crumb Rubber):
F = 0.80 x (Approved Mix Design Target Asphalt Cement %)

(5) If the quantity of Asphaltic Concrete is measured by volume, the supplemental agreement establishing the method of measurement will specify the manner in which the tons of bituminous material eligible for the adjustment is determined.

(C) Payment:

Price adjustments will be shown on the monthly progress estimate, but will not be included in the total cost of work for determination of progress or for extension of contract time.

Price adjustments will be calculated using the measurement methods described above. Only the tons of virgin asphalt binder determined by those methods will be subject to a bituminous material price adjustment.

No price adjustment will be made for the RAP binder in the mix.

No price adjustment will be made for the 8% of binder comprising crumb rubber when (TR+) is used.

No price adjustment will be made for the 20% of binder comprising crumb rubber in the asphalt-rubber material blend.

No compensation will be made for changes that may have occurred since the time of bidding and which may be the result of any increase in the IC of bituminous material.

Adjustment in unit prices of items governed by this provision will be made in the next regular monthly progress payment following actual use or application of the bituminous material.

(201PAY, 07/15/21)

SECTION 201 CLEARING AND GRUBBING:

201-5 Basis of Payment: of the Standard Specifications is modified to add:

When clearing and grubbing is not included as a contract pay item, full compensation for any clearing and grubbing necessary to perform the construction operations designated on the project plans or specified in the Special Provisions shall be considered as included in the price of contract item.

SECTION 202 REMOVAL OF STRUCTURES AND OBSTRUCTIONS: the first paragraph of the Standard Specifications is hereby deleted:

SECTION 202 REMOVAL OF STRUCTURES AND OBSTRUCTIONS:

202-3.03 (B) Bituminous Pavement: of the Standard Specifications is modified to add:

Upon removal, disposal of existing asphaltic concrete material not approved by the Engineer for use on the project, shall be the responsibility of the contractor.

(202LEAD, 10/21/21)

SECTION 202 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202-3.11 Removal of Lead-Based Striping and Paint Material: of the Standard Specifications is modified to add:

The Department has tested the paint material on existing items that are scheduled for removal. Painted items that contain lead-based paint material include the orange/yellow median paint and red curb paint material, yellow scale components paint material, and orange/gray, & white master booth angle iron steps paint material.

202-3.11(A) Lead Abatement Subcontractor: The third paragraph of the Standard Specifications is revised to read:

The lead abatement subcontractor shall have three years of documented experience performing related work with the aforementioned, valid certification.

202-3.11(B) Removal Plan: of the Standard Specifications is modified to add:

The locations of the lead-based paint material shall not be disturbed in any way until the removal plan has been approved in writing by the Engineer.

ITEM 2020050 REMOVE (MISC. ITEMS)

Description:

The work under this item shall consist of removing and disposing of the miscellaneous items below within the project limits at the locations indicated on the project plans and as specified herein.

- Metal Canopy – 1 Each
- Raised Brick Planter – 1 Each
- Metal Stairwell – 1 Each
- Scale Poles – 2 Each
- Signal Heads – 4 Each
- Ground Mounted Cabinet – 1 Each
- Steel Bollard Barriers – 2 Each
- Steel Bollards – 2 Each

Construction Requirements:

Removal of the metal canopy shall consist of disconnecting the base from the raised brick planter and embedded foundations and removing the canopy foundations to a minimum of 24 inches below the proposed finished grade surface.

Removal of the raised brick planter shall consist of removing any vegetation within the planter, removing the brick planter walls, removing the planter foundation to a minimum of 24 inches below the proposed finished grade surface, and removing and plugging any irrigation devices and/or irrigation lines within the planter area.

Removal of the metal stairwell shall consist of removing any bolt fasteners and attachments that are fastened to the pavements or building walls. Any machinery utilized to remove and dispose of the stairwell shall be approved by the Engineer.

Removal of the scale poles, existing ground-mounted cabinet, existing steel bollard barrier, existing steel bollards and any corresponding foundations shall be performed in accordance with the requirements of Section 202 and 737 of the specifications or as directed and to the satisfaction of the Engineer. Scale pole foundations shall be removed to a minimum of 24 inches below the proposed finished grade surface. Any holes, cavities, and depressions resulting from the removal of foundations shall be backfilled with suitable material and compacted to a density of not less than 95 percent of the maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer and in accordance with Subsection 202-3.01 of the specifications.

Removal of the signal heads shall conform to the requirements of Sections 202 and 737 of the specifications. The removal of the signal heads mounted to the overhead tubular bridge structure shall be done during nonbusiness hours. Power to the signal heads shall be turned off before removal. Contractor shall remove all associated equipment to the signal heads, such as mounting brackets and cabling.

The metal canopy, raised brick planter, metal stairwell, scale poles, signal heads, ground-mounted cabinet, steel bollard barriers, and steel bollards shall become the property of the contractor, who shall remove and properly dispose of the listed items off-site.

Method of Measurement:

Remove (Misc. Items) will be measured on a lump sum basis as a single complete unit of work.

Basis of Payment:

The accepted quantities of remove (Misc. Items), measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place.

No additional measurement or payment will be paid for cleanup. No additional measurement or payment will be paid for loading, transporting, unloading, of disposed equipment and materials.

ITEM 2020055 REMOVE AND SALVAGE (VIDEO SURVEILLANCE SYSTEM)

Description:

The work under this item shall include removing and salvaging all interior and exterior video surveillance cameras, removing and salvaging existing video recording and management equipment, dismounting and removing camera mountings, removing all cabling associated with the video management system, and removing the video management equipment rack.

Maintain any interior and exterior conduit pathways inside and outside of the building locations that are unaffected by the construction, which can be reused for the new video surveillance system.

Construction Requirements:

All existing equipment shall not be removed until new equipment is installed or until authorized by the Engineer. A temporary cable connection may be required to maintain the function of the existing video surveillance system during construction. The contractor shall coordinate with Jason Nelson with the ADOT Physical Security group about a temporary cable connection prior to construction.

The contractor shall submit to the Department an itemized list of all cameras and equipment to be removed and salvaged before removal of the equipment.

Disconnect the power and data cabling from each camera. Remove the cameras from their mountings. Salvage the cameras to the Department at the address provided by the Engineer.

Remove camera mountings - Unfasten and remove all camera mountings from walls, ceilings, or designated structures. Patch and repair any damage to surfaces caused by the removal of

mountings, if necessary, to maintain the integrity of the surfaces. The contractor shall ensure that all interior raceways that can be reused are retained and secured for future installations.

Any drilled holes left on streetlight poles or other fixtures that are either being reused or relocated shall be patched. Use a steel patch and weld the patch securely onto the pole or fixture. Ensure even distribution of the weld to cover the entire perimeter of the patch. Once the welding is complete, use a grinder to smooth out the welded surface. The contractor shall make sure the welded area is flush with the rest of the pole, avoiding sharp edges or protrusions. Apply a rust-inhibitive primer to the repaired area to protect against rust and corrosion.

Follow standard welding procedures, safety procedures, and local codes to ensure safety and compliance.

Remove Equipment rack - Disconnect, remove and salvage all equipment from the equipment rack and safely unmount and remove the equipment rack from its location.

Conduct a final inspection to ensure all specified components have been successfully removed and salvaged and that the interior raceways are intact and accessible for reuse. Confirm that the project area is clean and free of materials related to the removal process.

All video surveillance system components to be removed and salvaged shall be moved by the contractor to a site approved by the Department. The Department shall provide access to the location where the salvaged equipment is to be placed. The contractor shall contact Jason Nelson at (602) 712-8032 (office), (480) 490-1264 (cell), or jnelson2@azdot.gov two weeks in advance to coordinate salvaged material location.

All other non-salvageable video surveillance equipment (e.g., fasteners, mountings, etc.) as determined by the Engineer shall be removed and disposed of by the contractor at an approved off-site location. The work shall include all loading, transporting, unloading, stockpiling, or inventory of equipment at no additional cost to the Department in accordance with all local ordinances.

Method of Measurement:

Remove and Salvage (Video Surveillance System) will be measured on a lump sum basis as a single complete unit of work.

Basis of Payment:

The accepted quantity of Remove and Salvage (Video Surveillance System), measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including temporary cable connection, removals, patchwork, steel plugs, and welding.

No additional measurement or payment will be made for cleanup. No additional measurement or payment will be made for loading, transporting, and unloading of disposed equipment and materials.

ITEM 2020118 REMOVE (CATCH BASIN)

Description:

The work under this item shall consist of removing the catch basin within the project limits at the locations indicated on the project plans and as specified herein.

Construction Requirements:

Removal of the existing catch basin shall be performed in accordance with the requirements of Subsection 202-03 of the specifications.

The catch basin shall be removed and plugged 24” per CMP Std C-13.76.

Method of Measurement:

Remove (Catch Basin) will be measured per each.

Basis of Payment:

The accepted quantities of Remove (Catch Basin), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place.

ITEM 2020154 REMOVE (12’ X 20’ SCALE PIT AND SCALE)

Description:

The work under this item shall include the dismantling and removal of the existing scale, removal of the scale pit and removal of all associated components of the scale and site restoration.

Construction Requirements:

Contractor shall disconnect the scale from all power and data connections and remove any weighbridge components, load cells, support structures, barrier wall, and curbing from the scale. Dismantle the scale platform, making sure all parts are safely handled and stored for removal and disposal. Remove all remaining underground or embedded parts.

The removed scale and its components shall become property of the contractor.

The resulting hole shall be backfilled and compacted with material equivalent to the surrounding material. All voids shall be filled and made level with the surrounding ground. Any disturbed ground shall be restored to match the surrounding area.

Method of Measurement:

Remove (12’ X 20’ Scale Pit and Scale) will be measured on a lump sum basis as a single complete unit of work.

Basis of Payment:

The accepted quantity of Remove (12’ X 20’ Scale Pit and Scale), measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including removals, backfilling, compaction, storage, patchwork, steel plugs, welding and disposal.

No additional measurement or payment will be paid for backfill, compaction, and cleanup. No additional measurement or payment will be paid for loading, transporting, and unloading of disposed equipment and materials.

ITEM 2020155 REMOVE (SIGNS)

Description:

The work under this item shall consists of removal of existing sign assembly which includes the sign panels and its associated signpost and foundation within the project limits from the locations shown on the plans and directed by the Engineer.

Construction Requirements:

The contractor shall be responsible for removing existing sign panel, signpost and sign foundation shown on the plans in accordance with Section 202 of the specifications. This includes, but is not limited to, the nuts, washers, bolts or claps, posts and foundations. All removed items shall become the property of the contractor unless otherwise specified on the project plans.

Upon removal, the removed materials shall become the property of the contractor.

After removal, any holes or cavities resulting from the removal operation shall be backfilled in accordance with the requirements of Subsection 202-3.01 of the specifications.

Method of Measurement:

Remove (Signs) shall be measured by each sign assembly removed.

Basis of Payment:
The accepted quantities of Remove (Signs), measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place.

ITEM 2020157 REMOVE (PULL BOX)

Description:

The work under this item shall consist of removing existing pull boxes from the locations as shown on the project plans and as specified herein.

Construction Requirements:

The removal of existing pull boxes shall only occur when all cables and conductors have been removed from the conduits entering and exiting the pull box to be removed.

The contractor shall remove and dispose of the existing pull boxes called out for removal per Section 202 of the specifications.

The resulting hole shall be backfilled and compacted with material equivalent to the surrounding material. All voids shall be filled and made level with the surrounding ground. Any disturbed ground shall be restored to match the surrounding area.

Method of Measurement:

Remove (Pull Box) will be measured per each pull box removed.

Basis of Payment:

The accepted quantities of Remove (Pull Box), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place, including excavation, backfill, compaction, hauling and disposal.

ITEM 2020175 REMOVAL OF LIGHT POLES (ASSEMBLIES)

Description:

The work under this item shall consist of removing mast arms, light pole assemblies which includes, mast arms, poles, fuses, foundations, luminaires and wiring within pole and mast arm from the locations shown on the plans.

Construction Requirements:

All existing lighting equipment shall not be removed until new equipment is installed or until approved by the Engineer. The contractor shall submit an itemized list of all materials to be removed before removal of the equipment.

The contractor shall ensure that all ADOT identification numbers are removed, such as MU (Maintenance Unit) numbers, and are turned over to the Engineer.

Any lighting materials, shall be removed in accordance with the pertinent requirements of Sections 202 and 737 of the specifications. All removed materials, with the exception of the luminaires shall become the property of the contractor and shall be disposed off-site.

Luminaires shall salvaged and stored to be reused in the new poles.

The foundation shall be removed along with the anchor bolts and conduits to a depth of not less than 2 feet below the surface of sidewalk or unimproved ground. The resulting hole shall be backfilled with material equivalent to the surrounding material. All voids shall be filled and made level with the surrounding ground. Any disturbed ground shall be restored to match the surrounding area.

All existing underground conduit outside of existing foundations shall be removed to adjacent pull box, unless otherwise directed by the Engineer.

All conductors and detectable pull tape shall be removed from conduits to be abandoned. Removal of conductors from abandoned conduits will be paid for under its respective item.

Method of Measurement:

Removal of light poles (assemblies) will be measured per each light pole assembly removed.

Basis of Payment:

The accepted quantities for removal of light poles (assemblies), measured as provided above, shall be paid at the contract unit price per each, which price shall be full compensation for the work, complete in place.

ITEM 2020400 REMOVE AND RELOCATE (STORAGE CONTAINER)

Description:

The work under this item shall consist of the relocation of existing storage containers located within the POE from its existing location to the new location as shown on the plans and as specified herein.

Construction Requirements:

The containers have the approximate size of an intermodal shipping container (8’ wide x 8.5’ tall x 20’ long). The containers have swinging doors on one of the ends and two sliding garage doors on the front face. No other openings are located on the other sides of the container.

The contractor shall coordinate with the Engineer regarding the time of relocation of the storage containers. The contractor shall provide Department a two-week notice of relocation work so that Department has time to empty out and store the materials located in the containers.

The Department will remove all the equipment inside the containers, securely storing the equipment, and reinstalling the equipment back into the containers once the containers are relocated into their final positions by the contractor.

(A) Coordination with ADOT

Coordination with Department shall include the following:

(1) Pre-Move Inspection:

Before any container is moved, a joint inspection by the contractor and Department shall be conducted to document the condition of the empty containers. The intent of this inspection is to identify any pre-existing conditions and sets a benchmark for the post-move inspection. The contractor shall confirm that all doors on the container function properly. The contractor shall not be responsible for resolving any pre-existing conditions of equipment to be removed and relocated.

(2) Handling ADOT Locks:

Department locks will remain in custody of Department during the relocation of the containers. The contractor shall coordinate with Department for unlocking and relocking the containers as necessary during the relocation process.

(3) Post-Move Inspection:

After relocation, a final inspection by the contractor and Department shall be carried out to confirm that the containers have been relocated correctly and are in the same condition as noted in the pre-move inspection. Any damage to the container that is caused by the relocation process shall be mitigated at no additional cost to the Department.

The contractor shall relocate the containers to the locations shown on the plans and to the satisfaction of the Engineer. The contractor is responsible for maintaining the structural integrity of the containers throughout the moving process, avoiding bending, denting, door damage or other forms of physical damage. Containers shall be placed in the same condition as found during the pre-move inspection.

The multiple storage containers shall be reoriented to have their doors facing each other as shown in the project plans.

Measurement:

Remove and Relocate (Storage Container) will be measured as each, for each container successfully relocated.

Basis of Payment:

The accepted quantities of Remove and Relocate (Storage Container), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place and successfully inspected.

SECTION 203 EARTHWORK:

203-2 General: of the Standard Specifications is modified to add:

The Subgrade Acceptance Chart, see Appendix D, shall be used to determine whether subgrade materials are acceptable.

(203ERWK, 07/16/20)

SECTION 203 EARTHWORK:

203-9.02 Materials: the last sentence of the Standard Specifications is revised to read:

Borrow placed within three feet of the finished subgrade elevation shall conform to the following requirement:

PC + (2.83 x PI) shall not exceed 116,

where:

PC = Percent of material passing the No. 200 sieve (determined in accordance with Arizona Test Method 201), and

PI = Plasticity Index (determined in accordance with AASHTO T 90).

(303RASBAB, 04/18/24)

SECTION 303 AGGREATE SUBBASES AND AGREGATE BASES:

303-2 Materials: of the Standard Specifications is revised to read:

Aggregate for the various classes of aggregate subbases and aggregate bases shall consist of stone, gravel or other approved inert material of similar characteristics, and shall be clean and free from vegetable matter and other deleterious substances.

Aggregate subbase and aggregate base material may be comprised of processed salvaged asphaltic concrete, processed salvaged aggregate base material, processed salvaged Portland Cement Concrete materials, virgin aggregate base materials or any combination of these materials meeting the requirements of Table 303-1. These materials may be from a specific project site or approved commercial source. Processed salvaged materials shall conform to the requirements specified in AASHTO M 319.

Aggregate subbases and aggregate bases shall conform to the requirements of Table 303-1:

TABLE 303-1

Class of Aggregate	Percent Passing Sieve (Inch or No.)									PI, Max.
	3	1-1/2	1	3/4	1/4	4	8	30	200	
1		100	90 - 100				35 - 55		0 - 8.0	3
2		100	90 - 100			38 - 65	25 - 60	10 - 40	3.0 - 12.0	3
3										
4	100				35 - 70				0 - 10.0	5
5	100				30 - 75				0 - 10.0	5
6										

Notes:

(1) The PI (Plasticity Index) will be determined in accordance with the requirements of AASHTO R 58, T 89, and T 90.

(2) Classes 1, 2 and 3 are bases; Classes 4, 5 and 6 are subbases.

(3) The requirements for Class 3 and for Class 6 will be specified in the Special Provisions.

(4) For Class 1 through Class 4 aggregate, the amount of one fractured face coarse aggregate particles shall be at least 50 percent.

(5) Resistance to abrasion for Class 1 through Class 4 aggregate will be determined in accordance with the requirements of AASHTO T 96 and shall meet the following requirements:

Maximum loss of 12 percent at 100 revolutions
Maximum loss of 40 percent at 500 revolutions

(6) When determining gradation of aggregate subbase or aggregate base material containing processed salvaged asphaltic concrete materials, drying to a constant weight shall be performed at a temperature of 140 ± 5 F, in accordance with the requirements of AASHTO T 265.

Aggregate subbase and aggregate base material not conforming to the requirements of Table 303-1 for gradation and/or PI may be accepted by the Engineer upon the contractor's submittal of testing results demonstrating that the R-Value is at least 79 when determined by AASHTO T 190. At the contractor's option, the material may be reprocessed and re-compacted at no additional cost to the Department.

All metal reinforcement and expansion materials shall be removed from processed salvaged Portland Cement Concrete prior to its use in aggregate subbase and aggregate base material.

The contractor shall submit the testing information for the base and subbase materials which are intended to be used to the Engineer for approval. Any significant change in the materials shall be approved by the Engineer prior to use.

Mixing on grade shall be accomplished using a full depth reclamation machine or pulverizer, manufactured for this purpose. Motor graders, gannon boxes, auger scrapers, or other similar devices will not be allowed for mechanical mixing on grade.

If suitable in-place aggregate subbase or aggregate base materials are available, the contractor shall have the option of re-using such materials as processed salvaged aggregate base. Processed salvaged asphaltic concrete and salvaged Portland Cement Concrete materials may be blended with the processed salvaged aggregate subbase, processed salvaged aggregate base and virgin base aggregates. The blended material shall be homogenous mixture in which there is no segregation, crusts, lumps, or nesting, and shall be sampled and tested to meet the requirements specified herein.

303-3.01 Placement: of the Standard Specifications is modified to add:

When processed salvaged materials are utilized, either from in-place or from a commercial source, the Engineer may require a test section of 1000 feet be placed utilizing the processed materials and construction methods proposed for use by the contractor. Full operations shall not proceed until the test section has been tested and approved by the Engineer. The contractor shall use the same equipment, material processing, and construction methods for the remainder of the construction, unless adjustments made by the contractor are approved in advance by the Engineer.

303-3.02 Compaction: of the Standard Specifications is revised to read:

Each layer of aggregate subbase and aggregate base material shall be compacted to a density of not less than 100 percent of the maximum density determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer.

The moisture content shall be determined per AASHTO T 265 when determining density for aggregate subbase and aggregate base material containing processed salvaged asphaltic concrete and/or processed salvaged Portland Cement Concrete.

When AASHTO T 265 is utilized to determine moisture content, acceptance testing results for density will be furnished to the contractor up to 24 hours after performance of in-place density testing to allow sufficient time for moisture determination.

303-5 Basis of Payment: of the Standard Specifications is revised to read:

The accepted quantities of aggregate subbase and aggregate base, measured as provided above, will be paid for at the contract unit price per cubic yard, which price shall be full compensation for the work, complete in place.

ITEM 4010306 - LOAD TRANSFER DOWEL ASSEMBLY (6-FT):
ITEM 4010308 - LOAD TRANSFER DOWEL ASSEMBLY (8-FT):
ITEM 4010310 - LOAD TRANSFER DOWEL ASSEMBLY (10-FT):
ITEM 4010312 - LOAD TRANSFER DOWEL ASSEMBLY (12-FT):
ITEM 4010314 - LOAD TRANSFER DOWEL ASSEMBLY (14-FT):
ITEM 4010316 - LOAD TRANSFER DOWEL ASSEMBLY (2-FT):
ITEM 4010318 - LOAD TRANSFER DOWEL ASSEMBLY (4-FT):

Description:

The work under these items consists of furnishing all material for load transfer dowel assemblies including load transfer dowels and placing the assemblies in portland cement concrete pavement at the locations and in accordance with the details shown on the project plans and the requirements of these specifications.

Materials:

Dowel bars shall be plain round bars, 1 1/2 inches in diameter and 18 inches in length and shall conform to the requirements of AASHTO M 254 with Type B coating, except that the core material shall conform to the requirements of ASTM A 615, Grade 40.

The powdered epoxy resins which may be used for coating the dowel bars shall be in accordance with the requirements of Subsection 1003-5.02 of the Standard Specifications.

The approved powders are based on specified dowel bar preparation and powder application and curing methods, and these identical methods shall be followed during fabrication.

General Requirements:

Certification:

The coating manufacturer shall supply the purchaser with a certification which properly identifies the batch and/or lot number, material, quantity of batch, date of manufacture, and name and address of manufacturer. A statement shall also be submitted certifying that production bars and prequalification bars have been identically prepared and applied with epoxy powders.

Material for Repair:

Patching or repair material, compatible with the coating and inert in concrete, shall be made available by the epoxy manufacturer. This material shall be suitable for repairs of areas of the coating damaged during fabrication and/or handling in the field.

Application Requirements:

Coating Applicator:

The coating applicator's facilities shall be subject to approval by the Department. Applications for approval of facilities shall be made to the Department by the coating applicator.

Surface Preparation:

The surface of bars to be coated shall be blast cleaned in accordance with the Society for Protective Coatings, Surface Preparation Standard SSPC-10, Near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be as defined by SSPC-VIS 1, Pictorial Standards A Sa 2 1/2, or B Sa 2 1/2 as applicable.

The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than eight hours elapse between cleaning and coating.

Coating Application:

The powdered epoxy resin coating shall be applied in accordance with the requirements of the coating manufacturer. The epoxy coating may be applied before or after fabrication of the dowel bars.

Coating Thickness:

The epoxy coating shall be applied as a smooth uniform coat. After curing, the coating thickness shall be a minimum of 7 mils. Coating thickness shall be controlled by taking measurements on a representative number of bars from each production lot.

Continuity of Coating:

The coating shall be checked visually after cure for continuity. It shall be free of holes, voids, contamination, cracks and damaged areas.

The coating shall not have more than two holidays (pinholes not visible to the naked eye) in any linear foot of the coated bar. A holiday detector shall be used, in accordance with the manufacturer's instructions, to check the coating for holidays.

Coating Cure:

The coating applicator shall check each production lot to determine that the entire production lot of coated bars is in a fully-cured condition.

Quality Control:

The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating cure.

Plant Inspection:

The Department reserves the right to have its authorized representative observe the preparation, coating and test of the dowel bars. The representative shall have free access to the plant, and any work done when access has been denied shall be automatically rejected.

If the representative elects, lengths of coated bars may be taken from the production run on a random basis, for test, evaluation and check purposes by the Department.

Certificate of Compliance:

The contractor shall furnish a Certificate of Compliance, conforming to the requirements of Subsection 106.05, from the coating applicator with each shipment of coated bars. The Certificate of Compliance shall also include (1) a statement that the coated bars and coating material have been tested in accordance with the requirements of these specifications, (2) the actual test results for each requirement, and (3) a statement that the actual test results comply with the requirements.

Shop Repair of Coated Bars:

Epoxy coated dowel bars which do not meet the requirements for Coating Thickness, Continuity of Coating, or Coating Cure shall not be repaired.

Reinforcement bars with these defects shall be replaced or alternately, stripped of epoxy coating, recleaned and recoated in accordance with the requirements of these specifications.

Coating breaks due to fabrication and handling shall be repaired with patching material if the defective area is greater than the cross-sectional area of the reinforcement bar. Defects which are smaller than the cross-sectional area need not be repaired.

The repair of coating breaks shall be limited to bars of which the total of the defective coating areas does not exceed 5 percent of the surface area of the dowel bar. Bars with greater than 5 percent damage shall be replaced or alternately, stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

Field Repair:

The contractor shall be required to field repair damaged areas of the bar coating, and to replace bars exhibiting severely damaged coatings. The material used for field repair shall be that supplied by the coating applicator.

Field repair shall be performed wherever the area of coating damaged exceeds the cross-sectional area of the dowel bar.

Field repair shall not be allowed on bars which have severely damaged coatings. A severely damaged coating is defined as coating which has a total damaged area greater than 5 percent of the surface area of the dowel bar as determined by the Engineer. Dowel bars having severely damaged coating as determined by the Engineer, shall not be incorporated in the work and shall be removed from the work site. All such bars shall be replaced in kind by the contractor at no additional cost to the Department.

Anchor straps shall conform to the requirements on the project plans.

All legs, spacer bars and tie bars shall conform to the requirements of Section 1003.

Construction Requirements:

Load transfer dowel assemblies shall be placed at each transverse weakened plane joint on the lanes designated on the project plans.

Dowel assemblies shall be constructed to conform to the lane widths specified on the plans. Lane width refers to the traffic lane as defined in the typical sections. The actual width of the dowel assembly shall be in accordance with the plans or standard drawings. Dowel assemblies shall be constructed such that the dowels are placed at mid-depth of the slab and centered about the weakened plane joint.

Dowel bars shall be placed to a vertical and a horizontal tolerance of ± 1/2 of an inch of the specified depth, centering, and spacing, unless otherwise shown on the project plans.

Dowel bars shall be placed parallel to the pavement center line and pavement surface within a tolerance of ± 3/8 inch for the full dowel length.

Dowel assemblies shall be secured in position on the prepared base in a manner that will hold the assembly in position without disruption throughout construction. Wires or bars used to maintain the assemblies' shape for shipment shall be removed prior to placing concrete if, in the opinion of the Engineer, the wires or bars will offer restraint to early shrinkage of concrete or if the wires or bars extend across transverse joints.

The location of each dowel assembly shall be marked outside the limits of the pavement construction operations in such a manner as to insure the centering of the saw cut about the dowel location.

Payment for load transfer dowel assemblies will be adjusted as specified below when sawed joints are inaccurately placed over load transfer dowel assemblies.

The contractor shall supply equipment and methods of operation such that there is no interference with or movement of dowel assemblies. Final dowel positions shall not exceed the placement tolerances specified above.

Immediately prior to concrete placement, the dowel bars shall be uniformly coated with a thin film of heavy waterproof grease for the full length of the dowel.

Method of Measurement:

Load transfer dowel assemblies will be measured as a unit for each assembly.

Basis of Payment:

The accepted quantities of load transfer dowel assemblies, measured as provided above, will be paid for at the contract unit price, complete in place, except that when sawed joints are

placed inaccurately over load transfer dowel assemblies, as determined by the Engineer, payment will be made as specified in Table 1.

TABLE 1	
Horizontal Misalignment of Sawed Joint Over Load Transfer Dowel Assembly, Inches	Percent of Contract Unit Price Allowed For Load Transfer Dowel Assembly
0 – 1.5	100
1.5 2.0	90
2.0 – 2.5	75
2.5 – 3.0	50
Greater than 3.0	0*
* If allowed to remain in place.	

(402PCCPR, 02/15/24)

SECTION 402 PORTLAND CEMENT CONCRETE PAVEMENT REPAIRS: of the Standard Specifications is revised to read:

402-1 Description:

The work under this section shall consist of furnishing all materials and equipment necessary to repair Portland cement concrete pavement in accordance with the details shown on the plans and the requirements of the specifications.

The type of Portland cement concrete pavement repair may consist of one or a combination of the following:

(A) Partial Depth Repairs
(B) Full Depth Slab Repairs
(C) Diamond Grinding
(D) Pavement Grooving
(E) Joint and Crack Sealing
(F) Edge Sealing

402-2 Partial Depth Repairs:

402-2.01 Description:

The work shall consist of removing loose material and temporary bituminous patch material from potholes, damaged joints, and spalled areas, thoroughly cleaning and drying the repair area, and placing new repair material in reasonably close conformity with the existing pavement cross section.

402-2.02 Materials:

The contractor shall select one or more of the following products, or approved equal, as approved by the Engineer.

1. FPT Fibrecrete with primer
2. Crafco Techcrete with primer
3. Roklin Flexset
4. D.S. Brown Delpatch
5. R.J. Watson Poly-Tron

402-2.03 Construction Requirements:

Partial depth repair areas will be designated by the Engineer. If diamond grinding or pavement grooving is included as part of the project, the partial depth repair shall be performed prior to the commencement of the diamond grinding or pavement grooving work. The extent of the repair area will be marked by the Engineer and will be evaluated on an individual basis. The Engineer will be the final authority if questions arise in regard to the need for repair or the extent of a required repair.

The contractor shall furnish the Engineer with a copy of the product's technical data sheets with printed instructions for mixing and application, and the expiration date of the manufacturer's shelf life warranty. Material that has exceeded the shelf life warranty shall not be used. In order to assure proper mixing and placement, a qualified manufacturer's representative for the approved product shall be present at the start of partial depth repair operations, and shall remain until the Engineer is satisfied that the contractor is conforming to the recommended procedures.

Partial depth repair material shall not be placed under adverse conditions as detailed in the manufacturer's installation instructions

Hand held pneumatic tools shall be used to remove deteriorated material until sound clean concrete is exposed. If the depth of the partial depth repair area exceeds one-third the thickness of the concrete pavement slab, the affected portion of the pavement slab shall be removed and replaced in accordance with the requirements of Subsection 402-3 of the specifications.

Before application of the repair material, the exposed surfaces of the concrete shall be free of loose particles, oil, dust, traces of asphaltic concrete, other contaminants, and shall be cleaned in accordance with the manufacturer's recommendations. If the surface of the repair area is wet, the contractor shall dry the wet area using an open flame blow torch. Repair material shall be confined to the limits of the repair area and shall not overlap onto the surrounding pavement.

Repairs on both sides across a longitudinal or transverse joint shall be sawcut on the existing joint to structurally separate the two sides. The Engineer may approve the use of flexible repair materials, with modulus of elasticity less than 10 ksi, on both sides of a joint without a sawcut.

The repair area shall be finished to the cross-section of the existing pavement and textured with placement of broadcast sand prior to setting of the repair material. The repair area surface shall be struck off flush with the existing pavement surface.

Partial depth repairs shall be verified before substantial completion for acceptance. Repairs that have failed as determined by the Engineer shall be removed at no additional cost to the department and replaced with partial depth repairs meeting the requirements of these specifications.

402-2.04 Method of Measurement:

Partial depth repairs will be measured by the square foot. Each repair will be measured to the nearest one tenth square foot. The total cumulative measurement of all repairs will be rounded to the nearest square foot.

402-2.05 Basis of Payment:

The accepted quantities of partial depth repairs, measured as provided above, will be paid for at the contract unit price per square foot, which price shall be full compensation for the work, complete in place, including removal and disposal of the old pavement.; and replacement of shoulder material which is removed or damaged during repair work.

402-3 Full Depth Slab Repairs:

402-3.01 Description:

The work shall consist of furnishing all materials and removing existing concrete pavement and constructing full depth repairs or full panel replacements of Portland cement concrete pavement at the locations shown on the plans or determined by the Engineer, as specified herein, and in reasonably close conformity with the existing pavement cross-sections.

402-3.02 Materials:

The contractor shall not place concrete material until the mix design has been approved.

Mix design for full depth repairs or full panel replacements shall conform to the following:

- Standard Strength concrete shall obtain a minimum compressive strength of 3500 psi in 7 days and shall have a minimum 28-day compressive strength of 4000 psi.

Materials for Portland cement concrete shall conform to the requirements of Section 1006 of the specifications. Concrete shall be Class S, with size 57 coarse aggregate as designated in AASHTO M 43.

Materials furnished for joint seal shall conform to the requirements of Subsection 1011-3 of the specifications.

Materials furnished for tie bars shall conform to the requirements of Section 1003 of the specifications.

Materials furnished for dowel bars shall conform to the requirements of AASHTO M 254 with Type B coating except that the core material shall conform to the requirements of ASTM A615, Grade 60.

Liquid membrane forming curing compound shall conform to the requirements of Subsection 1006-6.01(C) of the specifications.

402-3.03 Construction Requirements:

Areas to be replaced will be as shown on the plans and/or as designated by the Engineer. If diamond grinding or pavement grooving is included as part of the project, the full depth repair shall be performed prior to the diamond grinding or pavement grooving work.

Pavement slabs containing two or more cracks through the full depth of the slab shall be repaired as a full depth slab repair.

The repair area shall be rectangular in shape, shall extend to include the full width of the existing panel, and shall be a minimum of six feet in length. Repair limits shall be such that any remaining section of the panel has a minimum length of six feet. Transverse joints shall align with existing joints unless otherwise indicated herein. When a repair area extends to an existing transverse joint with dowel bars, the repair limits shall be extended into the adjacent panel to a point just beyond the existing dowel bars. If this results in a panel length greater than 15 feet, an intermediate transverse joint shall be created. Repair areas shall be saw cut through the full depth of the concrete repair area.

The PCCP panel shall be removed by utilizing a lift out method. Any damage to the existing PCCP that is to remain, due to contractor's operations, shall be repaired at no additional cost to the Department. After removal of the PCCP panel, the contractor shall remove and clean any loose material. The contractor shall also re-grade and re-compact the base material prior to the placement of Portland cement concrete. Any damage resulting from panel removal or grade preparation, as determined by the Engineer, will be repaired at the expense of the contractor.

All transverse joints shall be constructed with plain round dowel bars. Dowel bars shall be 18" in length and shall be placed at 1.0 foot intervals, mid-depth of the panel. Dowels shall be placed parallel to the longitudinal joint and the roadway profile. Dowel bars shall not be placed within 1.0 foot of either edge of the panel (i.e. longitudinal joint). The dowel bar diameter shall be based on the pavement thickness as shown in the following table.

Pavement Thickness (inches)	Dowell Diameter (inches)
8.0 or less	1.0
8.5 or greater	1.25

The panel thickness for full depth repairs shall match existing.

When a repair panel has a different thickness than the adjacent panel, the dowel bar diameter and placement depth shall be determined based on the thinner panel.

Dowel bar holes shall be drilled with a mechanically supported drill to maintain proper alignment. Hole diameter shall be 1/8 inch larger than the dowel bar. Dowel bars shall be anchored into the existing concrete with an approved high viscosity epoxy. An epoxy retention disk shall be used to prevent anchoring material from flowing out of the hole. The retention disk shall fit snuggly over the dowel and against the face of the panel. Before concrete placement for the full depth repair, the 9-inch long free end of the dowel bar shall be uniformly coated with a thin film of heavy waterproof grease.

When the contiguous length of a repair is less than or equal to two full panels, or when a transverse joint does not align with the joints in an adjacent panel, a 1/8 inch thick bond breaker shall be placed along the length of the longitudinal joints to isolate the full depth repair. The fiberboard shall be configured to fit snugly against the adjacent slab, for the full depth and length of the longitudinal face of the repair.

Longitudinal tie bars shall be installed when the length of a repair exceeds two consecutive panels. Tie bars shall be installed in accordance with Section 401 of the Specifications, with the exception that they shall be No. 5 deformed bars.

The slab replacement shall be finished to the cross section of the existing pavement and textured with a stiff bristled brush to match the existing pavement. The replaced surface shall be flush with the existing pavement surface. Texturing will not be required if grinding or grooving shall be performed following the repair.

A new sealant reservoir shall be sawed or formed at the interface of the replacement and existing concrete, as well as any intermediate transverse joints. The full depth slab repair shall not be opened to traffic until all joints are sealed and the concrete has attained a compressive strength of at least 3000 pounds per square inch, unless otherwise approved by the Engineer.

402-3.04 Method of Measurement:

Full depth slab repairs will be measured by the square yard of pavement repaired. Each replacement will be measured to the nearest one tenth square foot. The total cumulative measurement of all pavement repaired will be rounded to the nearest square yard.

402-3.05 Basis of Payment:

The accepted quantities of full depth slab repairs, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work complete in place, including the saw cutting of joints and dowel and tie bars, dowel and tie bar installation, the removal and disposal of existing materials, the excavation and subsequent backfilling or repairs to base materials incidental to the removals and regrading and recompacting of the base material.

402-4 Diamond Grinding:

402-4.01 Description:

The work under this item shall consist of diamond grinding the surface of existing concrete pavement to improve the ride characteristics, texture, and frictional properties of the roadway

surface. Diamond grinding shall be performed at the locations shown on the plans and in accordance with the requirements of these specifications.

402-4.02 Construction Requirements:

(A) General:

Prior to diamond grinding, the contractor shall submit a plan on how to complete the diamond grinding work to the Engineer for review and approval. The plan shall include at a minimum a description of the diamond grinding method, a diamond grinding sequence plan, a list of required equipment types and quantities, truck ingress and egress, traffic control, concrete slurry collection and disposal, striping, and cleaning of the roadway before opening to traffic. Unless otherwise directed by the Engineer, or specified herein, the contractor shall design traffic control and provide ways to maintain it such that there shall be no stripe obliteration on the newly ground roadway surface.

The contractor shall determine the proper sequence of operations to comply with the requirements specified herein. If multiple passes of the diamond grinding equipment are required, the area will only be considered for payment once. A minimum of 95 percent of any 100- foot section of pavement surface shall be textured. Existing depressed pavement areas due to subsidence or other localized causes will be exempted from texture and smoothness requirements.

The contractor shall protect all bridge deck joints and any other roadway features that may be damaged by diamond grinding operations. If there are any existing damages to the joints, the contractor shall bring it to the Engineer’s attention prior to the diamond grinding operation.

Prior to diamond grinding, all repairs shall be completed as shown on the plans and specified herein.

No equipment will be allowed within three feet of a traffic lane that is open to the public.

When applicable, prior to the commencement of the work, the diamond grinding of ramp tie-in locations, radiused geometry at interchanges, etc. may be adjusted for the purposes of finished configuration, measurement, and payment with the approval of the Engineer.

(B) Equipment:

Diamond grinding shall be done with diamond blades, mounted on a self -propelled machine that has been designed for diamond grinding and texturing of pavements. The grinding equipment shall weigh a minimum of 35,000 pounds including the grinding head, and be of a size that will grind a strip at least 3-feet wide. The effective wheel base of the machine shall be no less than 12 feet. The effective wheel base is defined as the distance from the front wheel assembly transverse pivot point to the transverse pivot point of the profile/depth control/ ground drive wheels. The equipment shall have a positive means of vacuuming the grinding residue from the pavement surface, thereby leaving the surface in a clean, near-dry condition. Diamond grinding equipment that causes raveling, aggregate fractures, spalls, or disturbances of the transverse and/or longitudinal joints shall not be used.

All diamond grinding machines used in the cross-section of a lane shall have the same wheel base and diamond grinding head configuration. To provide the proper surface finish and to achieve the designated texture on the pavement section, the contractor shall select the number of blades per foot ranging from 55 to 60 for the diamond grinding process. A 1 to 2 inch overlap of diamond grinding passes shall be allowed.

(C) Procedure:

The contractor shall diamond grind the roadway sections shown on the plans.

Pavement surfaces shall be ground longitudinally beginning and ending at lines perpendicular to the roadway centerline. All diamond grinding shall be done in a direction parallel to the pavement lane lines. Diamond grinding shall continue for the full lane width until the pavement surface on both sides of all transverse joints and all cracks are in the same plane. Longitudinal ridges in adjacent passes of the diamond grinding equipment shall not exceed 1/8 inch in depth. The diamond grinding shall produce a neat, uniform finished surface. Joints and crack faults shall be ground so that there is no more than a 1/16-inch differential between adjacent sides of the joints and cracks. Transitions between ground and unground areas of concrete at the boundaries shall be smoothly feathered in. The joints between lanes and project limits shall be feathered in such a way to not create a drop off between the adjacent pavement surface and new diamond ground surfaces. The contractor shall maintain the existing cross slope and provide for positive drainage. The finished cross slope shall mirror the pre-grind cross slope and shall have no depressions or misalignment of slope greater than ¼-inch per 10 feet when measured with a 10-foot straightedge. Shoulder or ramp lane diamond grinding shall transition from the mainline to provide positive drainage leaving no more than a 3/16-inch ridge and a smooth riding surface. If requested by the contractor and approved by the Engineer, smaller equipment may be used for diamond grinding shoulder transitions.

Transitions from PCCP to asphaltic concrete shall be located as shown on the plans.

The contractor shall diamond grind a test section of pavement, where designated by the Engineer, to determine that the equipment proposed for use on the project will provide the specified surface texture.

The diamond grinding process shall produce a pavement surface that is true in grade and uniform in appearance with longitudinal line-type texture. The line-type texture shall contain corrugations parallel to the pavement lane lines and present a narrow ridge corduroy type appearance. The peaks of the ridges shall be 1/8-inch +/- 1/16-inch higher than the bottom of the grooves with evenly spaced ridges.

Diamond grinding shall result in at least 95% of any selected 2-foot by 100-foot longitudinal area meeting the specified surface texture.

The contractor shall be responsible for collection and disposal of all diamond grinding slurry. All slurry shall be vacuumed into a storage tank or truck and disposed of properly. The slurry from diamond grinding operations shall not be permitted to flow across lanes occupied by traffic, onto roadway shoulders or areas containing vegetation, or to flow into gutters or other

drainage facilities. The slurry shall be removed prior to opening the ground pavement section to traffic.

(D) Surfacing and Quality Testing Requirements:

After the diamond grinding and joint and crack sealing have been completed and the roadway is ready for testing, the contractor shall submit a written notice to the Engineer indicating that the work has been completed and the roadway is ready for testing.

The final ground concrete pavement surface shall be evaluated for smoothness by testing with an inertial profiler. The roadway smoothness shall be tested in accordance with the requirements of Arizona Test Method 829. The contractor shall sweep and clean the roadway prior to testing.

Traffic control costs during the smoothness testing period will be reimbursed under the provisions of Section 701 of the specifications. Any additional traffic control costs incurred, due to corrective action work and subsequent pavement smoothness measurements shall be borne solely by the contractor.

Testing shall be performed within 2 weeks of the completion of diamond grinding. The Engineer will notify the contractor of the test results no later than 10 days after the testing has been performed.

Testing will be performed on mainline traffic lanes, and will include the full length of the diamond grinding segments under the contract. Unless otherwise specified in the contract documents, testing of distress lanes, shoulders, ramps, tapers, cross roads, and frontage roads will not be performed.

(1) Incentive/Disincentive:

A pay adjustment incentive/disincentive will be applied based on an Actual Smoothness Value (AS) for the mainline lanes and freeway to freeway ramps shown on the plans. IRI values will be measured in accordance with Arizona Test Method 829 and reported every 0.1 mile. The incentive/disincentive pay will be adjusted for every 0.1 mile and shall be determined in accordance with the following table:

PCCP Smoothness Pay Adjustment	
AS Inches/mile	**Pay Adjustment $/0.1 mile**
<40	(45 – AS) x 45
≥40 and ≤50	0
>50 and <85	(45 – AS) x 45
≥85	Correction Required (1)

(1) Any 0.1 lane-mile increment having an AS value equal to or greater than 85 shall be repaired by the contractor at no additional expense to the Department.

The total adjustment in payment to the contractor shall be the summation of the individual adjustments for the respective 0.1 lane-mile increments, except the maximum total incentive allowed shall be $9,000 per tested lane-mile.

If repairs are required, the contractor shall prepare a written proposal detailing corrective actions and submit the proposal to the Engineer within 10 working days after the contractor's receipt of test results. Within three working days, the Engineer will review the submitted proposal and either accept it, or reject it and ask for a new proposal. If rejected, the contractor shall, within 10 working days, prepare and submit a new proposal for corrective action, based on discussions with the Engineer. The Engineer will review, and either accept or reject, the new proposal within three working days of receipt.

Upon completion of any necessary repairs, the 0.1 lane-mile increments containing repaired areas will be re-tested in accordance with the provisions of Arizona Test Method 829. Resultant values from re-testing will be used in determining the adjustment in payment to the contractor

402-4.03 Method of Measurement

Measurement for diamond grinding for payment will not be required unless adjustments are made in accordance with subsection 402-4.02(A) of this specification. When adjustments are required, diamond grinding will be measured by the square yard of ground pavement section. The ground section will be measured to the nearest 0.1 square yard. The total cumulative ground area measured will be rounded up to the nearest square yard.

402-4.04 Basis of Payment

The accepted quantities of pavement diamond grinding, as shown in the bidding schedule and any adjustments as specified in subsection 402-4.02(A) of this specification, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, as specified herein.

No measurement or payment will be made for feathering, the cost being considered as included in the contract item.

No measurement or payment will be made for water used during the diamond grinding process or the disposal of the diamond grinding slurry, the cost being considered as included in the contract item.

402-5 Pavement Grooving:

402-5.01 Description:

The work consists of furnishing all materials and grooving the surface of existing Portland Cement Concrete Pavement at the locations shown on the project plans and in accordance with the requirements of these specifications.

402-5.02 Blank

402-5.03 Construction Requirements:

(A) General:

The pavement surface shall be grooved longitudinally.

The methods used and tolerances employed shall provide a surface which will provide good wet or dry driving characteristics.

Longitudinally grooved areas shall begin and end at lines normal to the pavement center line and shall be centered within the lane width.

No equipment shall be allowed within three feet of a traffic lane open to the public. Maintenance and Protection of Traffic shall be in accordance with Section 701 of the specifications.

Removal of all slurry or residue resulting from the grooving operation shall be continuous. Residue from grooving operations shall not be permitted to flow across shoulders or lanes occupied by public traffic or to flow into gutters or other drainage facilities. Dried residue, resulting from grooving operations, shall be removed from pavement surfaces with a pick up or power broom before such residue is blown by the action of traffic or wind.

The noise level created by machinery shall not exceed 86 dbA at a distance of 50 feet normal to the direction of traffic.

(B) Equipment and Procedures:

Longitudinal grooving shall be performed using multiple diamond blades mounted on a self-propelled machine designed for diamond grooving concrete pavement and bridge decks. The grooving equipment shall have a depth control device enabling adjustment of the cutting head height to maintain the specified groove depth. The grooving equipment shall have the capability to maintain alignment to the center of the roadway. The equipment will be capable of installing grooves to the dimensions and spacing requirements specified herein.

At the beginning of each work shift, all grooving equipment shall be equipped with a full complement of grooving blades that are capable of cutting grooves of the specified width, depth and spacing.

If during the course of work, a single grooving blade on an individual grooving equipment becomes incapable of cutting a groove, work will be permitted to continue for the remainder of the work shift and the contractor will not be required to otherwise cut the groove omitted

because of the failed blade. Should two or more grooving blades on an individual grooving equipment become incapable of cutting grooves, the contractor shall cease operations.

The grooved area of any selected two-foot by 100-foot longitudinal area of pavement specified to be grooved shall not be less than ninety percent of that area. Un-grooved pavement within the selected area shall be limited to that which occurs as a result of pavement irregularities.

(C) Tolerance:

Longitudinal grooving shall begin six inches from the outside edge of pavement or reflective marker and run in a continuous pattern across the lane surface to within six inches of the longitudinal joint. The groove pattern shall be 1/8 inch in width by 3/16 inch in depth with a center to center spacing of 3/4 inch. The groove spacing tolerance shall be plus or minus 1/8 inch. The width of the groove shall have a tolerance of plus or minus 1/64 inches. The depth of the groove shall have a tolerance of plus or minus 1/16 inch.

On curves and/or super elevations, the width of the groove may exceed the above dimensions if approved.

If the pavement profile is very uneven, the Engineer may permit a variation in maximum groove depth in areas adjacent to rutted pavement and/or faulted joints.

Grooving shall be terminated at least one foot from all devices in place in the pavement, such as manholes, inlet casting, valve boxes, etc.

402-5.04 Method of Measurement:

Pavement grooving will be measured and accepted by the square yard of grooved pavement. The quantity of grooved pavement will be determined by multiplying the width times the length of the grooved area. No deduction will be made for grooving omitted at joints, manholes, inlets or other similar installations in the pavement surface.

402-5.05 Basis of Payment:

The accepted quantities of pavement grooving, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, as specified herein.

402-6 Joint and Crack Sealing:

402-6.01 Description:

The work shall consist of furnishing all materials and sealing longitudinal and transverse weakened-plane and sealing random cracks in existing Portland Cement Concrete Pavement, as specified herein.

402-6.02 Materials:

Joint and crack sealant material shall conform to the requirements of ASTM D6690 Type IV.

402-6.03 Construction Requirements:

(A) General:

Joint to be sealed will be identified by the Engineer. Joint sealing shall be accomplished by first removing old sealant and joint inserts, then refacing and cleaning the joints and installation of new hot-applied sealant.

Cracks will be identified by the Engineer. Crack sealing shall be accomplished by first cleaning the crack followed by installation of new hot-applied sealant.

(B) Joint Preparation Prior to Sealing:

Before sealing, all non-compressible debris shall be removed from the joints to the full depth of the sawed joints. Old sealant shall be removed by using a nominal 1/8 inch wide diamond blade. The joints shall be sawed to the depth of the original sawing. An air compressor utilizing an oil separator shall be used to remove old sealant and any non-compressible materials. Air compressors shall be capable of furnishing a sufficient amount of compressed air to clean the joints properly.

(C) Crack Cleaning Prior to Sealing:

Cracks shall be thoroughly cleaned of loose debris with an air compressor utilizing an oil separator. Air compressors shall be capable of furnishing a sufficient amount of compressed air to clean the crack properly. Areas requiring crack sealing will be determined by the Engineer.

(D) Installation of Sealant:

Sealant compound shall not be placed unless the joint or crack is dry, clean and free of dust. Heating and application of the sealant shall follow the installation instructions from the sealant manufacturer. The joints shall be sealed so that upon completion of the work, the surface of the sealant material will be 1/4 ± 1/8 inch below the adjacent pavement surface.

402-6.05 Method of Measurement:

Joint and crack sealing will be measured by the linear foot.

402-6.06 Basis of Payment:

The accepted quantities of joint and crack sealing, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place.

402-7 Edge Sealing:

402-7.01 Description:

The work shall consist of furnishing all materials and sealing the joints between the Portland Cement Concrete Pavement and the asphaltic concrete distress lane. This work shall be done after the completion of all specified pavement grinding and after all specified

rehabilitation of the distress lane or outside shoulder. The work shall be accomplished in accordance with the details shown on the project plans and as specified herein.

402-7.02 Material Requirements:

The edge sealant shall be a hot-applied joint filler conforming to the requirements of ASTM D5078.

402-7.03 Construction Requirements:

(A) General:

Edge sealing shall be accomplished by cleaning the edges and installation of new sealant.

The edge sealant shall not be placed under adverse conditions, which may include but are not limited to rain, snow, freezing weather, and high winds. Edge sealant material shall not be placed when the ambient temperature falls below 40 degrees F. At any time, the Engineer may require that the work cease or that the work day be reduced if weather conditions, either existing or expected, are anticipated to have an adverse effect upon the sealing material.

The edge sealant shall not be placed in cracks which are wet.

(B) Joint Preparation:

Immediately prior to application of the edge sealant material, the contractor shall ensure that the edges are thoroughly cleaned through the full depth of the edge. Loose particles, grass, grass roots, weeds, dust and other deleterious substances shall be removed by means of high velocity compressed air, vacuuming, or other methods approved by the Engineer. Compressed air equipment shall have traps or devices to prevent moisture and oil from contaminating the edge surfaces.

Immediately following the cleaning of edges and before the application of sealant, if required, a backer rod composed of an inert, compressible material shall be inserted along the lower portion of the joint groove at a uniform depth as shown on the project plans.

(C) Equipment Requirements:

The sealant material shall be mixed in a kettle or a melter constructed as a double boiler. The kettle or melter shall have a continuous sealant agitation and mixing system to provide uniform viscosity and be capable of maintaining the manufacturers recommended application temperature.

(D) Application of Edge Sealant:

The edge sealant shall be installed at the manufacturer’s recommended application temperature.

The edge sealant shall be flush or recessed with the surrounding pavement, as approved by the Engineer.

402-7.04 Method of Measurement:

Edge sealing will be measured by the linear foot.

402-7.05 Basis of Payment:

The accepted quantities of edge sealing, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place.

(409AGGR 06/19/25)

SECTION 409 ASPHALTIC CONCRETE (MISCELLANEOUS STRUCTURAL): the title and text of the Standard Specifications is revised to read:

SECTION 409 ASPHALTIC CONCRETE (MISCELLANEOUS STRUCTURAL-SPECIAL MIX):

409-1 Description:

The work under this section shall consist of constructing Asphaltic Concrete (Miscellaneous Structural-Special Mix), hereinafter asphaltic concrete, by furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, reclaimed asphalt pavement (RAP) if used, mineral admixture, and bituminous material (asphalt cement) to form a pavement course or to be used for other specified purposes, in accordance with the details shown on the project plans and the requirements of the specifications, and as directed by the Engineer.

The contractor shall acquire and make all arrangements for a source or sources of material, furnish a mix design which will meet the design criteria specified hereinafter, and provide all the equipment, materials, and labor necessary to complete the work.

409-2 Materials:

The bidding schedule quantities of asphaltic concrete mixes used (a) for PCCP Base and (b) at locations where Structural Section No. 3 is to be constructed as shown on the plans are based on an estimated unit weight of 147 pounds per cubic foot.

409-2.01 Mineral Aggregate:

Mineral aggregate shall conform to the following requirements when tested in accordance with the applicable test methods.

Mineral Aggregate Characteristics	Test Method	Requirement
Combined Bulk Oven Dry Specific Gravity	Arizona Test Method 251	2.350 - 2.850
Combined Water Absorption	Arizona Test Method 251	0 – 3.0%
Abrasion	AASHTO T 96	100 Rev., Max 9% 500 Rev., Max 40%
Sand Equivalent	AASHTO T 176 (After thoroughly sieving the sample, no additional cleaning of the fines from the plus No. 4 material is required.)	Minimum 55
Fractured Coarse Aggregate Particles	AASHTO T 335	Minimum 85% with at least two fractured faces and minimum 92% with at least one fractured face (plus No. 4 material)
Uncompacted Void Content	AASHTO T 304 Method A	Minimum 45.0%
Carbonates (1)	Arizona Test Method 238	Maximum 20%

(1): Testing for carbonates only applies if either of the following conditions exist:

(a) The asphaltic concrete is the designed final pavement surface normally used by traffic.

(b) The asphaltic concrete, temporary or otherwise, will be subject to traffic for more than 60 days.

The gradation will be determined in accordance with AASHTO T 11 and AASHTO 27, and shall conform to the requirements given below.

Mix Design Grading Limits				
Sieve Size	Percent Passing			
	1/2 Inch Mix		3/4 inch Mix	
	Without Admixture	With Admixture	Without Admixture	With Admixture
1-1/4 Inch	---	---	---	---
1 Inch	---	---	100	100
3/4 Inch	100	100	90-100	90-100
1/2 Inch	90 - 100	90-100	---	---
3/8 Inch	67 - 82	67 - 82	62 - 77	62 - 77
No. 8	40 - 48	41 - 49	37 - 46	38 - 47
No. 40	10 - 18	11 - 19	10 - 18	11 - 19
No. 200	1.5 - 4.5	2.5 – 6.0	1.5 - 4.5	2.5 - 6.0

Fine mineral aggregate shall be obtained from crushed gravel or crushed rock. All uncrushed material passing the No. 4 sieve shall be removed prior to the crushing, screening, and washing operations necessary to produce the specified gradation. The contractor shall notify the Engineer a minimum of 48 hours in advance of crushing the material to be used as mineral aggregate, so all crushing operations can be inspected. Existing stockpile material which has not been inspected during crushing will not be permitted for use unless the contractor is able to document to the Engineer's satisfaction that the mineral aggregate has been crushed. Any material inspected by the Department as crushed material for the project shall be separated from the contractor's other stockpiles and reserved for use throughout the project duration.

The contractor may blend uncrushed fine aggregate up to a maximum of 15 percent of the total aggregate, provided that the composite of uncrushed fine aggregate and crushed fine aggregate meets the requirement for uncompacted void content. The uncrushed fine aggregate shall be 100 percent passing the 1/4 inch and not contain more than 4.0 percent passing the No. 200 sieve. Should the contractor modify the method of producing either the uncrushed or crushed fine aggregate, the Engineer shall be immediately notified and the materials sampled and tested for determination of uncompacted void content.

409-2.02 Bituminous Material:

Asphalt cement for the asphaltic concrete mix for PCCP Base shall be a performance grade (PG) asphalt binder, conforming to the requirements of Section 1005 of the specifications. The type of asphalt binder shall be PG 64-16.

Asphalt cement for the asphaltic concrete mix used at the Structural Section No. 3 Locations shown on the plans shall be a performance grade (PG) asphalt binder, conforming to the requirements of Section 1005 of the specifications. The type of asphalt binder shall be PG 70-28 PM.

The percent of asphalt cement used shall be based on the weight of total mix (asphalt cement, mineral aggregate, and mineral admixture).

The contractor shall provide the laboratory mixing and compaction temperature ranges to the mix design laboratory for each PG asphalt binder used for mix design purposes. The laboratory mixing temperature range is defined as the range of temperatures where the un-aged asphalt binder has a rotational viscosity of 0.17 ± 0.02 Pascal·seconds, measured in accordance with AASHTO T 316. The laboratory compaction temperature range is defined as the range of temperatures where the un-aged asphalt binder has a rotational viscosity of 0.28 ± 0.03 Pascal·seconds, measured in accordance with AASHTO T 316. The testing required in AASHTO T 316 shall be performed at 275 degrees F and 350 degrees F, and a viscosity-temperature curve developed in accordance with ASTM D2493. The viscosity-temperature curve shall be included in the mix design report. For PG asphalt binders that have a maximum laboratory mixing temperature exceeding 325 degrees F or a maximum laboratory compaction temperature exceeding 300 degrees F, the laboratory mixing and compaction temperature ranges shall be specified in writing by the asphalt binder supplier. The laboratory mixing and compaction temperature ranges, as well as the actual laboratory mixing and compaction temperatures used, shall be reported on the mix design. The contractor shall ensure that the asphalt binder supplier information required in this paragraph

is provided to all appropriate parties in a timely manner, and that copies are included in the mix design report. The laboratory mixing and compaction temperatures are for mix design purposes only. Field mixing and compaction temperatures are specified in Subsection 409-3 of the specifications.

409-2.03 Mineral Admixture:

Mineral admixture shall be either Portland cement, blended hydraulic cement, or hydrated lime conforming to the following requirements:

Material	Requirement
Portland Cement, Type I or II	ASTM C150
Blended Hydraulic Cement, Type IP or 1L	ASTM C595
Hydrated Lime	ASTM C1097

The mineral admixture content shall be 2.0 percent, by weight, of the mineral aggregate. However, a minimum of 1.0 percent mineral admixture may be used if the contractor submits test information showing a lowered percentage of mineral admixture produces mix design results for Index of Retained Strength of at least 60 percent (70 percent if the average elevation of the project is above 3,500 feet) and a Minimum Wet Strength of 150 psi when tested in accordance with Arizona Test Method 802.

The certification and acceptance of Portland cement, blended hydraulic cement, and hydrated lime shall be in accordance with ADOT Materials Practice and Procedure Directive No. 13, "Certification and Acceptance of Hydraulic Cement, Fly Ash, Natural Pozzolan, Silica Fume, and Lime".

409-2.04 Mix Design:

Utilizing mineral aggregate which has been crushed, processed, separated, and stockpiled, a mix design shall be formulated and submitted by the contractor to the Engineer. The mineral aggregate samples used for mix design purposes shall be representative of aggregate materials to be used during production.

The mix design shall be based on the mix design criteria and other requirements specified herein, utilizing asphalt cement and mineral admixture of the type and from the sources proposed for use in the production of asphaltic concrete.

Mix designs shall be developed utilizing a minimum ratio of three (3) for the lift thickness to nominal maximum aggregate size.

The mix design shall be prepared by or under the direct supervision of a professional engineer experienced in the development of mix designs and mix design testing. Reclaimed asphalt pavement (RAP) may be used in the mixture if properly designed per Arizona Test Method 833. Limits for the usage of RAP shall be per ADOT Materials Practice and Procedure Directive No. 20, “Guidance on the Use of Reclaimed Asphalt Pavement (RAP) in Asphaltic Concrete”. The mix design engineer shall meet the requirements given in ADOT Materials Practice and Procedure Directive No. 4, “Asphaltic Concrete Mix Design Proposals and

Submittals". The mix design shall be provided in a format that clearly indicates all the mix design requirements and shall be sealed, signed, and dated by the mix design engineer.

The mix design shall be prepared by a mix design laboratory that has met the requirements of ADOT Materials Practice and Procedure Directive No. 19, "ADOT System for the Evaluation of Testing Laboratories".

If approved by the Engineer, as an alternative to meeting the mix design requirements specified herein, a mix design meeting the requirements of the specifications for a Section 416 Asphaltic Concrete (End Product) (1/2 inch Special Mix), Section 416 Asphaltic Concrete (End Product) (3/4 inch Special Mix), Section 417 Asphaltic Concrete (SHRP) (End Product) (1/2 inch Mix), or Section 417 Asphaltic Concrete (SHRP) (End Product) (3/4 inch Mix) may be substituted for use. The type of asphalt binder used in the alternative mix design must be the same as that specified in Subsection 409-2.02 of the specifications. The alternative mix design may include reclaimed asphalt pavement (RAP) if properly designed per Arizona Test Method 833. If a mix design meeting the requirements of Section 417 is used, the number of gyrations for N-design used in the alternative mix design must be at least that which would be specified at the location where the Asphaltic Concrete (Miscellaneous Structural-Special Mix) is to be placed. The lift thickness for the alternative mix design shall conform to the following table:

Alternative Mix Design	Minimum Lift Thickness
Section 416 (1/2 Inch Special Mix)	1-1/2 Inches
Section 416 (3/4 inch Special Mix)	2 inches
Section 417 (1/2 inch Mix)	2 inches
Section 417 (3/4 inch Mix)	2-1/2 inches

The contractor may propose the use of a mix design that has been developed for a previous project. The proposed mix design shall meet the requirements of these specifications. The contractor shall provide evidence that the type and source of bituminous material, the type of mineral admixture, and the source and methods of producing mineral aggregate, and RAP material if applicable, have not changed since the formulation of the previous mix design. The contractor shall also provide current test results for all specified characteristics of the mineral aggregate, and RAP material if applicable, proposed for use. The Engineer will determine if the previously used mix design is suitable for the intended use and if the previous use of the mix design was satisfactory to the Department. The Engineer will either approve or disapprove the proposed mix design. Should the Engineer disapprove the use of the previously used mix design, the contractor shall prepare and submit a new mix design proposal in accordance with the requirements of these specifications.

A previously used mix design older than two years from the date it was formulated, sealed, signed, and dated shall not be allowed for use. Once approved for use on a project, a previously used mix design may be used for the duration of that project.

Test results used in the formulation of the mix design must be from testing performed no earlier than 45 days prior to the date the mix design is signed by the mix design engineer. Historical abrasion values may be supplied on sources provided the testing was conducted within the past two years.

The mix design shall be submitted to the Engineer under a cover letter signed by an authorized representative of the contractor.

A copy of the mix design and representative samples of the mineral aggregate, mineral admixture, and asphalt cement used in the mix design shall be submitted to the Engineer for calibration of the ignition furnace, and for the determination of sand equivalent, fractured coarse aggregate particles, and uncompacted void content. The Engineer shall witness the sampling of the mineral aggregate. The mix design and samples shall be submitted to the Engineer at least five working days prior to the start of asphaltic concrete production.

The sand equivalent, fractured coarse aggregate particles, and uncompacted void content shall meet the requirements specified in Subsection 409-2.01 of the specifications. Additional testing of the uncrushed and crushed fine aggregate for uncompacted void content will be required if the method of producing either fine aggregate is modified.

If the mineral aggregate fails to meet the requirements specified herein, asphaltic concrete production shall not commence, and the contractor shall either submit a revised mix design which is representative of the materials produced or correct the deficiencies in the aggregate stockpiles.

The mix design shall meet the following criteria when tested in accordance with the requirements of the following test methods:

Criteria	Requirement	Arizona Test Method
1. Voids in Mineral Aggregate: %, Range	15.0 – 18.0	(See Note)
2. Effective Voids: %, Range	3.8 – 4.2	(See Note)
3. Absorbed Asphalt: %, Range	0 – 1.0	(See Note)
Note: For mixes without RAP, Arizona Test Method 815. For mixes with RAP, Arizona Test Method 833.		

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target value changes shall be made in writing and acknowledged by the Engineer prior to start of production. Self-directed target changes shall meet contract requirements for mix design criteria and grading limits.

MEASURED CHARACTERISTICS	ALLOWABLE SELF-DIRECTED TARGET VALUE CHANGES
Gradation (sieve size):	
3/8 inch	±4% from mix design target value
No. 8	±4% from mix design target value
No. 40	±2% from mix design target value
No. 200	±0.5% from mix design target value
Asphalt Cement Content	+0.2% from mix design target value
Effective Voids	None

The contractor may propose target value changes to the approved mix design for the Engineer's approval. The Engineer will determine if the proposed target value change will result in mix production that meets the contract requirements for mix design criteria and grading limits. For acceptance purposes, target value changes will not be retroactive.

In no case shall the approval of mix design changes relieve the contractor of the responsibility for the results obtained by the use of such approved changes.

409-2.05 Sampling and Testing:

Sampling and testing the materials and mixture for quality control purposes shall be the contractor's responsibility. The contractor shall perform sufficient testing to assure that mineral aggregate and asphaltic concrete are produced which meet all specified requirements.

For acceptance purposes, samples of the asphaltic concrete shall be taken by the contractor, under the observation of the Engineer, at random locations designated by the Engineer. A minimum of one sample shall be taken for each 500 tons of asphaltic concrete. Samples shall be taken in accordance with the requirements of the plate method in AASHTO R 97. The Engineer will immediately take custody of the samples. The material will be tested by the Engineer for the following properties:

Test Property	Test Method
Asphalt Cement Content	AASHTO T 308 (for both Non-RAP and RAP mixes) (See Note)
Gradation	
Marshall Density	AASHTO R 68
Maximum Theoretical Density	AASHTO T 209
Effective Voids	AASHTO T 269
Note: A new calibration of the ignition furnace shall be performed for each mix design, and at any other time the Engineer directs.	

409-3 Construction Requirements:

409-3.01 General:

All courses of asphaltic concrete shall be compacted as required, smooth and true to the required lines, grades, and dimensions.

The asphaltic concrete hot plant shall conform to the requirements of Section 403 of the specifications.

The moisture content of the asphaltic concrete immediately behind the paver shall not exceed 0.5 percent. The moisture content will be determined in accordance with the requirements of AASHTO T 329.

Asphaltic concrete shall be placed only when the temperature of the surface on which the asphaltic concrete is to be placed is at least 65 degrees F.

At any time, the Engineer may require that the work cease or that the work day be reduced in the event that weather conditions, either existing or expected, are anticipated to have an adverse effect upon the asphaltic concrete.

All wheels and tires of compactors shall be wetted with water, or if necessary soapy water, or a release agent in order to prevent the sticking of asphaltic concrete. All other equipment surfaces shall be treated when necessary with a release agent. Only release agents evaluated through AASHTO Product Evaluation & Audit Solutions (formerly NTPEP) are acceptable for use. The results from AASHTO Product Evaluation & Audit Solutions (formerly NTPEP) testing, when tested in accordance with AASHTO T 383, shall conform to the requirements shown in the table below:

RELEASE AGENT TEST	REQUIREMENT
Asphalt Stripping Test	
Diluted	No Stripping
Non-Diluted (Full Strength)	No Stripping
Asphalt Performance Test	Less than or equal to 10.0% after the third cycle

Release agents which degrade, dissolve, or in any way damage the bituminous material shall not be used. Diesel fuel shall not be used as a release agent.

Asphaltic concrete immediately behind the laydown machine shall be in a thoroughly mixed, free-flowing, and workable condition, be free of lumps and crusts, and have a minimum temperature of 275 degrees F.

All courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the Engineer deems the use of self-propelled paving machines impractical.

The speed of the paving machine shall be coordinated with the production of the plant and an adequate number of trucks for hauling asphaltic concrete shall be available in order to achieve, as far as practical, a continuous operation.

Self-propelled paving machines shall spread the mixture within the specified tolerances, without segregation or tearing, true to the line, grade, and crown indicated on the project plans. Pavers shall be equipped with hoppers and augers which will distribute the mixture uniformly in front of adjustable screeds.

Pavers shall be equipped with a screed for the full width being paved, heated if necessary, and capable of spreading and finishing all courses of asphaltic concrete.

Pavers shall be equipped with automatic screed controls with sensors for either or both sides of the paver, capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing the automatic signals which operate the screed to maintain the desired grade and transverse slope.

Failure of the control system to function properly shall be cause for the suspension of the placing of asphaltic concrete.

The base or subgrade upon which asphaltic concrete is to be placed shall be prepared and maintained in a firm condition until asphaltic concrete is placed. It shall not be frozen or excessively wet.

Before asphaltic concrete is placed, the surface to be paved shall be cleaned of all objectionable material and tacked with bituminous material in accordance with the requirements of Section 404 of the specifications.

Longitudinal joints of each course shall be staggered a minimum of 1 foot with relation to the longitudinal joint of any immediate underlying course. Longitudinal joints shall be located within 1 foot of the center of a lane or within 1 foot of the centerline between two adjacent lanes.

The contractor shall schedule its paving operations to minimize exposed longitudinal edges. Unless otherwise approved by the Engineer, the contractor shall limit the placement of asphaltic concrete courses, in advance of adjacent courses, to one shift of asphaltic concrete production. The contractor shall schedule its paving operations in such a manner to eliminate exposed longitudinal edges over weekends or holidays.

409-3.02 Compaction:

Compaction shall consist of an established sequence of coverage using specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used and the number of coverages required shall be as follows:

Rolling Sequence	Type of Compactor		No. of Coverages	
	Option No. 1	Option No. 2	Option No. 1	Option No. 2
Initial	Static Steel	Vibrating Steel	1	1
Intermediate	Pneumatic Tired	Vibrating Steel	2 - 6*	2 - 4*
Finish	Static Steel	Static Steel	1 - 3	1 - 3
Note: * Based on the roller pattern which exhibits the best performance.				

The Engineer shall select the option for compaction and, when pneumatic-tired compactors are used, will designate the tire pressure.

Steel wheel compactors shall not be used in the vibratory mode for courses of 1 inch or less in nominal thickness nor when the temperature of the asphaltic concrete falls below 180 degrees F. Steel wheel compactors shall weigh not less than 8 tons.

Initial and intermediate compaction shall be completed before the temperature of the asphaltic concrete falls below 200 degrees F. All edges shall be rolled with a pneumatic tired compactor, or other methods approved by the Engineer, while the mixture is still hot.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified and with the number of coverages of the compactors as specified.

409-3.03 Acceptance:

Asphaltic concrete will be accepted complete in place unless the result of any test varies from the contractor's mix design target value (TV) as follows:

Test Property	Allowable Variation from Target Value	
Gradation (Sieve sizes)		
3/8 inch	TV –10.0	TV + 10.0
No. 8	TV – 8.0	TV + 8.0
No. 40	TV – 6.0	TV + 6.0
No. 200	TV – 2.5	TV + 2.5
Asphalt Cement Content	TV – 0.60	TV + 0.70
Effective Voids	TV –2.5	TV + 2.0

Within 25 days after receiving notice of any failing test result(s), the contractor may submit a written proposal to accept the material represented by the failing test result(s), in place, at a reduction in cost. If the failing test result(s) are only on Asphalt Cement Content and/or Effective Voids, the reduction in cost will be $5.00 per ton. If the failing test result(s) are only on Gradation, the reduction in cost will be $3.00 per ton. If the failing test result(s) are on Asphalt Cement Content and/or Effective Voids, and also on Gradation, the reduction in cost will be $5.00 per ton. The proposal shall contain an engineering analysis of the anticipated performance (i.e. reduction in serviceability, in years) of the asphaltic concrete if left in place. The engineering analysis shall also detail the potential root cause of the problem, any proposed corrective action, and the anticipated effect of such corrective action on the performance. The engineering analysis shall only include acceptance or referee test results, as applicable to the standard specifications. The engineering analysis shall include the expected additional cost to the Department (over original performance life) to maintain the pavement at an acceptable condition. The engineering analysis shall include supporting information such as pictures of the area, control charts, plant and field records, etc. The engineering analysis shall be performed by an independent professional engineer, who is not an employee of the contractor or materials supplier, experienced in asphaltic concrete testing and the development of asphaltic concrete mix designs.

Within three working days, the Engineer will determine whether or not to accept the contractor's proposal. If the proposal is accepted, the asphaltic concrete shall remain in place, at a reduction in cost per ton, as described above, and any necessary corrective action shall be performed at no additional cost to the Department. If the proposal is not accepted, the asphaltic concrete shall be removed at no additional cost to the Department and replaced with asphaltic concrete meeting the requirements of these specifications.

The contractor may request that a sample with a failing test result(s) on gradation and/or asphalt cement content be allowed to remain in place without the completion of an engineering analysis if the application of a self-directed target value change as outlined in section 409-2.04 would have brought the failing test result(s) to within the specified tolerances. This proposal must be made to the Engineer in writing with justification. Once accepted, the material will be allowed to remain in place at the maximum negative pay factor(s). Maximum negative are defined as a minus $3.00 per ton for mixture properties lots in reject for Gradation only, minus $5.00 per ton for mixture properties lots in reject for Asphalt Cement Content and/or Effective Voids only, and minus $5.00 per ton for mixture properties lots in reject for Asphalt Cement Content and/or Effective Voids and also Gradation.

If the asphaltic concrete, represented by failing test results, is used as temporary pavement which will be removed prior to, or after, the completion of construction, the Engineer reserves the right to waive the engineering analysis and accept the material in place, at a cost reduction described above, provided the temporary pavement maintains the functionality of the intended use for the duration of the project.

409-4 Method of Measurement:

Asphaltic concrete will be measured by the ton for the mixture actually used, which will include the weight of mineral aggregate, bituminous material, and mineral admixture. Measurement will include any weight used in construction of intersections, turnouts, curbs, spillways and spillway inlets, ditches, catch basin entrances, median strips, sidewalks, or other miscellaneous items or surfaces.

409-5 Basis of Payment:

409-5.01 General:

The accepted quantities of asphaltic concrete, measured as provided above, will be paid for at the contract unit price per ton for the bituminous mixture complete in place.

No direct payment will be made for the bituminous material and mineral admixture in the asphaltic concrete, or the bituminous material for tack coat and application of tack coat, the price being considered as included in the price paid for asphaltic concrete.

Asphaltic concrete may be measured, by volume, upon the execution of a supplemental agreement which will specify the manner in which the volume is determined. The volume will include the volume of mineral aggregate, bituminous material, mineral admixture, and any necessary blending material.

409-5.02 Reduction for Noncompliance:

A reduction in payment to the contractor for asphaltic concrete will be made for asphalt cement (bituminous material) that do not meet the requirements of Section 1005 as determined by corresponding test results. Adjustments in payment will be made in accordance with the requirements of Table 1005-1.

(501QCDRN, 07/15/05)

SECTION 501 PIPE CULVERT AND STORM DRAINS:

501-3 Construction Requirements: of the Standard Specifications is modified to add:

501-3.01(A) Contractor Quality Control:

The contractor shall perform the quality control measures described in Subsection 106.04(C). At the weekly meeting, the contractor shall be prepared to explain and discuss how the following processes will be employed:

(a) Bedding and backfill production, including crusher methods, pit extraction, and washing.

(b) Stockpile management, including stacking methods, separation techniques, stockpile pad thickness, and segregation prevention.

(c) Transporting and placing, including transport technique, lift thickness, processing and mixing technique, and compaction methods.

The contractor shall obtain samples and perform the tests specified in the following table:

CONTRACTOR QUALITY CONTROL TESTING REQUIREMENTS			
TYPE OF TEST	TEST METHOD	SAMPLING POINT	MINIMUM TESTING FREQUENCY
Backfill Material			
Gradation	ARIZ 201	***Stockpile***	1 per 500 CY per Source
PI	AASHTO T 89 AASHTO T 90		
Proctor Density	ARIZ 225 ARIZ 226 **ARIZ 245**	Stockpile	1 per Source and as needed
Field Density	ARIZ 227 ARIZ 230 **ARIZ 232** ARIZ 235 **ARIZ 246**	In-place	1 per 200 CY, minimum 1 per lift
Bedding Material			
Gradation	ARIZ 201	***Stockpile***	1 per 300 CY per Source
PI	AASHTO T 89 AASHTO T 90		
Proctor Density	ARIZ 225 ARIZ 226 **ARIZ 245**	Stockpile	1 per Source and as needed

Field Density	ARIZ 227 ARIZ 230 **ARIZ 232** ARIZ 235 **ARIZ 246**	In-place	1 per 50 CY

(501PIPE, 01/20/22)

SECTION 501 PIPE CULVERTS AND STORM DRAINS:

501-3.02(A)(1) GENERAL: the last paragraph of the Standard Specifications is revised to read:

Bedding material for all metal pipe shall have a value of resistivity not less than 2,000 ohm-centimeters unless otherwise specified or approved by the Engineer. Bedding material shall have a pH value between 6.0 and 10.0, inclusive, for all metal pipe installations except aluminum. Bedding material for aluminum pipe installations shall have a pH value between 6.0 and 9.0, inclusive. Bedding material shall have a pH value between 6.0 and 12.0, inclusive, for all concrete or plastic pipe installations. Tests for pH and resistivity shall be in accordance with the requirements of Arizona Test Method 236.

(601PCC, 09/21/23)

SECTION 601 CONCRETE STRUCTURES:

601-3.03(C) Pumping Concrete: of the Standard Specifications is revised to read:

Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be of suitable type and shall have adequate capacity for the work. The concrete shall not flow either over or through any piping, fittings or equipment which is fabricated of aluminum or aluminum alloys. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. Excessive segregation due to high velocity discharge of the concrete will not be permitted. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there is no contamination of the concrete or segregation of the ingredients. Standby equipment shall be readily available to replace initial pumping equipment should breakdown occur.

ITEM 6060301 RELOCATE EXISTING BRIDGE SIGN STRUCTURE

Description:

The work under this item shall include the furnishing of all materials, personnel, and equipment necessary to relocate the existing bridge sign structure as shown on the project plans.

Construction Requirements:

The contractor shall relocate the existing bridge sign structure from its existing location to the two new foundations installed with the project as specified in the project plans and to the satisfaction of the Engineer. For removing the existing sign from its current location and installing the removed signs in its new locations, the contractor shall provide all equipment and accessories necessary such as bolts, nuts, washers and clamps used to maintain the integrity of the sign structure.

The contractor shall survey the existing sign structure to confirm its size and also survey and stake the new foundation location and elevations. The contractor shall obtain the approval of the Engineer before pouring the new bridge sign structure foundations which will ultimately hold the relocated bridge sign structure.

After removal, the existing bridge sign structure foundations shall become the property of the contractor and shall be removed and disposed of by the contractor.

Method of Measurement:

Relocate Existing Bridge Sign Structure will be measured as a lump sum, for all bridge sign structures relocated.

Basis of Payment:

The accepted quantities of Relocate Existing Bridge Sign Structure, measured as provided above, will be paid for at the contract lump sum price which price shall be full compensation for the work, complete in place, including furnishing all fastening hardware, all necessary sign supports, stringers and post ties.

The new foundations upon which the removed sign structure will be installed on will be paid for under its respective item.

(608 PANEL, 06/19/25)

SECTION 608 SIGN PANELS:

608-1 Description: of the Standard Specifications is revised to read:

The work under this section shall consist of furnishing and installing sign panels in accordance with the details shown on the plans and the requirements set forth herein.

The sign panels shall be of the following types:

(A) Extruded Aluminum Sign Panels with Direct-Applied, or Demountable Characters;

(B) Flat Sheet Aluminum Sign Panels with Direct-Applied, Electronic-Cut, or Screen-Printed Characters;

(C) Warning, Marker, and Regulatory Sign Panels;

(D) Route Shields for Installation on Sign Panels; and/or

(E) EXIT ONLY Panels for Installation on Sign Panels.

608-2.02 Extruded Aluminum Sign Panels with Direct-Applied, Digitally-Imaged, or Demountable Characters: the title and the third paragraph of the Standard Specifications are revised to read:

608-2.02 Extruded Aluminum Sign Panels with Direct-Applied or Demountable Characters:

The letters, numerals, symbols, borders and other features of the sign message shall be direct-applied, or demountable, and shall conform to the requirements of Subsection 608-2.08 or Subsection 608-2.09 of the specifications.

608-2.03 Flat Sheet Aluminum Sign Panels with Direct-Applied, Digitally Imaged, Electric-Cut or Screen-Printed Characters: the title and the fifth paragraph of the Standard Specifications are revised to read:

608-2.03 Flat Sheet Aluminum Sign Panels with Direct-Applied, Electronic-Cut, or Screen-Printed Characters:

Messages shall be reflectorized white or, if called for on the plans, opaque black, and shall be produced by either screen printing, direct-applying, or electronic cutting, as specified under Subsections 608-2.09 of the specifications.

608-2.05 Route Shields (For Installation on Sign Panels): The first paragraph of the Standard Specifications is revised to read:

Route shields may be demountable or direct-applied.

608-2.06 EXIT ONLY Panels (For Installation on Sign Panels): the first paragraph of the Standard Specifications is revised to read:

EXIT ONLY panels may be demountable or direct-applied. Demountable EXIT ONLY panels shall be attached to the sign panel with self-plugging aluminum blind rivets.

608-2.10 Digitally-Imaged Characters: the title and the text of the Standard Specifications are revised to read:

608-2.10 Digital Printing of Signs:

Digital printing of signs shall utilize a matched component system, including appropriate software and drivers in accordance with an APL certified retroreflective sheeting manufacturer’s warranty requirements. Finished signs shall consist of a UV-protective clear

overlay applied to the entire face of the sign. Any overlays shall also be compatible with the retroreflective sheeting manufacturer's matched component system and warranty. Digitally printed signs shall conform to the requirements of ASTM D4956 for daytime and nighttime requirements, as well as the requirements of the Department's Traffic Engineering Guidelines and Processes (TGP) 380 and Section 1007 of the specifications.

ITEM 6080105 RELOCATE SIGNS:

Description:

The work under this item shall include the furnishing of all materials, personnel, and equipment necessary to relocate an existing sign panel as shown on the project plans or as directed by the Engineer.

Construction Requirements:

The contractor shall remove the sign panels designated for relocation as shown on the plans in accordance with the requirements of Section 202 of the specifications.

After removal, the existing signposts and the foundations shall become the responsibility of the contractor and shall be disposed of site.

The removed signs shall then be installed on the newly installed sign posts and foundations at the location shown on the plans following the same orientation along the roadway so that the entire legend of the signs appear uniform under normal viewing conditions, both day and night.

The heads of bolts on the panel face shall be anodized or painted to match the background or legend color in which they are placed. The nylon washers on the panel face shall be the color of, or shall be painted to match, the background or legend color in which they are placed. Bolts shall be tightened from the back by holding the bolt head stationary on the face of the panel. Twisting of the bolt head on the panel face will not be allowed.

Method of Measurement:

Relocate Signs will be measured as a lump sum, for the sign panel relocated from an existing signpost to a new signpost.

Basis of Payment:

The accepted quantities of Relocate Signs, measured as provided above, will be paid for at the contract lump sum price which price shall be full compensation for the work, complete in place, including all fastening hardware, all necessary sign supports, stringers and post ties.

(609DRSFD, 09/19/24)

SECTION 609 DRILLED SHAFT FOUNDATIONS: of the Standard Specifications is revised to read:

609-1 Description:

609-1.01 General:

The work under this section shall include furnishing all materials and constructing reinforced concrete shafts formed within a drilled excavation. Each drilled shaft foundation shall consist of a shaft section with or without casing left in place, with or without a rock socket or a belled footing. The drilled shaft foundation shall be constructed in accordance with the details and dimensions shown on the plans, and the requirements specified herein.

609-1.02 Certification:

The contractor shall be responsible to review all available geotechnical investigation reports, and its signature on the proposal form shall certify that the firm performing the drilled shaft operations, whether the prime contractor or a subcontractor, has completed this review. The geotechnical investigation reports are available on the ADOT Contracts and Specifications Group website, under Current Advertisements.

609-1.03 Installation Plan:

The contractor shall provide to the Engineer for review and approval a detailed installation plan containing the following information:

(A) List of proposed equipment to be used including cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, sampling equipment, tremies or concrete pumps, casing, etc.

(B) Details of overall construction operation sequence and the sequence of shaft construction in bents or groups.

(C) Details of shaft excavation methods, including equipment and procedures for checking the dimensions and alignment of each shaft excavation.

(D) When slurry is selected for borehole stabilization, the contractor shall submit Safety Data Sheets, quality control procedures, and disposal details.

(E) Details of methods to clean the shaft excavation.

(F) Details of reinforcement placement, including support and centralization methods, lifting equipment, and staging location for tied steel reinforcement cages prior to placement.

(G) Details of concrete mix designs and mitigation of possible loss of slump during placement, including slump loss test results in accordance with the requirements shown in Appendix D.

(H) Details of concrete placement, including concrete volumetric charts, and the elapsed time for slump loss (as defined in Subsection 609-3.07(A) and determined by the slump loss test). The concrete placement duration (as defined in Subsection 609-3.07(A)) shall be submitted for each drilled shaft diameter.

(I) Details of casing dimensions, material and splice details.

(J) List of work experience in previous similar projects.

(K) Other information shown on the plans or as requested by the Engineer.

(L) Emergency horizontal construction joint method if unforeseen stoppage of work or interruption in concrete delivery occurs.

(M) Details of any special access or setup requirements needed to position the drill equipment to advance excavations.

The contractor's installation plan shall be developed with input from subcontractors, material suppliers, and all others with drilled shaft responsibility. The installation plan shall also identify which portion of the drill shaft construction the contractor and each of the subcontractors will be performing. The documentation required above shall be submitted to the Engineer at least four weeks before work on shafts is to begin. The Engineer will review the initial submittal within 10 working days, and subsequent submittals, as necessary, within five working days. A drilled shaft preconstruction meeting will be scheduled following the final approval of the installation plan and prior to commencement of drilling activity. All parties named in the installation plan shall be represented at the preconstruction meeting. No drilled shaft work shall be performed until the contractor's final submittal has been approved by the Engineer and the preconstruction meeting concluded. Such approval will not relieve the contractor of responsibility for results obtained by use of the installation plan, or any of its other responsibilities under the contract. The contractor shall be responsible to submit a modified installation plan each time a change is made to facilitate construction.

Unless otherwise specified in the Special Provisions, foundations of 4 feet or less in diameter and 30 feet or less in length utilized in light pole and sign post foundations shall be exempt from the requirement to perform integrity testing.

609-2 Materials:

609-2.01 Concrete:

Concrete shall conform to the requirements of Section 1006 of the specifications, with the following additions or modifications:

(A) Cement:

Where concrete is placed in drilled shaft excavations containing slurry or water, the cementitious material content of the concrete shall be between 660 and 750 pounds per cubic yard.

(B) Aggregate:

Maximum nominal aggregate size shall be limited to 1/5 of minimum clear bar spacing (vertical and horizontal), not to exceed 3/4 inch nominal for drilled shafts constructed with a wet method or with temporary casing (excluding collar-only casings), and 1 inch nominal for drilled shafts constructed with a dry method.

(C) Air-Entraining Admixtures:

Air entrainment requirements detailed in Section 1006 shall be utilized in drilled shaft foundations.

(D) Slump:

Unless otherwise specified, or as directed by the Engineer, the concrete slump for the concrete placement duration (as defined in Subsection 609-3.07(A)) shall be 4 to 7 inches for dry, uncased excavations and 7 to 10 inches for all other excavations.

The proposed concrete mix designs may use various admixtures to delay the concrete's initial set time and/or to reduce slump loss.

609-2.02 Reinforcing Steel:

Reinforcing steel shall conform to the requirements of Section 1003. Welded splices will not be allowed except as shown on the plans.

609-2.03 Casing:

Casing shall be steel and may be of unit or sectional construction. The casing shall be of sufficient strength to withstand handling and driving stresses, to withstand the pressure of concrete and the surrounding earth and to prevent seepage of water. Steel shall conform to the requirements of AASHTO M270 (ASTM A709), Grade A36, unless otherwise specified.

Should telescoped casing be used, the contractor shall not allow concrete to overfill any interior casing. Spillage must be removed from the annulus, or the shaft shall be declared deficient.

Temporary casing shall be clean, inside and out, prior to placement in the excavation. All casing shall be handled so as to limit distortion to within 2 percent of the diameter. No side shear capacity will be allowed where temporary casing installed becomes permanent. If approved by the Engineer and if conditions permit, temporary casings may be corrugated and non-watertight.

The contractor shall be responsible to compensate for loss of frictional capacity in the cased zone if temporary casing is abandoned in the shaft. Such modifications shall be approved by the Engineer, and shall be at no additional cost to the Department.

609-3 Construction Requirements:

609-3.01 General:

The methods and equipment used shall be appropriate for the intended purpose and materials encountered. The allowable methods are the dry method, wet method, temporary casing method, or permanent casing method, as defined by the 2017 LRFD Bridge Construction Specifications 4th Edition, Section 5. The most suitable of the listed methods for the conditions recorded in the geotechnical investigation report, or a combination of these methods, shall be used, subject to approval of the Engineer, to produce sound and durable concrete drilled shaft foundations. The permanent casing method shall be used only when required by the plans or authorized by the Engineer.

If at any time during the construction of the drilled shafts the Engineer determines that the equipment, materials, employees, or procedures are such that defects in the work may occur, the Engineer may stop the work until appropriate changes are made by the contractor. In no case shall the contractor be relieved of its responsibility for constructing acceptable drilled shaft foundations.

609-3.02 Confirmation Shafts:

Unless otherwise specified in the Special Provisions, the contractor shall construct a confirmation shaft to determine the adequacy of the contractor's equipment, materials, employees, and procedures for completion of the drilled shaft foundations in accordance with the requirements of the plans, specifications, and installation plan. Confirmation shafts may also be waived if approved in writing by the Engineer.

Unless otherwise approved by the Engineer, the confirmation shaft shall be the first drilled shaft foundation to be developed. The Engineer will specify the location of the confirmation shaft, unless shown on the plans. The confirmation shaft holes shall be completed in the same manner as other production shafts. The contractor shall revise its methods and equipment as necessary at any time during the construction of the confirmation shaft hole to satisfactorily complete the excavation. When the contractor fails to satisfactorily demonstrate the adequacy of its methods, procedures, or equipment; or when unforeseen conditions require revision, such as the need for slurry; the installation plan shall be revised and the adjacent shaft shall be designated as the confirmation shaft for the revised installation plan, as approved by the Engineer.

When shown on the plans or when directed by the Engineer in writing, the reaming of bells or development of rock sockets at specified confirmation shaft holes shall be required to establish feasibility in specific soil strata.

609-3.03 Excavation:

The contractor shall perform all excavation required for the shafts, rock sockets, or belled footings, through any material encountered, to the dimensions and elevations shown on the plans or as directed by the Engineer. Unless otherwise shown on the plans, the maximum deviation from plumb shall be not more than 1.5 percent. The maximum permissible variation of the design center axis for both the borehole and rebar cage at the top shall be 5 percent of the shaft diameter, not to exceed 3 inches from its project plan location. The contractor shall determine plumbness by plumb lines in dry excavations and by Kelly bar position readings at 10-foot intervals in wet excavations, or as approved by the Engineer. The contractor shall provide the Engineer with the plumbness readings for each borehole to verify the plumbness requirements prior to concrete placement in the borehole. When bells or rock sockets are required, they shall be excavated so as to form a bearing area of the size and shape shown on the plans.

If suitable material is not encountered at the design tip elevation shown on the plans, the bottom of any excavated hole shall be lowered, at the direction of the Engineer. When the contractor is directed by the Engineer to excavate past the design tip elevation, the contractor shall be compensated for any additional excavation in accordance with the requirements of Subsection 109.04 of the specifications. The limits of additional excavation will be determined by the Engineer.

When the contractor accidentally excavates beyond the design tip elevation, the criteria are as follows:

(A) If suitable material was encountered due to over excavation, the contractor shall not be compensated for the additional excavation.

(B) If unsuitable material was encountered due to over excavation, the Engineer will direct the contractor to excavate past the unsuitable material; the contractor shall be compensated for the additional excavation in accordance with the requirements of Subsection 109.04 of the specifications.

The reinforcing steel cage and concrete shall not be placed in the shaft until the final excavated hole elevation has been established and the Engineer has approved the completed excavation. Modifications to the reinforcing steel cage shall be in accordance with the requirements of Subsection 609-3.06 of the specifications.

If caving conditions are encountered, no further drilling will be allowed until a construction method is employed that will prevent excessive caving and which is acceptable to the Engineer. If casing is proposed, the shell shall be clean and shall extend to the top of the drilled shaft excavation. The inside diameter of the casing shall not be less than the specified size of the shaft unless approved by the Engineer. The outside diameter of the shaft shall not exceed plan dimension by more than 6 inches unless use of telescoping casing or surface casing is allowed by the installation plan.

Adjacent shafts, unless separated by a minimum of four shaft diameters measured center to center, shall not be excavated until the concrete in the first shaft has been in place for a minimum of 48 hours.

Temporary surface casings may be used to aid shaft alignment and position, and to prevent sloughing of the top of the shaft excavation, if approved by the Engineer. Where temporary casing is used to stabilize excavations that include rock sockets, the temporary casing shall be 6 to 12 inches larger than the rock socket diameter and centered on the rock socket.

If the Engineer determines that the amount of caving is within acceptable limits and the contractor elects to drill under the same methods and procedures, the excavation shall be filled with concrete at no additional cost to the Department, regardless of the extent. Any excavation beyond the dimensions shown on the plans where casings are not used shall be filled with concrete at no additional cost to the Department.

If the use of drilling slurry is to be employed, either with or without the use of casing, the contractor shall use a method of construction which will allow completion of the drilled shaft in a continuous manner without any mixing of concrete and drilling slurry.

Material excavated from shafts and bells and not incorporated elsewhere on the project shall be disposed of by the contractor.

When the plans indicate drilled shafts are to be constructed within embankments, the embankments shall be constructed prior to drilling, except when approved otherwise by the Engineer.

After the completion of the drilled shaft excavation and prior to the placement of the reinforcing steel cage and concrete, all loose material shall be machine cleaned from the shaft. A flight auger or other equipment, as approved by the Engineer, shall be used for cleaning dry excavations where slurry or ground water is not present. Where slurry or ground water is present, the excavation shall be cleaned with a clean-out bucket or similar type of equipment, as approved by the Engineer.

After final removal of all loose material from the bottom of the excavated drill shaft hole, and prior to any concrete placement, the final shaft depths shall be measured with a weighted tape or other methods approved by the Engineer.

For all drilled shaft excavations in soils, the maximum depth of any sediment, loose, and/or disturbed material at any location at the base of the excavated hole shall not exceed 2 inches.

For wet or dry drilled shaft excavations in rock, the maximum depth of any sediment, loose and/or disturbed material at any location at the base of the excavated hole shall not exceed 1/2 inch for 50 percent of the excavated hole base area.

All open excavations shall be covered at the end of each shift in a manner approved by the Engineer.

609-3.04 Drilling Slurry:

(A) General Requirements:

The contractor is responsible to select, formulate, and implement the use of slurry to facilitate drilled shaft construction. Quality control procedures of the slurry implementation shall be detailed in the contractor's submitted installation plan. Only commercially prepared mineral slurries or polymer slurries shall be employed when slurry is used in the drilling process. Mineral slurry shall have both a mineral grain size that will remain in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. For all slurries the percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement. During construction, the level of the slurry in the shaft excavation shall be maintained at a level of 5 feet or more above the highest expected piezometric pressure head along the depth of the shaft. Unless otherwise approved in advance by the Engineer, slurry shall be injected into the excavation immediately upon encountering ground water. No further excavation shall be completed until slurry has been introduced into the shaft. In the event of a sudden significant loss of slurry to the hole, the construction of that foundation shall be stopped until either a method to stop slurry loss or an alternative construction procedure has been approved by the Engineer.

The slurry shall be premixed thoroughly with clean, fresh water. Adequate time, as prescribed by the slurry manufacturer, shall be allotted for hydration prior to introduction into the shaft excavation. Slurry tanks of adequate capacity shall be required for slurry circulation, storage, and treatment. No excavated slurry pits shall be allowed instead of slurry tanks. No mixing of slurry shall be allowed in the drilled shaft excavation. Mineral slurry shall not stand for more than four hours in the excavation without agitation. If this is not possible, excavation sidewalls shall be cleaned to remove filter cake. Mineral slurry density shall be increased by adding barite only when sodium bentonite is the mineral.

Desanding equipment shall be provided by the contractor as necessary to control mineral slurry sand content. Desanding will not be required for setting casing. The contractor shall take all steps necessary to prevent the slurry from "setting up" in the shaft. Such methods may include agitation, circulation and/or adjusting the properties of the slurry. The contractor shall dispose of all mineral slurry off site at an approved disposal site.

(B) Slurry Inspection and Testing:

Quality control procedures for utilization of slurry shall be detailed in the contractor's submitted installation plan. The contractor shall have suitable apparatus available at the site capable of obtaining slurry samples at any depth within the drilled shaft excavation.

609-3.05 Integrity Testing:

(A) General:

Each drilled shaft foundation completed, unless otherwise noted on the project plans, shall be inspected by means of a cross-hole sonic logging (CSL) survey and a gamma-gamma logging (GGL) survey. The drilled shaft contractor shall furnish and install 2-inch (inside

diameter) Schedule 80 PVC pipes for the surveys. The minimum number of PVC-pipe inspection tubes shall be equal to the diameter of the drilled shaft, measured in feet, and rounded-up to the next whole integer, but not less than four, or as specified in the plans. The inspection tubes shall be approximately evenly spaced around the inside circumference of the reinforcing steel cage, or as shown on the project plans. To account for any reinforcing cage stabilizing bars installed by the contractor, the maximum clearance from the reinforcing cage's stirrups to the test tube shall be no more than the size of the vertical reinforcement plus 1 inch. The pipes shall be joined to provide a clean, watertight, and unobstructed opening as specified in Subsection 609-3.05(B) of the specifications. If any damage to the tubes occurs during the installation they shall be repaired or replaced at no additional cost to the Department. If testing cannot be performed because of blockage of the tubes, the contractor shall core drill or otherwise determine the extent of any potential anomalies in the concrete, as approved by the Engineer, at no additional cost to the Department.

CSL and GGL testing shall be performed by a qualified subcontractor selected by the contractor and approved by the Engineer. The subcontractor shall provide the equipment meeting the minimum requirements listed herein, and shall have at least one year experience in CSL survey and GGL survey evaluation. The subcontractor performing the GGL shall provide proof that it is licensed to possess and use radioactive material in accordance with the Arizona Radiation Regulatory Agency. Recorded measurements shall be interpreted and the required reports shall be prepared and sealed by a licensed professional engineer, registered in the State of Arizona, with at least three years of experience in CSL survey and GGL survey evaluation. Resumes of proposed personnel shall be submitted to the Engineer for approval at least four weeks prior to commencement of work.

CSL tests shall be completed within two to four days after concrete placement and GGL tests shall be completed within two to seven days of concrete placement.

The CSL survey and the GGL survey requirements shall be as specified in Subsection 609-3.05(B) of the specifications. Inspection reports containing the acquired raw data, and evaluation reports, shall be provided as specified in Subsection 609-3.05(B) of the specifications. All reports shall be provided to the Engineer within three working days of test completion.

If the testing indicates the presence of anomalies, as defined herein, or the Engineer determines that construction defects may have occurred, the contractor shall conduct remedial testing and make repairs, as specified in Subsection 609-3.05(B)(6) of the specifications, at no additional cost to the Department.

Concrete volumetric charts shall be completed for each drilled shaft. A copy shall be delivered to the Engineer with the submittal of the inspection reports of the associated drilled shaft.

After the inspection of a shaft has been completed and the shaft accepted, all holes and test pipes in the shaft shall be filled with an approved grout.

(B) Testing Requirements:

(1) General:

The inspection tubes shall have a round, regular, internal diameter free of defects or obstructions, including at any pipe joints, in order to permit the free, unobstructed passage of source and receiver probes from top to bottom. The tubes shall be watertight and free from corrosion, with clean internal and external faces, to ensure passage of the probes and to ensure a good bond between the concrete and the tubes. Standard glue-on PVC couplings shall be used. No compression, rubber, or clamp fittings will be allowed. Care shall be taken during reinforcement installation operations to not damage the tubes or break the fasteners of the tubes. Before placement of concrete, pipes shall be checked to ensure they are free from blockages, bends, crimps or other impediments to the free passage of the testing probes.

Each pipe shall be fitted with a watertight shoe on the bottom and a removable cap on the top. The bottom cap of each tube shall be adequately secured such that it can withstand the hydrostatic pressure for the full depth of the shaft without water leakage. The pipes shall be securely attached to the reinforcement cage in a straight line, and in a regular, symmetrical pattern. The tubes shall be adequately secured to the reinforcing cage such that the tubes stay in position during placement of the rebar cage and concrete placement. At a minimum, the tubes shall be securely fastened to the inside of the reinforcing cage at least every 10 feet vertically. The tubes shall be as near to vertical and parallel as possible. The tubes shall extend from 1 inch above the bottom of the reinforcement cage to at least 4 feet above the shaft top, or approximately 2 feet above the top of the rebar cage if above the ground. Under no circumstance shall the tubes be allowed to rest on the bottom of the excavated hole. If the shaft top is below the ground surface, the tubes shall extend at least 2 feet above the ground surface. Joints shall not be allowed in the section(s) of tubes above ground. Any joints required to achieve full length tubes below ground shall be made watertight.

The tube tops shall be bare clean pipe with no pipe joints, level cut, and capped to keep debris out of the tubes. If the rebar cage extends above the top of the tubes, the circular or spiral tie-raps shall temporarily be cleared away from 1 foot below the tube top to approximately 3 feet above. After placement of the reinforcement cage, the tubes shall be filled with clean water as soon as possible, immediately before or within 1 hour after concrete placement. Care shall be exercised in the removal of caps or plugs from the pipes after installation so as to not apply excess torque, hammering, or other stresses which could break the bond between the tubes and the concrete.

Before the start of testing, the contractor shall:

(a) Run a 1.5 inch diameter 6 foot long rigid cylinder through the complete length of each access tube to check for tube blockage.

(b) Clean the top of the shaft. The shaft top shall serve as the reference zero depth for all cross-hole sonic and gamma-gamma testing. Therefore, the shaft top must be level and, if mud covered, be cleaned before testing.

(c) Provide proper access to the shafts so that the testing subcontractor can park their logging equipment within 2 to 3 feet of each access tube.

(d) Provide any special safety equipment required.

(e) Make sure the access tubes extend to at least 4 feet from the top of the concrete, and are capped and filled with water all the way to the top.

(f) Make sure each access tube is bare (no pipe joints), clean (grind edges and concrete residue), level cut, and capped.

(g) Provide an independent and stable source of 110 Volt, 1000-Watt power.

(h) Using a permanent pen marker, mark each access tube with the shaft designation and tube number. For example, Pier 2 Shaft 3 Tube 4 shall be denoted as P2S3 T4. By definition, Tube 1 is the northernmost tube, with other tubes referenced in a clockwise direction from Tube 1.

The contractor shall also provide documentation that the testing equipment has been calibrated and is functioning properly.

Changes from the design conditions such as: test tube lengths, shaft diameter and the as-drilled tip elevation shall be noted in the report.

(2) Requirements for CSL Tests:

The minimum equipment requirements for CSL shall be as follows:

(a) The ultrasonic source and receiver probes shall be capable of producing records with good signal amplitude and energy through uniform, good quality concrete. The probes shall be of a diameter and have cabling such that they descend freely through the 2 inch internal diameter Schedule 80 PVC pipe for the full depth of the shafts shown on the plans. Probes shall allow a generated or detected pulse within 6 inches of the bottom of the access tubes. The transmitter probe shall generate an ultrasonic pulse frequency not to exceed 40,000 Hz for drilled shafts 8 feet in diameter or less. For drilled shafts greater than 8 feet in diameter, the frequency to be used shall be determined by the manufacturer’s equipment calibration guidelines and shall be approved by the Engineer prior to testing. The weight of each probe shall in all cases be sufficient to allow it to sink under its own weight in the access tubes. The probe housing shall be waterproof to at least 1.5 times the maximum depth of the testing. The receiver probe shall be of a similar size and compatible design to the transmitter probe, and be used to detect the arrival of the ultrasonic pulse generated by the transmitter probe.

(b) The depth of the probes shall be recordable with a measurement wheel or other suitable measuring device.

(c) The CSL equipment shall include a microprocessor-based system for analog to digital conversion and recording of data, for display of individual records, and for analysis of receiver responses and printing of logs.

(d) The CSL system shall have an appropriate filter for amplification of data and cable systems.

(e) Synchronized triggering of the recording system with the ultrasonic pulse shall be a feature of the CSL system.

(f) The system shall be able to indicate zero depth at the shaft top and not at the bottom of access tubes. In addition, the system shall be able to log both from the top of the shaft to the bottom as well as from the bottom to the top.

(3) Testing Procedure Requirements for CSL Tests:

The minimum testing procedure requirements for CSL logging shall be as follows:

(a) Preparation of the tubes for CSL Tests:

All inspection tubes shall be filled with water prior to testing. During testing, the water level in any tube shall not drop below the top of the tube that is being tested.

(b) CSL Procedure:

Information on the shaft bottom and top elevations, tube lengths and position, along with construction dates, shall be provided by the contractor to the CSL logging subcontractor prior to the logging being performed.

All possible tube pairs shall be tested. The tests shall be carried out with the source and receiver probes in the same horizontal plane unless test results indicate potential defects, in which case the questionable zone shall be further evaluated with angled tests (source and receiver vertically offset in the tubes).

The electronic circuit shall be thoroughly checked. The choice of time base will be such that the “zero signal” and first arrival time are 2 to 3 divisions apart on the horizontal axis. Amplitude shall be such that the signal fills 2/3 to 3/4 of the screen vertically.

Once the slack is taken up out of the cables to provide accurate depth measurements of the logs, the probes shall be pulled simultaneously and uniformly from the bottom of the tubes over the depth wheel or other measuring device. All slack shall be taken out of the cables before the analyzer is switched on. The rate of ascent shall be the rate recommended by the equipment manufacturer. The cross-hole sonic measurements shall be taken at 2-inch intervals or less from the bottom to top of shaft.

(c) Anomaly Identification:

Anomalies in a drilled shaft shall be determined by evaluating the pulse arrival times and amplitude/energy signals. Zones where the measured sonic velocity reduction is 10 percent

greater than the local mean measured sonic velocity within a 5-foot interval above and below the suspected anomalous zone shall be reported to the Engineer. In situations where a 5-foot interval is not available above and/or below the suspected anomalous zone, the local mean sonic velocity shall be measured to the top of the shaft or the bottom of the inspection tubes. Further investigations to evaluate the extent of such anomalies may be required by the Engineer, and shall be in accordance with the requirements specified in Subsection 609-3.05(C) of the specifications.

(d) CSL Results:

A report showing the results of the completed CSL survey shall be submitted to the Engineer for each drilled shaft foundation within three working days of completion of testing. The Engineer will review the report within three working days of the contractor's submittal. The report shall include:

(i) Dates of shaft construction; shaft diameters; shaft lengths; shaft tip elevations; shaft cutoff elevations; type and size of drilling equipment; type of slurry if used; description of concrete mix; concrete placement method; shaft layout with shaft numbers.

(ii) Dates of logging; brief description of the testing equipment; identification of shaft logged; location of obstructions in PVC tubes; location of PVC couplers; calibration date, data and plot; summary of any unusual occurrences during testing; description and explanation of adjustments made to instrumentation or data (if any); identification of anomalies using the criteria described herein; delineation of affected tubes; vertical location and extent of anomalies; and estimated percentage of anomalous cross-sectional area.

(iii) The cross-hole sonic logs expressing the results in terms of velocity and pulse amplitude/energy versus depth. The cross-hole sonic logs shall be presented for each tube pair with all anomalous zones indicated on the logs.

(iv) Analyses of the initial pulse arrival time versus depth, velocity versus depth, and pulse amplitude/energy versus depth.

(v) Appropriate discussion of the results in the text of the report shall be included.

(vi) Tomography of anomalous zones.

(4) Requirements for GGL Tests:

The minimum equipment requirements for GGL shall be as follows:

(a) The gamma-gamma probe shall consist of a rigid cylinder containing a gamma particle emitting source and a gamma particle detector. The probe

shall be suspended by a cable of sufficient design and length that it is safely capable of raising and lowering the gamma-gamma probe within a 2-inch internal diameter Schedule 80 PVC inspection pipe to the desired test depths.

(b) The cables affixed to the probe shall be of sufficient strength and durability to raise and lower the probe safely and at a controlled rate of speed. A winch mechanism shall be such that it does not damage the cables or compromise data collected in the test. A means of determining and recording probe depth shall be provided.

(c) The gamma particle emitting source shall be Cesium-137 in a sealed source form.

(d) The gamma-gamma probe detector shall consist of a proven method of gamma detection, such as Geiger Mueller or scintillation-based counters.

(e) The detector shall be connected to a readout device that is capable of displaying or recording counts, densities, and sampling duration or probe speed.

(f) The gamma-gamma probe shall possess a minimum density precision of 1.0 pounds per cubic foot.

(g) The gamma-gamma probe shall have a minimum radius of detection of 4.0 inches in concrete with density between 140 and 160 pounds per cubic foot. The probe shall have the capability of varying the radius of detection up to 7 inches in concrete with density between 140 and 160 pounds per cubic foot. The radius of detection is defined as one half of the center to center distance between the source and the detector. The actual radius of detection used in the test shall be subject to the approval by the Engineer.

(h) Prior to using GGL, the contractor shall provide the Engineer with the calibration of the gamma-gamma probe and readout unit to correlate count rate and concrete density. The calibration shall not be more than one year old, and shall be performed using the same source and detector combination as that proposed for the GGL testing on the project. Furthermore, the calibration shall have been conducted in an environment (e.g., water-filled, Schedule 80 PVC pipes) similar to the shafts being tested for the project. GGL shall not be performed until the Engineer has approved the calibration records. Upon approval, the contractor shall perform the gamma-gamma tests exactly in the manner as the calibration of the probe and readout unit was performed.

(5) Testing Procedure Requirements for GGL Tests:

The minimum testing procedure requirements for GGL shall be as follows:

(a) Preparation of GGL Access Tubes:

A GGL survey may be performed by an experienced subcontractor using inspection tubes completely filled with water only if the gamma-gamma probe has been calibrated in concrete calibration samples that contained inspection tubes filled with water, and the radius of detection and density precision calibration have been performed under water and found to be within the prescribed limits. In the event of gamma-gamma testing in water filled tubes, the water level during testing in any tube shall not drop below the top of the tube.

(b) GGL Procedure:

Information on the shaft bottom and top elevations, tube lengths and position, along with construction dates shall be provided by the contractor to the GGL subcontractor prior to the logging being performed.

The test shall be started by lowering the probe to the bottom of the access tube. When extracting the probe, the readings shall be taken at depth intervals not exceeding 1.5 inches and within the density precision of 1.0 pounds per cubic foot. The probe shall be extracted at a rate of between 8 to 10 feet per minute, and recorded.

To evaluate the repeatability of the GGL tests, the contractor shall perform one repeat log for each shaft in which GGL tests have been performed. After all the tubes in a given shaft have been GGL tested, the repeat log shall be performed in the first tube that was tested.

(c) GGL Data Analysis:

The following steps shall be used in the analysis of the GGL data:

(i) Apply the approved calibration parameters from the concrete calibration samples to the raw count readings and obtain bulk concrete densities. Verify that the data set contains no logging errors, duplicated data or skipped data points.

(ii) Determine the arithmetic mean of a set of bulk densities and record it on each log. A set shall consist of data collected from a single inspection pipe, using the same equipment, within the same time period. Data that shall not be included in the calculation of the mean density are: (1) repetitive data points collected at a single depth, (2) data collected at the top of the drilled shaft where the reading(s) were influenced by the gamma detector component exiting the shaft concrete, (3) data collected in the access tube above the top of the drilled shaft, (4) data affected by the anomalous zones of concrete, and (5) data that cause the population distribution to be statistically non-normal.

(iii) In the event that a known difference in the steel reinforcement layout (e.g., splices using overlapping bars) exists in a segment of a drilled shaft that affects the apparent mean, a separate mean shall be generated and utilized as the mean for that portion of the data.

(iv) Subtract the mean from each data point in the set to obtain a data set that reflects the variation from the mean.

(v) Repeat the above steps for all inspection tubes contained within an individual shaft and plot and present that data as (1) a single plot from all tubes, and (2) an individual plot for each tube.

(d) GGL Standard Deviation Analysis:

The following steps shall be used in the standard deviation analysis of the GGL data:

(i) Determine the standard deviation (SD) of a compilation of bulk densities. A compilation shall consist of data collected from the test drilled shaft using the same equipment, within the same time period. Data that shall not be included in the calculation of the mean density are: (1) repetitive data points collected at a single depth, (2) data collected at the top of the drilled shaft where the reading(s) were influenced by the gamma detector component exiting the shaft concrete, (3) data collected in the access tube above the top of the drilled shaft, (4) data affected by the anomalous zones of concrete, and (5) data that cause the population distribution to be statistically non-normal.

(ii) The SD value that is used in step 3 shall be between 2.5 and 3.75 pounds per cubic foot. If the calculated value is below 2.5 pounds per cubic foot, then 2.5 pounds per cubic foot shall be used in step 3. If the calculated value is above 3.75 pounds per cubic foot, then 3.75 pounds per cubic foot shall be used in step 3.

(iii) Multiply the value obtained for SD from the above step by -2.0 and -3.0 to obtain values of “Minus Two Standard Deviations” (-2SD) and “Minus Three Standard Deviations” (-3SD), respectively.

(e) Anomaly Identification:

Anomalies in a drilled shaft shall be determined by evaluating the data points developed by the above processes to the -3SD deviation criterion as follows:

(i) In a single inspection tube over any 0.5 foot or greater depth interval, all of the density readings have a value less than the determined value for -3SD.

(ii) In the same inspection tube identified anomalous by the above step, any data point that falls below the value for -3SD within a 1 foot vertical extent immediately above or below, then that depth shall be considered as anomalous in addition to the depth identified in the previous step.

(iii) In all inspection tubes adjacent to inspection tubes already identified as anomalous, if at least one data point within 2 feet vertically above or below the adjacent tube anomaly falls below the value for the -3SD, then the depth in that tube at which the anomaly is found is also anomalous, in addition to the depths identified in the previous two steps.

For the 3 steps above, if the data point falls within an interval of 1-foot or 2 feet from the top or bottom; the interval above shall be to the top of the shaft and the interval below shall be to the bottom of the test tubes.

(f) GGL Results:

A report showing the results of the completed GGL survey shall be submitted to the Engineer for each drilled shaft foundation within three working days of completion of testing. The Engineer shall review the reports within three working days of the contractor's submittal. The report shall include:

(i) Dates of shaft construction; shaft diameters; shaft lengths; shaft tip elevations; shaft cutoff elevations; type and size of drilling equipment; type of slurry if used; description of concrete mix; concrete placement method; shaft layout with shaft numbers.

(ii) Dates of logging; brief description of the testing equipment; identification number of shafts logged; location of obstructions in PVC tubes; location of PVC couplers; calibration date, data and plot; summary of any unusual occurrences during testing; description and explanation of adjustments made to instrumentation or data (if any); identification of anomalies using the criteria described herein; delineation of affected tubes; vertical location and extent of anomalies; and estimated percentage of anomalous cross-sectional area.

(iii) Plots of each individual tube with the data points and the values of -2SD and -3SD. The plots shall indicate these points and values at all depths. Utilize symbols or line formats that permit lines corresponding to -2SD and -3SD to be distinguishable from data points.

(iv) Appropriate discussion of the results in the text of the report shall be included.

In all inspection tubes adjacent to inspection tubes already identified as anomalous, if at least one data point within 2 feet vertically above or below the adjacent tube anomaly falls below the value for the -3SD, then the depth in that tube at which the anomaly is found is also anomalous, in addition to the depths identified in the previous two steps.

(C) Procedures in Case of Anomaly Detection:

If the testing indicates the presence of anomalous zones, as identified by either the CSL or GGL tests in the drilled shaft foundation, the contractor shall conduct three-dimensional

tomographic surveys based on CSL results of the anomalies, at no additional cost to the Department. The results of the tomographic surveys shall be presented in the form of concrete velocity images in two-dimensions (2-D) between each pair of tubes, and in three-dimensions (3-D) for the anomalous zone.

After reviewing the results of the CSL, GGL, and the tomographic surveys, the Engineer will make an assessment of the possibility of defects, considering the impact on design and serviceability. The Engineer will either determine that no further action is required and the drilled shaft is accepted, or that further action by the contractor is required.

If the Engineer determines that further action is required to identify any possible defects in the anomalous zones, the Engineer will direct the contractor to proceed with an excavation investigation if the location of the anomaly can be reached using hand or mechanical excavation. If the Engineer determines that due to the location of the anomalies an excavation investigation is not feasible, the Engineer will direct the contractor to proceed with a concrete coring investigation or other investigative methods.

The selected investigation shall conform to the following requirements:

(1) Excavation Investigation:

The contractor shall submit an excavation investigation plan to the Engineer for review and approval in order to determine if any defects exist in the anomalous zones. The excavation investigation plan shall include equipment and methods to be used for excavation and concrete removal, the location of the excavation in the vicinity of the designated testing tubes, and provisions for replacement of earthen materials disturbed by excavation. If needed, the excavation investigation plan shall also include a shoring or confined space plan.

The excavation shall extend to a depth of 1-foot below the identified anomaly. After excavation and exposure of the anomaly, all visually deleterious or questionable material shall be removed. Mechanical tools shall be used to remove all inclusions or compromised concrete until competent concrete is encountered.

If the surface of the drilled shafts shows competent concrete, a small section in the center of the identified anomaly shall be removed to a minimum depth of one inch to demonstrate that the concrete surface is consistent with the concrete one inch into the drilled shaft surface.

If the visual inspection is inconclusive, a minimum 3 inch inside diameter core sample shall be obtained from the anomalous zone for either an additional visual inspection or a cylinder strength test. The depth of the core sample shall not exceed 10 feet below the top of the drill shaft. The core shall extend to 12 inches beyond the anomalous zones or as directed by the Engineer.

If the visual inspection or the results of the compressive strength testing indicate the concrete is not acceptable, all of the unacceptable concrete shall be removed and replaced to the limits determined by the Engineer.

(2) Concrete Coring Investigation:

The contractor shall submit a concrete coring investigation plan to the Engineer for review and approval in order to determine if any defects exist in the anomalous zones. The concrete coring investigation plan shall include the following information:

(a) Whether the contractor or a subcontractor will be performing the coring.

(b) The contractor or the subcontractor's relative experience in successfully coring concrete drilled shafts on a minimum of 3 projects.

(c) The concrete coring method and equipment to be used to drill and remove cores from the drilled shaft concrete.

A hole with a minimum size N-series core shall be advanced from the top of the shaft down to 12 inches below the anomaly. Anomalies detected at depth of less than 25 feet the contractor may elect to use common coring methods. For anomalies detected at depths below 25 feet, a wire-line coring method will be required starting from the top of the shaft to the location of the anomaly as described herein. Care should be taken when coring in order to use the core to assess the quality or compressive strength of the concrete. Cores shall be logged and labeled for use in assessing the required repairs.

Coring shall not begin until the concrete coring investigation plan has been approved by the Engineer.

The number, locations, diameter and depth of the core holes and lengths of individual core runs will be determined by the Engineer. The coring procedure shall avoid damage to the reinforcing steel.

(D) Procedures Post Anomaly Investigation:

After the contractor has performed the work in accordance with the approved investigation plan, and the results indicate that no defects exist in the anomalous zones, the contractor will be compensated for all the work performed under the approved investigation plan in accordance with the requirements specified in Subsection 104.02 of the specifications.

If the Engineer determines that defects exist in the anomalous zones, the contractor shall repair the defects per the requirements of Subsection 609-3.05(E) of the specifications.

(E) Procedures in Case of Defects:

A defect includes any voids, discontinuity, deficient concrete strength, inclusion or crack within the drilled shaft concrete that, in the opinion of the Engineer, requires further investigation, whether or not it is subsequently determined to represent an inadequate or unsafe condition for the completed drilled shaft.

Should the Engineer determine that the anomalous zones reveal defects; the contractor shall submit a plan to repair, replace, or supplement the defective work in a format conforming to the template example forms and mitigation plans found in FHWA-NHI 18-024 Drilled Shafts:

Construction Procedures and Design Methods, Geotechnical Engineering Circular No. 10; Appendix F, Drilled Shaft Acceptance: Example Forms and Mitigation Plans and in a manner approved by the Engineer. After review and acceptance by the Engineer, the contractor shall perform the work specified in the approved plan at no additional cost to the Department. The work described herein shall be performed by a contractor or subcontractor that has performed a similar procedure on a minimum of 3 projects.

609-3.06 Reinforcing Steel, Cage, Construction, and Placement:

The reinforcing steel cage for the drilled shaft, consisting of longitudinal bars and spiral hooping or lateral ties shall be completely assembled and placed into the shaft as a unit. All reinforcing steel intersections shall be tied as specified herein. The reinforcing steel unit shall be placed in the shaft no sooner than two hours prior to the start of concreting operations, and shall be placed in accordance with the details shown on the plans.

If approved by the Engineer, bundling of vertical or horizontal reinforcing steel may be allowed if necessary to maintain a minimum bar spacing equal to five times the maximum nominal aggregate size of the concrete. Bundling of spiral reinforcing will not be allowed. A maximum of three bars may be bundled. Bundled vertical or horizontal steel shall be spaced uniformly. The contractor shall also make the necessary modifications, in accordance with the appropriate ACI specifications, to the splicing and tying details for the reinforcing steel, and submit these to the Engineer for approval along with the contractor's request for bundling of steel.

The reinforcing cage shall be adequately supported and anchored from the top to prevent movement from the required location during and for four hours after completion of concrete placement. If temporary casing is used, the reinforcing cage shall be supported prior to removing casing, and for four hours following removal of the casing. The rebar cage shall be kept plumb. The rebar cage shall not rest directly on the bottom of the excavation.

The minimum number of spacers shall be equal to the diameter of the drilled shaft, measured in feet, and rounded-up to the next whole integer, but not less than four. The spacers shall be approximately even spaced along the outside circumference of the reinforcing steel cage. Spacers shall be placed at a maximum vertical spacing of 15 feet. For all drilled shafts, unless otherwise shown on the plans for pedestrian bridges or light pole and sign post foundations, the spacers shall provide for a minimum of 6 inches of concrete cover between the reinforcing steel and the excavation wall. Only smooth plastic roller spacers, with a minimum width of 1-1/2 inches approved by the Engineer will be allowed. Rollers shall be installed per the manufacturer’s recommendations. In no case shall “dobies”, other rectangular “blocks” or bent rebar tied to the reinforcing steel be used in the excavations.

If the shaft is lengthened by 24 inches or less under any circumstances, the reinforcement and test tubes shall not be extended.

If the shaft is lengthened by more than 24 inches per the direction of the Engineer, the reinforcement and test tubes shall be extended. The Engineer will provide details for the additional reinforcing. Such additional reinforcing will be paid for in accordance with the requirements of Subsection 109.04 of the specifications.

If the shaft is lengthened by more than 24 inches due to over-excavation, the reinforcement and test tubes shall be extended at no additional cost to the Department. The contractor shall submit details for the additional reinforcing to the Engineer for review and approval.

The contractor shall submit a written request to the Engineer for approval of any variation from the splices for reinforcing steel specified in the contract documents.

All reinforcing cages shall be fabricated and supported to avoid damage during the lifting and placing. Any temporary bracing and supports shall be removed prior to final placement. Equipment used for lifting reinforcing cages shall have adequate capacity and boom length to lift the cage clear of the ground. Reinforcing cages shall not be dragged while being moved. Reinforcing cages shall be placed with splices in the lowest possible position within the excavation.

609-3.07 Concrete Placement:

(A) General:

The contractor shall begin placement of concrete within 24 hours after the completion of the drilled shaft excavation. All concrete shall be placed in accordance with Section 601 of the specifications and as specified herein. If slurry excavation is used, concrete shall be placed the same day the excavation is completed.

Prior to concrete placement, the contractor shall make all necessary arrangements to assure the uninterrupted delivery of concrete so that all drilled shaft foundations will be constructed without cold joints.

The Elapsed time for slump loss refers to the duration between the initial mixing of concrete and the point at which the concrete's workability reaches the minimum slump requirements per Subsection 609-2.01(D).

The concrete placement duration refers to an estimate of the entire duration required to fill the drill shaft with concrete. The concrete placement duration shall begin at the initial mixing of the concrete and extend through to the completion of placement of the concrete in the drilled shaft, including removal of any temporary casing that may cause the concrete to flow into the space previously occupied by the casing and transit time.

The concrete placement duration, shall not exceed the elapsed time. If the concrete placement duration exceeds the elapsed time, the Engineer shall be promptly notified and the placement of the drill shaft shall continue to completion. Appropriate measures shall be taken to rectify the situation if needed. The Engineer may determine the need for further action or remedial work. Remedial measures and any additional work required shall be at no additional cost to the Department.

Tremie downpipes and pump pipes shall be made of steel; no aluminum shall be allowed. The inside diameter of the tremie pipe shall be at least 10 inches for all drilled shafts 4 feet or greater in diameter. The inside diameter of the pump pipe shall be at least 5 inches.

(B) Placement in Dry Excavations:

For placement in dry excavations, concrete may be placed by free fall except in fragile, non-cohesive soils where bottom scour is likely to occur, or where other caving conditions exist. The contractor shall prevent concrete from striking either the reinforcing cage or excavation side walls during free fall. Where free fall cannot be used, concrete shall be placed through a suitable clean downpipe.

Concrete vibration for the full height of the shaft is not necessary to achieve proper consolidation of the concrete. However, the shafts shall be vibrated in the top 10 feet. If temporary casing is used, the vibration shall occur after the casing has been removed.

To be considered a dry shaft, the maximum depth of water in the bottom of a drilled shaft excavation at the time of concrete placement shall be no more than 3 inches.

(C) Placement under Slurry or Water:

Concrete shall be placed by tremie methods or by pumping. Care shall be taken to ensure that all the fluid and suspended solids are expelled from the excavation during concrete placement. If concrete is placed by pumping, it shall be in accordance with the requirements of Subsection 601-3.03(C) of the specifications.

The contractor’s installation plan shall demonstrate the procedures used to determine when the tremie pipe is to be raised during concrete placement. The procedure shall assure that the opening of the tremie pipe will be deeper than 5 feet below the surface of the concrete at all times for shaft diameters less than 6 feet, and deeper than 10 feet below the surface of the concrete for shaft diameters 6 feet and larger. A rapid raising or lowering of the tremie will not be permitted.

In order to prevent contamination of concrete placed initially, the lower end of the pump or tremie pipe shall be provided with either a valve, sealable cap, or a plug ("pig"). The discharge end shall be placed at the bottom of the excavation prior to commencement of concrete placement. If a plug is used, it shall be inserted at the top after the pipe has been set in place. Concrete shall then be placed by pushing the plug ahead, separating the concrete from the drilling fluid. Only when the tremie pipe is completely filled shall the open end be lifted off the bottom. The concrete flow that comes to the top of the shaft shall be displaced out of the shaft excavation in a continuous flow until clean, fresh concrete is expelled.

Slurry ejected during concrete placement may be reused provided that it is screened to remove gravel chips or other granular materials, and providing the slurry meets acceptance criteria. Slurry to be discarded shall be disposed of in a manner approved by the Engineer.

Concrete placed under slurry or water shall not be vibrated, except that the top 5 feet of the shaft shall be vibrated after the slurry or water and contaminated concrete have been totally expelled from the shaft. If temporary casing is used, the vibration shall occur after the casing has been removed.

609-3.08 Casing Removal:

During removal of any casing, a sufficient head of not less than 10 feet of fluid concrete in the tremie pipe shall be maintained above the level of concrete in the shaft (outside the tremie pipe), except at the top of the shaft. All contaminated concrete shall be removed from the shaft. Temporary casings shall be removed while the concrete slump is a minimum of 4 inches. The contractor shall maintain a minimum 5-foot head of concrete for shaft diameters of less than 6 feet, and a minimum 10-foot head of concrete for shaft diameters 6 feet or greater, in the casing as it is being removed. Movement of the casing by exerting upward pressure and tapping to facilitate extraction, or extraction with a vibratory hammer will be permitted. Casing extraction shall be at a slow, uniform rate with the force in-line with the shaft axis. The removal method shall prevent the intrusion of water, grout, and soil into the excavation, displacement of the reinforcing steel, and lifting of the concrete.

Due care shall be exercised to prevent upward movement of the shaft concrete and reinforcing steel during casing extraction. Upward movement beyond 1 inch, excluding movement due solely to tension on the top anchoring system, may indicate serious concrete separation or necking problems at the bottom of the casing. The contractor shall be responsible for corrective action which may include leaving the casing in place and compensating for the loss of frictional capacity in the resulting cased zone.

609-4 Method of Measurement:

Drilled shafts will be measured to the nearest linear foot from the top elevation of the shaft to the top elevation of the rock socket stratum, if required, or to the actual bottom of the shaft, as shown on the plans, or as determined in the field by the Engineer.

Rock sockets, when specified, will be measured to the nearest linear foot from the top elevation of the rock socket stratum to the actual bottom of the shaft, as shown on the plans, or as determined in the field by the Engineer.

Bell sections will be measured by the unit for each type of foundation constructed.

609-5 Basis of Payment:

The accepted quantities of drilled shafts and rock sockets, measured as provided above, will be paid for at the contract unit price per lineal foot for the diameter designated in the bidding schedule, complete in place. Price shall include excavation and disposal of spoils; drilling slurry; metal casing; steel reinforcing; Portland cement concrete; any needed forming, curing and finishing; exposing of concrete and the subsequent repair of foundations; furnishing all materials, equipment, and labor for splicing of reinforcing steel; all labor, conduit, and equipment for CSL and GGL; and all required testing and test reports.

No additional payment will be made for metal casing that is to remain in place.

No additional payment will be made for confirmation shafts, as the costs are considered to be included in the cost of constructing the drilled shaft foundation.

Payment for belled sections will be at the contract unit price for each type of foundation constructed, including excavation and concrete beyond the diameter of the shaft.

Obstructions will be defined as either material or objects of excessive dimension, which were not recorded in the geotechnical and foundation report, either in the text or boring logs. Payment for obstructions will be made in accordance with the provisions of Subsection 109.04 of the specifications.

(610PNT, 8/21/25)

SECTION 610 PAINTING:

610-3.02 (A)(2) Steam Cleaning: the first paragraph of the Standard Specifications is revised to read:

All dirt, grease, loose chalky paint, and other foreign material which has accumulated on previously painted surfaces shall be removed with a steam cleaning apparatus prior to all other phases of cleaning. It is not intended that sound paint be removed by this process. After steam cleaning, any paint which has become loose, curled, lifted, or loses its bond to the preceding coat or coats shall be removed to sound paint or metal surface by the contractor a t no additional cost to the Department.

610-3.02 (A)(3) Hand Cleaning: of the Standard Specification is revised to read:

Manual or powered wire brushes, hand scraping tools, power grinders, or sandpaper shall be used to remove all dirt, loose rust, mill scale, and paint which is not firmly bonded to the surfaces.

610-3.05 (A)(1) General: the second paragraph of the Standard Specifications is revised to read:

All paints used shall be appropriately chosen from among the types described in Subsection 1002-2 of the specifications and shall conform to the requirements given therein.

(704TPMF, 5/21/26)

SECTION 704 THERMOPLASTIC PAVEMENT MARKINGS:

704-1 Description: of the Standard Specifications is revised to read:

(A) General:

The work under this section shall consist of cleaning and preparing pavement surfaces and furnishing and applying either white or yellow thermoplastic reflectorized pavement markings using extrusion or ribbon dispensing devices of the required shape and thickness to the prepared pavement surface at the locations and in accordance with the details shown on the project plans, the manufacturer's specifications, and the requirements of these specifications.

(B) Profile Thermoplastic Pavement Markings:

When constrained by pavement thickness, width, condition, or structural section, profile thermoplastic pavement markings may be used as centerline and edge line rumble stripes by applying yellow and white thermoplastic lines with bumps at specified widths, thicknesses, and configurations. The thermoplastic formulations used for profile thermoplastic rumble stripes shall be specifically designed as extruded profile thermoplastic reflectorized marking systems.

704-2.02(A) General: of the Standard Specifications is revised to read:

The thermoplastic composition shall conform to the following requirements:

Component	Percent by Weight		Profile Thermoplastic	
	White	Yellow	White	Yellow
Binder (Min.) (Note 1)	20	20	20	20
Titanium dioxide (Min.)	10	1.75	10	--
Yellow Lead- Free Pigment (Min.)	----	1.5	---	5
Reflective glass inter-mix beads (Min.) (Note 1)	20/ M 247 T 1 & 20/ M 247 T 3	20/ M 247 T 1 & 20/ M 247 T 3	30	40
Calcium carbonate or equivalent filler (Max.)	30	36.75	31	41
Note: As described in 704 - 2. 05 (C), for precertification purposes, thermoplastic material will be tested for binder content and glass bead content according to ASTM D4797.				

704-2.02(C) Filler: of the Standard Specifications is revised to read:

The filler shall be a white calcium carbonate or equivalent filler.

704-2.03(C) Retroreflectance: of the Standard Specifications is revised to read:

Profile thermoplastic material used as rumble stripes shall have a minimum retroreflectance value of 200 millicandelas using 30-meter geometry with an 88.76° entrance angle and 1.05° observation angle as measured by ASTM E1710. standard method 30 days after application to the roadway surface.

704-2.03(F) Impact Resistance: of the Standard Specifications is modified to add:

For profile thermoplastic marking as rumble stripes, the impact resistance requires a minimum of 10-inch based on specifications. The test involves applying heat (425 degrees F for 240 mins) to samples and testing via ASTMD-256 method A (un-notched).

704-2.03(H) Abrasion Resistance: the second paragraph of the Standard Specifications is revised to read:

The maximum loss of thermoplastic material shall be from 0.4 to 0.5 grams.

704-2.03(M) Flash Point: of the Standard Specifications is revised to read:

The thermoplastic material shall have a flash point not less than 475 degrees F, or manufacturer's specification, when tested in accordance with the requirements of ASTM D92.

704-2.03(O) Primer-Sealer: of the Standard Specifications is modified to add:

Material provided for profile thermoplastic marking used as rumble stripes and/or re-striping shall not require the application of separate primer sealer on AR- ACFC surfaces prior to application of the thermoplastic material. The material shall be fully compatible for use on an AR-ACFC surface which is less than 60 days old.

It is the responsibility of the contractor and/or the Engineer to determine if the substrate where the installation will occur warrants the need of a primer.

704-2.04 Physical Requirements for Glass Beads: the first paragraph of the Standard Specifications is revised to read:

Inter-mix and drop-on reflective glass beads shall conform to the requirements of Subsection 708- 2. 02 of the specifications and manufacturer's requirements, except as noted herein.

(708 PTVCT, 07/17/25)

SECTION 708 WATERBORNE PAVEMENT MARKINGS:

708-2.01(D) Quantitative Requirements of Mixed Paints: the viscosity row of the Table 708-1 of the Standard Specifications is revised to read:

Table 708-1

	White	Yellow
Viscosity: Krebs Units at 77 ± 1˚ F, ASTM D562	70 - 95	70 - 95

(731STRSUP, 03/18/21)

SECTION 731 STRUCTURAL SUPPORTS AND FOUNDATIONS FOR TRAFFIC SIGNAL AND HIGHWAY LIGHTING:

731-1 Description: of the Standard Specifications is revised to read:

The work under this section shall consist of furnishing all materials and constructing new supports and foundations for traffic signal and highway lighting systems or modifying poles

and mast arms of existing systems at the locations shown on the plans, and in accordance with the details shown on the plans and the requirements of these specifications.

Pole foundations shall include all conduits, elbows, anchor bolts, grounding wires and reinforcing steel. Cabinet foundations shall include conduits, elbows, anchor bolts and clearance pads.

731-2 Materials: of the Standard Specifications is revised to read:

Excavation and backfill shall conform to the requirements of Section 203-5.03 of the specifications. Concrete shall conform to the requirements of Sections 601 and 1006 of the specifications. Reinforcing steel and wire mesh shall conform to the requirements of Sections 605 and 1003 of the specifications.

Concrete for all foundations shall be Class S and shall have a required 28-day compressive strength of 3,500 pounds per square inch.

731-2.01 BLANK: the title and text of the Standard Specifications is revised to read:

731-2.01 Aluminum Poles and Mast Arms:

(A) General:

Standard aluminum poles assemblies for highway lighting shall include pole shafts, pole bases, and mast arms. Aluminum components of the pole, mast arm, base, and hardware shall conform to the details shown on the plans and in these specifications.

Each aluminum pole and mast arm shall be designed and manufactured as a complete assembly. The assembly shall be furnished and installed as a complete unit that is configured to the necessary dimensions with all the required components including mounting brackets and assembly, ground lugs, rain caps, hand hole covers, anchor bolts, nuts, washers and related hardware and accessories.

The design of the pole assembly (pole, mast arm, and luminaire attachment portion) shall be per the requirements of the 2013 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th edition with 2015 interim revisions. The design of the poles, mast arms and luminaire mounting brackets shall be based on a wind speed of 90 miles per hour with a luminaire having an effective projected area of 1.5 square feet and a weight of 55 pounds.

The design shall also be based upon the worst case loading, derived by combining the loads caused by a 20 foot truss mast arm, except for S and T poles, design luminaire, design wind speed and other dead loads, as appropriate. Secondary deflections shall be accounted for in all designs.

Aluminum poles shall have a minimum design life of 50 years.

The pole and mast arm shall be supplied from the same manufacturer and of similar metal properties providing a uniform appearance.

(B) Pole and Mast Arm Assembly Design Parameters:

(1) Pole Shafts:

The tapered pole shaft shall be fabricated from a one-piece, seamless, round tapered tube of Aluminum Alloy 6063-T6, conforming to the requirements of ASTM B221, and shall be full-length heat treated after tapering and welding on the base and hand hole reinforcing to produce a T6 temper. The pole shafts shall either maintain a uniform taper rate from the base of the pole to the pole top or shall be non-tapered. The base plate shall be constructed to match the foundation bolt pattern for standard poles shown in the Standard Drawings for Aluminum Light Poles. No field splices of pole shafts shall be allowed. The pole shaft shall have an internal vibration damper.

The pole shaft shall be smooth with a uniform brushed sheen finish that is free from all dents, scratches, and shipping/handling marks. Poles that have a finish that is not uniform or that fails to meet the requirements of this specification will be rejected by the Engineer and shall be repaired or replaced to the satisfaction of the Engineer at no expense to the Department in accordance with Subsection 105 of the specifications.

All aluminum poles shall have a hand hole in the base of the poles and shall conform to the details shown on the Standard Drawings, with the exception that the hand hole shall use aluminum components and stainless steel screws.

An aluminum tag shall be permanently attached to the pole above the hand hole. The tag shall state the manufacturer’s name, pole type, ADOT standard drawing number, pole length, and gage number.

(2) Truss Mast Arms:

The aluminum truss mast arms shall be fabricated by the same manufacturer as the aluminum pole manufacturer and from Aluminum Alloy 6063-T6 conforming to the requirements of ASTM B221.

The aluminum truss mast arms shall be smooth with a uniform brushed sheen finish that is free from all dents, scratches, and shipping/handling marks. Aluminum truss mast arms that have a finish that is not uniform or that fails to meet the requirements of this specification will be rejected by the Engineer and shall be repaired or replaced by the contractor to the satisfaction of the Engineer at no expense to the Department in accordance with Subsection 105 of the specifications.

(3) Welding:

Welding of all components of aluminum light poles shall conform to the American Welding Society (AWS) D1.2 Specifications for Class I Structures. All aluminum components and welding shall be identified and included in the Certificate of Analysis, which shall state compliance to AWS Specifications.

(4) Break-away Transformer Bases:

Break-away bases for light poles and flasher poles shall be a frangible pole mounting pedestal (base). Break-away bases shall be used on Type A, G, H, I, S, and T poles when indicated on the plans or specifications. Break-away bases shall be fabricated from 356 T6 aluminum alloys and shall have a stainless steel wheel abraded finish. The break-away bases shall have all the necessary hardware to make a complete and functional unit.

Bolts, nuts, and washers connecting the pole to the break-away base shall be fabricated from steel conforming to the requirements of ASTM F3125 Grade A325. Bolts shall be galvanized in accordance with the requirements of ASTM F2329. The 2-3/4 inch x 1/2-inch thick washers shall be zinc mechanically coated per ASTM B695-85 Class 50 or shall be galvanized per the requirements of ASTM F2329.

Welding of all components of aluminum break-away bases shall conform to the AWS D1.2 Specifications

Break-away bases shall be certified by the manufacturer to meet or exceed the change in momentum requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and to be acceptable for use on Federal Aid projects. The manufacturer shall also certify that the break-away base has been tested and approved by the Federal Highway Administration (FHWA) and that the casting has the same chemistry, mechanical properties, and geometry as the casting used in the tests.

(5) Anchor Bolts, Nuts, and Washers:

All anchor bolts shall be fabricated from steel conforming to the requirements of ASTM F1554 Grade 55, shall be fully galvanized in accordance with the requirements of ASTM F2329, and shall conform to the requirements shown on the Standard Drawings. All anchor bolts shall be submitted for approval and a certificate of analysis shall be provided from the manufacturer that is in accordance with the requirements of Subsection 106.05 of the specifications.

(C) Submittals:

The contractor shall submit a Certificate of Analysis for all aluminum components in accordance with the requirements of Section 106.05 of the specifications. The contractor shall also submit shop drawings that have been sealed and signed by a registered professional engineer that show all the details of the poles assembly units to be furnished and installed. The shop drawings shall be complete in every aspect, including all dimensions, material specifications and appropriate details. The details shall include the configuration of the pole shaft, mast arm and mast arm mounting bracket, base plates, luminaire mounting bracket and the hand hole. All welds shall be shown and identified with standard AWS symbols. The submittal shall include structural calculations along with the name of the engineer(s) who sealed the drawings and performed the calculations.

The contractor shall submit the supporting documents for review by the Engineer. The principal purpose of the review is to verify that suitable structural calculations have been made in the design of the pole and mast arm assembly. The contractor's engineer shall utilize accepted standard engineering principles. If a computer program is utilized, the contractor

shall furnish the Engineer with all necessary information, such as formulas and assumptions, to conduct a meaningful review.

The Engineer shall provide written review comments to the contractor. The contractor shall respond to these comments and resubmit the calculations, if required. Fabrication shall not take place until the shop drawings have been approved.

If the contractor utilizes a pre-approved design from ADOT's Approved Product List (APL), submittal of the structural calculations is not required. Shop drawings for APL designs shall be submitted. Drawing numbers for the pre-approved designs found in the APL are available at https://azdot.gov/business/engineering-and-construction/product-evaluation-program.

731-2.02 Standard Steel Poles: the title and text of the Standard Specifications is revised to read:

731-2.02 Steel Poles and Mast Arms:

(A) General:

Standard steel poles assemblies for traffic signals and highway lighting shall include pole shafts, mast arms, and pole bases. Steel components of the pole, mast arm, base, and hardware shall conform to the details shown on the plans and in these specifications.

Each steel pole and mast arm shall be designed and manufactured as a complete assembly. The assembly shall be furnished and installed as a complete unit that is configured to the necessary dimensions with all the required components including mounting brackets and assembly, ground lugs, rain caps, hand hole covers, anchor bolts, nuts, washers and related hardware and accessories.

The design of the traffic signal and lighting supports shall be per the requirements of the 2013 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th edition, with the 2015 interim revisions.

All pole lighting supports and mast arms shall be designed to withstand 90 miles per hour wind, and a 3-second Gust. Fatigue analysis is to be per Fatigue Category 2, without galloping. Truck Induced velocity shall be 55 mph wind speed.

Metal parts of standard steel poles and hardware shall conform to the details shown on the plans and the following specifications. Welding shall conform to the requirements of the American Welding Society, Structural Welding Code - Steel, D1.1, latest edition.

(B) Pole and Mast Arm Assembly Design Parameters:

(1) Poles Shafts:

Tapered pole shafts shall be fabricated from sheet steel of weldable grade which shall meet a minimum yield stress, after fabrication, of 50,000 pounds per square inch. A taper rate of approximately 0.14 inches in diameter per linear foot shall be required unless otherwise specified.

Standard pipe pole shafts shall be fabricated from standard weight structural steel which conforms to the minimum strength requirements of ASTM A53, or A500 Grade B. Each section shall be fabricated from not more than two pieces of sheet steel. When two pieces are used, the longitudinal welded seams shall be directly opposite one another. When the sections are butt-welded, seams shall be directly opposite one another. When the sections are butt-welded together, the longitudinal welded seams on adjacent sections shall be placed to form continuous straight seams from base to top of pole. Pole shafts shall be straight, with a permissive variation not to exceed one inch measured at the midpoint.

Pole shafts shall be galvanized in accordance with the requirements of ASTM A123. The visual appearance of the galvanized finish shall be uniform. Discoloration of the galvanized finish such as dark areas, dark streaks, dark rings or transportation handling marks which are considered excessive by the Engineer shall not be allowed. Pole shafts that have a finish unacceptable to the Engineer shall either be repaired or replaced to the satisfaction of the Engineer at no additional cost to the Department.

All steel poles shall have a hand hole in the base of the poles and shall conform to the details shown on the Standard Drawings. All welds shall be continuous and any exposed welds, except fillet welds, shall be ground flush with the base metal.

A metal tag shall be permanently attached to the pole above the hand hole stating the manufacturer's name, pole type per the Department's plans, pole drawing number, shaft length and gage number.

(2) Mast Arms:

Tapered mast arms for all pole types shall be fabricated from sheet steel with a minimum yield stress of 50,000 pounds per square inch after fabrication. Mast arms shall be fabricated according to the thickness requirements shown on the plans.

A taper rate of approximately 0.14 inches change in diameter per linear foot shall be required unless otherwise specified. All bolts, washers, and nuts for mast arms shall be high strength, shall be fabricated from steel which meets the requirements of ASTM F3125 GR A325, and shall be electro-galvanized in accordance with the requirements of ASTM F2329.

Mast arms shall be galvanized in accordance with the requirements of ASTM A123. The visual appearance of the galvanized finish shall be uniform. Discoloration of the galvanized finish such as dark areas, dark streaks, dark rings or transportation handling marks which are considered excessive by the Engineer shall not be allowed. Mast arms that have a finish unacceptable to the Engineer shall either be repaired or replaced to the satisfaction of the Engineer at no additional cost to the Department.

A metal tag shall be permanently attached on the side of the mast arm near the base stating the manufacturer's name, pole type and name as shown on the plans, mast arm or pole drawing number, length, and gage number.

(3) Steel Pole Extensions and Twin Luminaire Brackets:

Pole extensions and twin luminaire brackets shall be fabricated from new pipe conforming to the requirements of ASTM A53 or A500 Grade B. All welding shall conform to the

requirements of the American Welding Society, Structural Welding Code - Steel, D1.1, latest edition. Pole extensions and twin luminaire brackets shall be fully galvanized in accordance with the requirements of ASTM A123. Fabrication of the pole extensions and twin luminaire brackets shall be in accordance with the dimensions as specified in the plans.

(4) Standard Bases:

Poles shall have standard bases fabricated from structural steel plates conforming to the minimum strength requirements of ASTM A36. Exposed surfaces shall be finished smooth and all exposed edges shall be neatly rounded to a 1/8-inch radius. Standard bases shall be galvanized in accordance with the requirements of ASTM A123.

(5) Anchor Bolts, Nuts and Washers:

Standard anchor bolts, washers, and nuts shall be fabricated from steel conforming to the requirements of ASTM F1554 Grade 55. Anchor bolts, washers, and nuts shall be fully galvanized in accordance with the requirements of ASTM F2329. Anchor bolts shall conform to the requirements shown on Standard Drawings.

Welding shall not be performed on any portion of the body of these bolts. Certificates of Analysis conforming to the requirements of Subsection 106.05 of the specifications shall be submitted for high strength bolts, washers and nuts.

(C) Submittals:

The contractor shall submit a Certificate of Analysis for all steel components and welding in accordance with the requirements of Section 106.05 of the specifications. The contractor shall also submit shop drawings that have been sealed and signed by a registered professional engineer that show all the details of the poles assembly units to be furnished and installed. The shop drawings shall be complete in every aspect, including all dimensions, material specifications and appropriate details. The details shall include the configuration of the pole shaft, mast arm and mast arm mounting bracket, base plates, luminaire mounting bracket and the hand hole. All welds shall be shown and identified with standard AWS symbols. The submittal shall include structural calculations along with the name of the engineer(s) who sealed the drawings and performed the calculations.

The contractor shall submit the supporting documents for review by the Engineer. The principal purpose of the review is to verify that suitable structural calculations have been made in the design of the pole and mast arm assembly. The contractor's engineer shall utilize accepted standard engineering principles. If a computer program is utilized, the contractor shall furnish the Engineer with all necessary information, such as formulas and assumptions, to conduct a meaningful review.

The Engineer shall provide written review comments to the contractor. The contractor shall respond to these comments and resubmit the calculations, if required. Fabrication shall not take place until the shop drawings have been approved.

If the contractor utilizes a pre-approved design from ADOT’s Approved Product List (APL), submittal of the structural calculations is not required. Shop drawings for APL designs shall

be submitted. Drawing numbers for the pre-approved designs found in the APL are available at https://azdot.gov/business/engineering-and-construction/product-evaluation-program.

731-2.04 **Mast Arms and Tie Rods:** of the Standard Specifications is hereby deleted:

731-3.02 **Foundations:** the sixth paragraph of the Standard Specifications is revised to read:

Signal and lighting pole foundations shall be set flush with the existing or new curb and sidewalk or flush with the finished grade where there is no curb or sidewalk, except in sloped areas they shall be as shown on the plans. The dimensions and locations of foundations shall be as specified on the plans; however, the Engineer may direct that changes be made in locations due to obstructions or other existing conditions. The contractor shall verify top of foundation elevations with the Engineer prior to foundation construction.

731-3.02 **Foundations:** the tenth paragraph of the Standard Specifications is revised to read:

Anchor bolts and conduit stubs shall be placed and held in proper alignment, position, and height during the placing and vibrating of concrete. All pole foundations shall set for seven days prior to pole installation.

731-3.02 **Foundations:** of the Standard Specifications is modified to add:

The stations and offsets for traffic signal poles shown on the plans and in the pole/equipment schedule are approximate. The final location of each pole shall be staked in the field by the contractor and approved by the Engineer, to ensure that the edge of pole foundation is immediately adjacent (1-inch maximum) to the back of sidewalk, back of wheelchair ramp, or integrated into the sidewalk ramp design. The intent of these criteria is to ensure that the pedestrian push button assemblies are accessible to wheelchair-bound pedestrians.

ITEM 7310832 RELOCATE EXISTING LIGHT POLES:

Description:

The work under this item shall consist of removing existing light pole, mast arm, and luminaire and installing them on a new foundation at the locations designated on the plans. The existing foundation shall be removed (2) two feet below grade, where poles shown on the project plans are to be relocated, and as specified herein.

Construction Requirements:

Prior to the commencement of the relocation operations and installing the new foundation for the poles at their new locations, the existing light poles, mast arms, and luminaire shall be inspected for damage. If poles, mast arms, or luminaires are damaged, the contractor shall

notify the Engineer. Poles shall be installed level and square with mast arm perpendicular to travel lanes.

Unless otherwise specified or shown on the project plans, the existing foundations shall be removed after removing the poles and their associated equipment. When a foundation is to be abandoned, the top of foundation, anchor bolts and conduits shall be removed to a depth of not less than 2 feet below the surface of sidewalk or unimproved ground. The resulting hole shall be backfilled with material equivalent to the surrounding material. All voids shall be filled and made level with the surrounding ground. Any disturbed ground shall be restored to match the surrounding area. All existing underground conduit outside of existing foundations shall be removed to adjacent pull box, unless otherwise directed by the Engineer. All conductors and detectable pull tape shall be removed from conduits to be abandoned. Removal of conductors from conduits are paid for under separate item.

The removed light poles and their associated equipment shall be installed on the newly installed foundations as shown on the plans in accordance with the pertinent requirements of Section 731 of the specifications and to the satisfaction of the Engineer.

Method of Measurement:

Relocate Existing Light Pole will be measured as a unit for each pole removed and reinstalled and foundation removed.

Basis of Payment:

The accepted quantities of Relocate Existing Light Pole measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place, including hauling, storage, excavation, backfill, compaction, and surface restoration.

ITEM 7320050 ELECTRICAL CONDUIT (2”) (PVC)
ITEM 7320055 ELECTRICAL CONDUIT (2”) (PVC) (DIRECTIONAL DRILL)
ITEM 7320073 ELECTRICAL CONDUIT (2 - 3”) (PVC)
ITEM 7320130 ELECTRICAL CONDUIT (2”) (RIGID METAL)
ITEM 7320291 ELECTRICAL CONDUIT (2 - 2” PVC)

Description:

The work under these items shall consists of the installation of various types, sizes, and installation methods of electrical conduit at the locations identified on the plans.

Materials:

Unless otherwise shown on the plans, conduit bends, fittings, expansion couplings, sweeps, and other accessories shall be of the same material as the conduit.

Conduit elbows for new or future fiber optic cable shall have a minimum radius of 36 inches. Other conduit elbows shall have a minimum radius of 24 inches.

Polyvinyl Chloride (PVC) conduit shall conform to Subsection 732-2.02 of the specifications. Intermediate Metal Conduit (IMC) is not allowed. Conduit runs which enter pole and cabinet foundations shall consist of PVC.

(A) PVC Conduit:

PVC conduit and materials shall conform to Subsection 732-2.02, of the Standard Specifications.

Should the contractor choose to substitute HDPE conduit in place of the installation of direct buried PVC conduit, the HDPE conduit must meet the specifications for HDPE conduit listed below, and the contractor shall provide original data sheets or a Certification of Compliance letter from the HDPE conduit manufacturer to the Engineer stating that the product meets these Special Provisions and obtain the written approval from the Engineer prior to procuring and installing the HDPE conduit. Direct buried HDPE conduit shall be paid at the unit bid price of direct buried PVC conduit.

Unless otherwise shown on the project plans; bends, conduit fittings, expansion joints, 36-inch sweeps and other conduit accessories not specifically mentioned shall be manufactured from a material similar to the connecting conduit.

(B) HDPE Conduit:

HDPE conduit shall have a minimum rating of SDR 11. It shall have a cell classification of PE334470C (for black conduit) and PE334470E (for colored conduit) per ASTM D3350: *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.*

The polyethylene base resin shall meet the density requirement and melt index properties described herein. The density shall not be less than 0.940 and not more than 0.955 g/CM3 in accordance with ASTM D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique. The range for the melt index shall be between 0.05 to 0.5g/10 minutes in accordance with ASTM D 1238: Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer. The HDPE conduit shall have a minimum Flexural Modulus, of 80,000 psi, per ASTM D 790 and a minimum tensile strength at yield of 3,000 psi, per ASTM D-638.

Additives to the base resin shall be included to provide heat stabilization, oxidation prevention and ultraviolet (UV) protection. It shall utilize carbon black in the range of 2 to 3 percent for long term protection against UV degradation. The minimum protection period shall be one year from date of manufacture in unprotected, outdoor storage in accordance with ASTM D 1603: Standard Test Method for Carbon Black in Olefin Plastics.

HDPE conduit and fittings shall comply with ASTM D 2241 and ASTM-F2160-01.

The contractor shall provide the Engineer with manufacturer’s certification of analysis and compliance showing that HDPE conduit meets these specifications.

(C) Rigid Metal Conduit:

Rigid metal conduit and materials shall be in accordance with Section 732-2.02, of the ADOT Standard Specifications.

(D) Innerduct

When called for in the project plans or Special Provisions, innerduct shall be smooth wall HDPE. The number of innerducts per conduit and sizes of innerduct shall be as called for in the project plans or as directed by the Engineer. Innerducts furnished and installed shall be of one color. Tracer wire shall be installed in the $1^{1}/_{4}$" innerducts as shown in the project plans.

(E) Conduit Warning Tape:

Conduit warning tape shall be a minimum four-mil composite reinforced thermoplastic, with a minimum width of 3 inches and minimum length of 5 feet. Warning tape shall be highly resistant to alkalis, acids, and other destructive agents found in the soil.

Warning tape shall have a continuous printed message warning of the location of underground conduits. The message shall be in permanent ink specifically formulated for prolonged underground use and shall bear the words, "CAUTION - ELECTRIC LINE BURIED BELOW" or "CAUTION – COMMUNICATION CABLE BURIED BELOW" in black letters on a red (electric) or orange (communications) background. Where both electric and communications lines are in a single trench, both tapes, as described above, shall be provided.

(F) Pull Tape:

Pull tape shall be constructed of fiber and shall be low-stretch and moisture-resistant. The tape shall have nominal pull strength of 2,500 pounds. The tape shall include distance markings at intervals not to exceed two feet.

(G) Plugs and Caps:

All plugs or caps used on the ends of occupied and unoccupied conduits, and innerducts, shall be corrosion-proof, removable, reusable, water-tight, and vermin resistant end treatment recommended by the manufacturer to prevent intrusion of water, mud, gravel, rodents, etc. Duct tape or similar material shall not be used for sealing conduit ends.

Construction Requirements:

Conduit installation shall comply with Subsection 732-3.01 of the Standard Specifications except as specified herein.

(A) Conduit Routing and Underground Obstructions:

Conduit runs shown on the plans are depicted to indicate the intended path from point to point. The actual pathway shall be staked prior to any excavation and shall be modified as necessary, as approved and directed by the Engineer, to avoid obstacles and obstructions that will prevent ease of installation, obstacles and future maintenance or conformance with appropriate codes and specifications. Final conduit locations shall be documented and submitted to the Engineer in the form of an as-built drawing.

(B) Conduit Size:

Changes in the size of the conduit shall, prior to construction, be submitted to the Engineer for approval. All changes in conduit size shall be documented by the contractor in the form of an as-built drawing.

(C) Conduit Bend Radius and Deflection:

Except for factory bends, conduit bends shall have a radius of not less than that specified in the NEC. Conduit shall be bent without crimping or flattening, using the longest radius practicable. Communications conduits shall not deflect more than 1 inch per foot (1:12) vertically or horizontally. This is equivalent to a minimum radius of 6 feet.

If the 1:12 rule cannot be achieved, standard factory-made elbows of 11 1/4, 22 1/2, 30 or 45 degrees, with a minimum radius of 24 inches shall be used. 90-degree cumulative turns shall be made of individual elbows with a minimum radius of 36 inches.

(D) Conduit Ends and Connections:

New runs of HDPE conduit shall be continuous from pull box to pull box, unless otherwise shown on the project plans. HDPE conduit shall not be joined to PVC conduit in the length of the run. At pull boxes and/or cabinets where new HDPE is required to transition into new or existing PVC elbows, the contractor shall submit for approval a manufacturer recommended coupling.

When joining segments of HDPE conduit, the contractor shall utilize non-corrosive, sit-tight, water-tight couplings. Heat fusion, electrofusion fittings and mechanical connections shall be permitted if the HDPE conduit and joining device manufactures recommendations are observed and the internal diameter of the HDPE conduit is not reduced. Extrusion welding and hot gas welding to join HDPE conduits is not permitted.

Upon completion of joining HDPE conduit sections and setting the pull boxes, the contractor shall clean the HDPE conduit with compressed air. The contractor shall demonstrate by pulling a cleaning mandrel or ball mandrel, correctly sized for the conduit (80 percent of the HDPE inside diameter), that the conduit was not deformed during installation. If the mandrel passes through the HDPE the contractor shall install the pull tape in accordance with Section 732 of the specifications. If the mandrel encounters a deformity in the HDPE conduit,

the contractor shall replace the entire segment of HDPE between pull boxes with new HDPE at no cost to the Department.

(E) Conduit Depth:

Conduits shall be at a minimum cover depth of 30 inches, or as indicated in the project plans. Backfill compaction shall be in accordance with Subsection 203-5.03 (B) (4) of the specifications.

When conduit in protected and open areas cannot be installed at the minimum depths, it shall be encased in Class B concrete, as defined in Section 1006 of the specifications.

(F) Conduit in Trenches:

Conduit installation methods identified in the plans as “Plowed” and “Trenched” may be completed by a different installation method, if approved in advance by the Engineer as a means of facilitating installation or mitigating potential damage to existing surface and subsurface elements. If approved by the Engineer, the substitution of a different installation method for the original method of installation specified in the plans shall be paid for at the original method of installation bid price of the conduit item.

Conduit installed by direct plowing shall include a vibratory plow, and conduit feeder tube to displace the soil and install the conduit at the required depth. In locations where pre-ripping is performed the use of a non-vibratory plow is allowed. The contractor shall use the appropriate plowing equipment based on the field soil conditions and the conduit depth.

Open trenching and plow trenching shall be backfilled, compacted and regraded to meet pre-disturbance condition within a day following the installation of the conduit.

The contractor shall place detectable warning tape in trenches in which new PVC and HDPE conduit is placed by plow and trench methods. Warning tape is not required in conduit segments where trenchless methods (e.g., direction drill and bore) are used for installation except direct plow method. Warning tape shall be buried at a depth of 6 to 8 inches below the finished grade, unless otherwise noted on the plans.

Immediately after conduits are installed, they shall be sealed to prevent the intrusion of water, mud, gravel, vermin, etc. The conduits shall be sealed after mandrelling, tracer wire and/or pull tape, cable and/or fiber, installation. Taping the ends of the conduit shall not be allowed.

All unoccupied conduits on which work is performed shall be sealed with a water-tight, corrosion-proof, removable, reusable, and vermin resistant conduit plug or cap. Prior to use, the conduit plug, or cap shall be submitted to the Engineer for approval.

Occupied conduits on which work is performed shall be sealed with a conduit cap, as approved by the Engineer. The conduit cap must be water-tight, corrosion-proof, removable, and vermin resistant.

All unoccupied innerduct on which work is performed extending beyond the end of the capped conduit shall be sealed with a water-tight, corrosion-proof, removable, reusable, and vermin

resistant innerduct plug or cap. Prior to use, the innerduct plug or cap shall be submitted to the Engineer for approval.

Occupied innerduct on which work is performed extending beyond the end of the capped conduit shall be sealed with an innerduct cap, as approved by the Engineer. The innerduct cap must be water-tight, corrosion-proof, removable, and vermin resistant.

A 3-inch “Y” shall be cut into the face of the curb directly over conduit located under rolled or vertical curbs.

The contractor shall place warning tape in all trenches in which new PVC or trenched HDPE conduit is placed. Warning tape is not required in conduit segments where trenchless methods are used for installation. All warning tape shall be buried at a depth of 6 to 8 inches below the finished grade.

(G) Conduit by Trenchless Methods:

Conduit under existing pavement, curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces, and at other specified locations, shall be installed by Horizontal Directional Boring (HDB) or Horizontal Directional Drilling (HDD) methods. Use of either method is allowed, subject to approval of the Engineer.

Conduit installation in areas where trenching would typically be allowed may be installed by trenchless method, if preapproved by the Engineer as a means of facilitating installation or mitigating potential damage to existing surface and subsurface elements.

The proposed bore profile shall be submitted to the Engineer, after the contractor has completed the necessary potholing, and approved prior to beginning the operation at each location.

Directional boring/drilling shall be used to install all conduits along a prescribed path from the surface with minimal impact to the surrounding area. Installation shall be performed in accordance with industry standards and as directed by the Engineer.

The contractor’s installation process shall utilize the “walkover” locating system, or other Engineer approved equivalent, for determining the installation profile. The installation equipment shall register the depth, angle, rotation and directional data. At the surface, equipment shall be used to gather the data and relay the information to the equipment operator.

Excavation and backfill of excavated pits shall be in accordance with the requirements of Subsection 203-5.03 (B) (4) of the specifications.

When enlargement of an installation hole is necessary, the hole shall be at least 25 percent larger than the conduit to be installed, unless otherwise specified by the Engineer. Pulling equipment such as grips, pulling eyes, and other attachment hardware external to the conduit will be permitted as long as a wooden dowel is placed inside the conduit to prevent it from collapsing at the point of attachment when pull tension is at its peak. A swivel shall be used with all pulling hardware when pulling back the conduit into the installation path. Drilling fluid

shall be pumped down the hole to provide lubrication for the conduit as it is pulled in. The pulling tension for installing conduit into the installation path shall not exceed 75 percent of the conduit manufacturer's tensile strength rating in order to prevent the conduit from "necking down" or deforming.

All final installation profiles shall be submitted to the Engineer.

Method of Measurement:

The various sizes and types of electrical conduit will be measured by the linear foot for each conduit run, regardless of the method of installation. Measurements will be taken in the following ways: from center to center of pull boxes; from the edge of the foundation to the center of pull boxes; from edge to edge of the foundation; from the end of the conduit to the center of a pull box or foundation; and from end to end of the conduit when no pull boxes are used.

No measurement will be made for conduit that is below ground in vertical conduit stub-ups and field equipment cabinets.

Basis of Payment:

The accepted quantities of the various sizes and types of Electrical Conduit, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place, including the cost of warning tape, excavation, backfill, slurry, detectable pull tape, connectors, fittings, horizontal directional drilling, horizontal directional boring, removal of spoil, compaction of trenches and directional drilling/boring pits, restoration of the surface to existing condition, including concrete, pavement, decomposed granite and other landscaping items where appropriate, repair of irrigation facilities, locating of existing conduit when new is to be intercepted with existing, and all necessary tasks required to complete the work.

ITEM 7320450 PULL BOX (NO. 7) (FMS)

Description:

The work under this item shall consist of furnishing and installing No. 7 pull boxes at the locations shown on the plans.

Materials:

All pull boxes and lids shall conform to the applicable ITS Standard Drawings, project plans and these Special Provisions.

Pull box lids shall bear the words "ADOT FMS" unless otherwise specified on the project plans and these Special Provisions.

Markings shall be clearly defined and shall be placed parallel to the long side of the cover. Letters shall be a minimum of 1 inch in height.

All pull boxes shall have a locking mechanism approved by the Engineer.

No. 7 pull boxes shall be a precast, polymer concrete, fiberglass reinforced, pull box, conforming to the ITS Standard Drawings. A certificate of compliance, in accordance with Subsection 106.05 of the specifications shall be supplied for structural capabilities and materials used in manufacture. Concrete pull boxes and lids shall not be used. The contractor shall submit test results to certify that the pull box sidewalls and lids remain intact when subjected to the loading conditions specified.

No. 7 pull boxes shall be 24 inches in depth and consist of a single-piece box unit. Stacked units shall not be used unless otherwise specified on the project plans or in these Special Provisions. No. 7 pull boxes shall have 6-inch by 12-inch preformed knockouts located in the short ends of the box.

Chipped, cracked or otherwise damaged pull boxes and lids will not be accepted.

Construction Requirements:

The contractor shall restore the surrounding surface conditions back to their original state, including concrete areas.

The contractor shall provide their own locks for No.7 pull box installations until Final Acceptance then TSMO will replace them.

The compaction around the box shall not damage the pull box. The contractor shall replace pull boxes damaged by compaction at no additional cost to the Department.

Method of Measurement:

New No. 7 pull boxes will be measured as a unit for each pull box furnished and installed.

Basis of Payment:

The accepted quantities for No. 7 pull boxes, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including excavation, backfill, compaction and surface restoration.

ITEM 7320456 PULL BOX (NO. 4B)

Description:

The work under this item shall consist of furnishing and installing locking lid pull boxes for highway lighting as shown on the plans and as specified herein.

Materials:

No. 4B pull boxes shall be approximately 13 x 24 x 24 inches and shall conform to the details on Standard Drawing TS 1-12.

The pull boxes shall be made from reinforced concrete. Covers shall be installed and located as shown on the project plans.

Chipped or cracked pull box covers will not be accepted.

Portland cement concrete shall conform to the requirements of Section 1006 for Class S concrete (3,000 PSI). When requested by the Engineer, pull boxes and covers shall be furnished for testing at no additional cost to the Department.

Lids shall be provided with locking devices and the wording “A.D.O.T. ELECTRICAL HIGH VOLTAGE” on the lids. Markings shall be clearly defined and uniform in depth and shall be placed parallel to the long side of the cover. Letters shall be one inch high. The locking mechanism shall consist of a set of jaws which clamp onto the opposing vertical walls of the box and require a deliberately designed tool to engage and disengage. One locking/unlocking tool shall be provided to ADOT after final acceptance. The locking mechanism shall be secured by two ½” – 13 x 1-½” security bolts. These bolts shall be tightened with a torque wrench to the specifications of the manufacturer. The lid shall have a 1-1/2” x ¼” continuous steel band around the perimeter. The lid shall conform to the requirements of ANSI 77-2010.

The pull box shall be equipped with threaded ferrule loops cast into the base of the box and 12” long galvanized steel arms which attach to the loops.

Construction Requirements:

Pull boxes shall be installed in accordance with the requirements of Section 732 of the specifications.

Excavation and backfill shall be in accordance with the requirements of Subsection 203-5 of the specifications.

The contractor shall contact Steve Koebler at 480-589-8250 prior to ordering pull boxes to determine the pattern used for the security bolts and locking/unlocking tool.

Method of Measurement:

Pull Box (No. 4B) will be measured as a unit for each pull box furnished and installed.

Basis of Payment:

The accepted quantities of Pull Box (No. 4B) measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place, including hauling, storage, excavation, backfill, compaction, and surface restoration.

ITEM 7320740 REMOVAL OF EXISTING CONDUCTORS

Description:

This work under this item shall consist of removing existing ADOT lighting conductors and conductors from other electrical systems as found in existing conduits as shown on the project plans and as specified herein.

Construction Requirements:

The contractor shall remove existing conductors in such a manner to avoid damaging existing conduits and pull boxes.

In the event that the contractor finds additional conductors within the conduit system besides the conductors called out to be removed on the Plans, the contractor shall immediately stop work so that the Engineer can identify what the additional conductors are and whether they should remain in place or be removed.

The contractor shall repair all conduits damaged as a result of removing the conductors at no additional cost to the Department.

Removed conductors shall become the property of the contractor.

Method of Measurement:

Removal of existing conductors will be measured by the linear foot of conductor removed as follows:

(A) From center to center of pull boxes;

(B) From edge of foundation to center of pull box;

(C) From edge to edge of foundation;

(D) From end of conduit to center of pull box; and

(E) From end to end of conduit when no pull boxes are used.

Basis of Payment:

The accepted quantity of removal of existing conductors, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place.

No measurement or direct payment will be made for removing conductors in poles, sign structures, inside existing buildings, and pull boxes, the cost being considered as included in the cost of the contract items.

ITEM 7320765 SINGLE MODE FIBER OPTIC CABLE (12 FIBERS)
ITEM 7320788 SINGLE MODE FIBER OPTIC CABLE (6 FIBERS)

Description:

The work under these items shall consist of the installation and testing of 12 or 6 Single Mode Fiber Optic (SMFO) cable at the locations shown on the plans.

Material Requirements:

(A) SMFO Cable (12 or 6):

The branch SMFO cable (12 or 6) shall be of loose tube construction, filled with a water-blocking material, and constructed by a certified ISO 9001 or 9002 manufacturer. Fiber optic

cable shall be dielectric and comply with the requirements of REA PE-90, except as modified by the following requirements:

(B) Technical Requirements:

(a)	Number of fibers:	12 or 6 as specified
(b)	Cladding diameter:	125 ±1.0 µm
(c)	Core-to-cladding offset:	≤0.8 µm
(d)	Cladding non-circularity:	≤1.0 percent
(e)	Maximum attenuation:	
(i)	≤0.35 dB/km at 1310 nm,	
(ii)	≤0.25 dB/km at 1550nm	
(f)	Microbend attenuation	
(i)	1 turn, 1.25-inch dia.:	≤0.5 dB at 1550 nm
(ii)	100 turns, 3 foot dia.:	≤0.05 dB at 1310 nm
(g)	Mode-field diameter (matched cladding):	
(i)	9.3 ±0.5 µm at 1310 nm	
(ii)	10.5 ±1.0 µm at 1550 nm	
(h)	Maximum chromatic dispersion:	
(i)	≤3.2 ps/(nm x km) from 1285 nm to 1330 nm	
(ii)	<18 ps/(nm x km) at 1550 nm	
(i)	Fiber polarization mode dispersion:	≤0.5 ps/(km)1/2
(j)	Fiber coating: Dual layered, UV cured acrylate	
(k)	Coating diameter: 245 µm ±10 µm	
(l)	Minimum storage temperature range:	-40 to 158 degrees Fahrenheit
(m)	Minimum operating temperature range:	-40 to 158 degrees Fahrenheit

Construction Requirements:

No fiber optic cable shall be installed until the pull boxes and cabinets through which fiber cables will pass or terminate have been approved for fiber optic cable installation.

Installation of fiber optic cable shall be continuous and without splices between allowable splice points as identified on the Plans and these special provisions. The contractor shall perform all final length measurements and order cable accordingly.

(A) Cleaning Existing Conduit:

No more than one week prior to installation of fiber optic cable, all new and existing conduits in which fiber optic cable is to be installed shall be cleared/cleaned by pulling through a metal-disc mandrel with a diameter of 90 percent of the conduit inside diameter for PVC conduit, or a ball mandrel with a diameter of 80 percent of the conduit inside diameter for HDPE. The conduit may be brushed or swabbed, if deemed necessary, prior to pulling the mandrel through the conduit. Where cable is to be installed by the contractor over existing cables that remain in place, conduit clearing/cleaning is not required.

(B) Installation Procedures:

The contractor shall ensure that the cable is protected from dragging or scraping on sharp edges and excessive bending. The contractor shall not cause the cable to violate the minimum bending radius for which the cable was designed, as specified by the cable manufacturer. In the event the contractor violates the minimum bending radius, the entire length of cable from the previous splice point shall be removed from the project and a new cable shall be pulled, at no additional cost to the Department.

Fiber optic cables shall be pulled through conduit with a device designed to provide a firm hold on the exterior covering and the central strength member of the cable. Cable shall not drag on the ground or pavement and be guided into conduits to avoid contact with sharp edges.

The contractor shall ensure that the tensile load on the cable does not exceed the manufacturer's allowed maximum tensile load by using a break-away tension limiter set below the recommended tensile limit of the cable being pulled and/or a system that provides a means of alerting the installer when the pulling tension approaches the tensile load limit.

During pulling, the cable shall be lubricated at each pull box, as directed by the Engineer. The contractor shall use a pre-lubrication or continuous lubrication method. The lubricant used shall be compatible with the cable jacket, as recommended by the cable manufacturer. Liquid detergent shall not be used.

The contractor shall use a pre-lubrication or continuous lubrication method. Lubricant quantity for each pull shall be as follows:

$$Q = 0.0008 \times D \times L$$

Where:

- Q = is the quantity of lubricant in gallons
- D = is the diameter of the conduit in-inches
- L = is the length of the pull in feet

The contractor shall supply documentation identifying the manufacturer's recommendation for maximum pulling tension and speeds, and these values shall not be exceeded. The contractor shall have this documentation on site during each fiber optic cable installation pull. If the contractor fails to continuously lubricate the cable, the work shall be stopped until a meeting is held between the contractor and the Engineer to discuss why the terms of this specification are not being met. No compensation for the work stoppage shall be given.

Use of equipment required to install cable, including equipment to limit pull-tension and speed will be incidental to these items. All installation equipment will remain the property of the contractor.

(C) Cable Slack & Coiling:

In all locations where fiber optic cable enters an existing or new No. 7 or No. 9 pull box, cable slack shall be loosely looped into a circular shape, using the rack and hook system integral to the wall of the No. 7 or No. 9 pull box.

Each new fiber optic cable shall be attached to the rack and hook system with industry standard nylon cable ties. Cables should be looped independently of one another. Cable ties shall encompass the cable loops of one cable per cable tie, applying ties to each cable individually. Cable ties shall be tightened to prevent cable slippage, but not as to deform or damage the cable sheath.

No. 7 and No. 9 pull boxes without splice closures shall provide a minimum of 25 feet of slack in each cable passing through the pull box, unless otherwise noted on the project plans or in the Special Provisions.

(D) Test Requirements:

Fiber optic cable shall meet the following test requirements.

(1) Pre-Installation Testing:

The contractor shall inspect all cable upon delivery, and prior to installation. The Cable shall be tested on the reel using an OTDR per the following section prior to installation.

(2) Post-Installation Testing:

After installation and splicing of fiber optic cable, the contractor shall perform the following tests:

Power Meter Test:

The contractor shall conduct Power Meter Tests for each fiber to measure installed fiber cable attenuation, demonstrate connectivity, and correct splicing. The contractor shall perform Power Meter Tests on each fiber strand terminated with connectors utilized in circuits, in accordance with Method A.3 of TIA/EIA-526-7 – “Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant” and submit test results for each fiber to the Engineer.

The contractor shall submit proof of calibration of the power meter equipment dated less than a year prior to use on this project.

Power meter tests shall be conducted after all cable has been installed, all splices have been made, all fiber optic pigtails have been installed, and all break-outs have been installed. Testing shall be conducted at the cable ends in one direction for all fiber strands using 1310 nm wavelength. The testing shall include a test summary spreadsheet included in the following path:

https://azdot.gov/business/engineering-and-construction/its-references

OTDR Tests:

The contractor shall conduct bi-directional tests using an OTDR in accordance with EIA/TIA-455-8 for each fiber. The contractor shall demonstrate that the attenuation for each fiber, splice, and connector, individually complies with the requirements of the project Special Provisions. The contractor shall test each fiber at 1310 nm and 1550 nm using a launch cable of a length recommended by the OTDR manufacturer. The contractor shall submit OTDR traces for approval and clearly annotate the location of each splice and identify the measured loss. The contractor shall submit proof of calibration of the OTDR meter equipment dated less than a year prior to using it on this project.

The contractor shall test all fibers in all splice enclosures the contractor works in, whether existing or new, including dark fibers.

The contractor shall identify unacceptable losses and take corrective actions at no additional cost to the Department. Failed splices shall be remade and re-tested for compliance. The contractor shall replace cable in its entirety that is not compliant with these special provisions, at no additional cost to the Department.

Following completion of all testing and approval by the Department, the contractor shall compile and submit organized test notebooks reflecting the post-installation tests, in electronic form (PDF) on a flash drive to the Engineer. These notebooks shall include a fiber test summary sheet that includes, at a minimum, the parameters shown in the following path:

https://azdot.gov/business/engineering-and-construction/its-references

The contractor shall submit an electronic copy of the actual OTDR traces, and any software applications required for the Department to view the files.

Method of Measurement:

The 12 SMFO Cable or 6 SMFO Cable will be measured by the linear foot for each cable furnished and installed; it will be measured horizontally along the route from center of pull box to center of pull box, or center of pull box to center of foundation.

Basis of Payment:

The accepted quantity of 12 SMFO Cable or 6 SMFO Cable, measured as provided above, will be paid for at the contract unit price per foot, which shall be full compensation for the work, complete in place, and successfully tested.

No measurement or direct payment will be made for pull tape, lubricant, labels, conduit cleaning and sealing or testing.

No measurement or direct payment will be made for cable that is below ground in vertical conduit stub-ups or for slack cable in pull boxes.

ITEM 7340100 CONTROL CABINET:
ITEM 7340101 CONTROL CABINET (POLE MOUNTED):
ITEM 7340103 CONTROL CABINET (WALL MOUNTED):

Description:

The work under these items consists of the installation of various types of control cabinets at the locations identified in the plans.

Materials:

Cabinets shall conform to the following:

(A) Control Cabinet

(1) General:

Control Cabinet (ITEM 7340100) shall be as shown in ADOT Standard Drawing FM-3.01 and FM 3.02 and shall be ground-mounted. Cabinet identification decals are not required.

Bolts, nuts, washers, screws, hinges, and hinge pins shall be stainless steel, unless otherwise specified.

(2) Control Cabinet Foundation:

The foundation for control cabinets shall be constructed as shown on ADOT ITS Standard Drawing FM-3.21.

The contractor shall furnish and install all wire, cable, connectors, and other incidental materials through the foundation to the cabinet necessary to connect all equipment to be incorporated in or connected to the work to form a properly operating and fully functioning unit.

The contractor shall construct foundations in accordance with the requirements of Subsection 731-3.02 of the specifications. The contractor shall stake all locations and receive the Engineer's approval of cabinet location and orientation prior to excavation of the foundation.

(3) Control Cabinet Housing:

Control cabinet housing shall be ventilated NEMA 3 weather-resistant with the top of the enclosure crowned, to prevent standing water. Overall appearance and dimensions shall be as shown in the ITS Standard Drawings, as indicated on the project plans or Special Provisions. The outside surface of the control cabinet shall have a smooth, uniform, natural, unpainted aluminum finish.

The enclosure, doors, two lifting eyes, gasket channels and supports welded to the enclosure and doors shall be fabricated of 0.125-inch minimum thickness 5052-H32 sheet aluminum. Bolted-on supports shall be either the same material and thickness as the enclosure or shall be

0.105-inch thick (minimum) steel. The side panels and filter shell shall be fabricated of 0.080-inch minimum thickness sheet aluminum.

Each control cabinet shall be provided with two lifting eyes. Each lifting eye opening shall have a minimum diameter of 0.75-inch. Each lifting eye shall be able to support a load of 1,000 pounds.

Exterior seams for the enclosure and doors shall be continuously welded. Welds shall be neatly formed and free of cracks, blow holes, and other irregularities. Edges shall be filed to a minimum radius of 0.03125-inch. Exterior cabinet welds shall be accomplished by the gas Tungsten arc Tungsten Inert Gas (TIG) process only. For the TIG process, the ER5356 (AlMg-5) 5% Magnesium, Aluminum alloy welding rod, conforming to AWS A5.10 requirements shall be used for welding on aluminum. Procedures, welders, and welding operators shall conform to the requirements and practices in AWS B3.0 and C5.6 for aluminum. Internal cabinet welds shall be done by either the gas metal arc Metal Inert Gas MIG (also known as Gas Metal Arc Welding (GMAW)) or the gas tungsten arc TIG process.

An anodic coating shall be applied to aluminum surfaces after the surface has been cleaned and etched. The cleaning and etching procedure shall be to immerse in inhibited alkaline cleaner at 159.8 degrees Fahrenheit for 5 minutes (in a mix of 6 to 8 ounces per gallon to distilled water) then rinsed in cold water and etched in a sodium solution at 150.8 degrees Fahrenheit for 5 minutes (0.5-ounce sodium fluoride, plus five ounces of sodium hydroxide mix per gallon to distilled water). The surface shall again be rinsed in cold water and then degreased in a 50 percent, by volume, nitric acid solution at 68 degrees Fahrenheit for 2 minutes. Finally, the surface shall be rinsed in cold water.

The anodic coating shall conform to MIL-A-8625F (Anodic Coatings for Aluminum and Aluminum Alloys) for Type II, Class I Coating except the outer housing surface coating shall have a 0.0007-inch minimum thickness and a 0.952 ounces per square inch minimum coating weight. The anodic coating shall be sealed in a 5 percent aqueous solution of nickel acetate (pH 5.0 to 6.5) for 15 minutes at 210.2 degrees Fahrenheit.

The control cabinet door frames shall be double-flanged on all four sides and shall have strikers to hold tension on and form a firm seal between the door gasket and the frame. The dimension between the door edge and the enclosure external surface when the door is closed and locked shall be 0.156 + 0.08 inch.

Gaskets shall be provided on door openings and shall be dust-tight. Gaskets shall be 0.25-inch minimum thickness, closed-cell neoprene or silicone, and shall be permanently bonded to the metal. If neoprene is used, the mating surface of the gasket shall be covered with a silicone lubricant to prevent sticking to the mating metal surface. A gasket top channel shall be provided to support the top gasket on the door to prevent gasket gravitational fatigue.

No bolts shall protrude through the cabinet top or walls. Inside and outside edges of the cabinet shall be free of burrs.

The control cabinet housing shall have single front and rear doors, each equipped with a lock. The handles shall have provisions for padlocking in the closed position. Each handle shall be 0.75-inch minimum diameter stainless steel with a minimum 0.50-inch shank. The padlocking

attachment shall be placed at 4 inches from the handle shank center to clear the lock and key. An additional 4-inch minimum gripping length shall be provided.

The latching mechanism shall be a 3-point draw-roller type. The center catch and push-rods shall be cadmium plated, Type II Class 1. Rollers shall have a minimum diameter of 0.75-inch with nylon wheels and steel ball bearings. The push rods shall be turned edgewise at the outward supports and have a cross-section of 0.25-inch thick by 0.75-inch wide, minimum. The center catch shall be fabricated from 0.140-inch steel, minimum.

When the door is closed and latched, the door shall be locked. The lock and lock support shall be rigidly mounted on the door. In the locked position, the bolt throw shall extend a minimum of 0.25-inch into the latch-cam area. A seal shall be provided to prevent dust or water entry through the lock opening.

Locks shall be consistent and compatible with current ADOT control cabinet maintenance keys. The key shall be removable only in the locked position. One key shall be furnished with each lock. All parts of the locking mechanism shall be stainless steel. Locks shall have rectangular spring-loaded bolts. Bolts shall have a 0.281-inch throw and shall be 0.75 inches wide by 0.75 inches thick (tolerance is +/- 0.035 inches).

The rear door shall be provided with louvered vents. The louvered vent depth shall be a maximum of 0.25-inch. A removable, reusable air filter shall be housed behind the door vents. The filter shall cover the vent opening area. A filter shell that fits over the filter and provides mechanical support for the filter shall be furnished. The shell shall be louvered to direct the incoming air downward. The shell sides and top shall be bent a minimum of 0.25-inch to contain the filter. The filter resident in its shell shall be held firmly in place with a bottom bracket and a spring-loaded upper clamp. No incoming air shall bypass the filter. The bottom filter bracket shall be formed into a waterproof sump with drain holes to the outside of the housing. The filter shall be 16 inches wide x 12 inches high x 0.875 inches thick, and compatible with the control cabinet the filter is serving. The intake (including filter with shell) and exhaust areas shall pass a minimum of 100 cubic feet of air per minute.

Two-bolt per leave hinges shall be provided to bolt the enclosure to the door. The housing shall have 4 hinges. Each hinge shall be 3.5-inch minimum length and have a fixed pin. The pin ends shall be welded to the hinge and ground smooth. The pins and bolts shall be covered by the door edge and not accessible when the door is closed.

Front and rear doors shall be provided with catches to hold the doors open at both 90 and 180 ± 10 degrees. The catch minimum diameter shall be either 0.375-inch for plated steel or aluminum rods or 0.25-inch for stainless steel. The catches shall hold the door open at 90 degrees in a 60 mile per hour wind acting at an angle perpendicular to the plane of the door.

The contractor shall furnish and install pressure-sensitive, permanent identification decals on load center cabinets, as shown in the ITS Standard Drawings. The decals shall be 3- inch tall, Series C, Gothic letters and shall be top-grade, glass-beaded, reflective black letters on a silver or chrome background.

(4) DIN Rail Shelf:

A 4U DIN rail shelf shall be included and capable of supporting power supplies, an Ethernet

Switch, a fiber termination panel, power supplies, and other control cabinet accessories.

(5) Ventilation Fan:

Control cabinets shall be equipped with two electric fans with ball or roller bearings and each with capacity of 100 cubic feet of free air flow per minute. Fans shall be mounted within the interior of the cabinet and vented.

Fans shall be thermostatically controlled and shall be manually adjustable to turn on between 32- and 140-degrees Fahrenheit, with a differential between automatic turn on and off of not more than 20-degrees Fahrenheit. It shall be possible to manually adjust the on/off temperature set point in 20-degree Fahrenheit increments. Each fan circuit shall be protected at 125 percent of the fan motor current rating.

(6) Cabinet Lighting:

The control cabinets shall contain two LED light fixtures. The fixtures shall be mounted on the inside top of the cabinet near the front edge and rear edge of the roof so that the front or rear of the control equipment will be illuminated when the corresponding door is open. A door-actuated, refrigerator-type, normally-closed, durable push-button type switch shall automatically turn the appropriate light fixture on and off when the front or rear door is opened and closed.

(B) Control Cabinet (Pole Mounted)

The cabinet (ITEM 7340101) shall be pole-mounted at the locations shown on the plans. The control cabinet shall be a NEMA 3 enclosure constructed of corrosion-resistant materials suitable for outdoor installation and shall be fabricated from aluminum or stainless steel, with a minimum thickness of 0.090 inches for aluminum or equivalent strength. Ventilation, if provided, shall be designed to maintain the NEMA 3 rating. Screens or filters shall be corrosion-resistant.

The cabinet dimensions shall be 18 inches (H) x 12 inches (W) x 6 inches (D).

The cabinet shall include a continuous gasketed door to provide protection against rain, sleet, snow, and windblown dust. The cabinet door shall be hinged and equipped with a lockable latch mechanism. A padlock hasp or keyed lock shall be provided.

All hardware, including hinges, latches, bolts, and mounting brackets, shall be stainless steel. Each cabinet shall include a padlock with an ADOT Master lock key.

The cabinet shall include an internal mounting panel suitable for mounting CCTV PoE injectors and associated network equipment. The cabinet shall be provided with cable entry provisions through the rear or bottom to accommodate conduit or cabling routed internally through the pole. Grommets or bushings shall be provided at all cable entry points to prevent abrasion.

The enclosure shall include an internal back panel for mounting electrical and communication equipment. The back panel shall be removable or adjustable and constructed of aluminum or galvanized steel.

(C) Control Cabinet (Wall Mounted)

The Control Cabinet (Wall Mounted) (ITEM 7340103) shall be surface-mounted to a wall of the inspection building. Cabinet location shall be according to the inspection building plans. The cabinet shall be constructed of aluminum and shall be suitable for indoor installation.

The cabinet dimensions shall be 24 inches (H) x 24 inches (W) x 12 inches (D).

The cabinet shall be provided with a hinged, lockable door and corrosion-resistant hardware. The cabinet shall include a padlock with an ADOT Master lock key.

The cabinet shall include an internal mounting back panel suitable for mounting CCTV PoE injectors and associated network equipment. Cable entry points shall be provided for power, copper Ethernet cabling, and fiber-optic cabling, and shall include grommets or bushings to prevent cable damage. The cabinet shall be designed to accommodate fiber-optic termination hardware or patch panels as required for connection to the building-to-building fiber link.

The cabinet shall be of sufficient size to accommodate all wiring, terminations, and control components required to operate the lane control signal system without overcrowding. The cabinet shall include internal mounting provisions for terminal strips and shall provide adequate space for orderly routing and identification of conductors.
All hardware, including hinges, latches, bolts, and mounting brackets, shall be stainless steel.

The cabinet shall be grounded in accordance with the ADOT Standard Specifications.

(D) Control Cabinet

Construction Requirements:

(A) General

The construction requirements for cabinets shall conform to the following:

Material submittals shall conform to the general requirements of the special provisions.

The contractor shall supply Certificates of Compliance for each control cabinet and each accessory within a control cabinet at the time of delivery of the control cabinet assembly for the following:

(1) Acceptance testing of each supplied component

(2) Physical and functional testing of each module

All cabling entering cabinets shall be routed neatly and secured to prevent strain on connections. Where applicable, separation shall be maintained between power and communication cables in accordance with applicable codes.

PoE injectors, switches, and media converters shall be securely mounted to the cabinet back panel or cabinet racks. Equipment shall be installed to allow adequate airflow and service access.

All PoE injectors, internal wiring, grounding, and fiber-optic terminations within the cabinet shall be installed in a neat and workmanlike manner. All wiring shall be routed and secured to prevent strain on connectors and to maintain clear access to equipment.

Fiber-optic cables entering the cabinet shall be protected and terminated in accordance with manufacturer recommendations.

The contractor shall provide complete wiring diagrams and schematics for all control cabinets at the time of delivery. An electronic copy and one set of 11-inch x 17-inch prints shall be provided with each control cabinet. The wiring diagram shall illustrate circuits and components in detail. Components shall be identified by name or number so as to be clearly noted in the drawings.

The contractor shall transport each control cabinet to the project site and install them as shown on the project plans. Installation shall include:

(1) Grounding the control cabinet to the ground system;

(2) Connecting the control cabinet to the power source;

(3) Completing fiber optic splices and terminations within the control cabinet, as required;

(4) Furnishing and installing necessary mounting hardware (pole-mount, if applicable, to specific control cabinet type).

Field wires and power service cables shall be wired to the control cabinet shown in the project plans. The contractor shall connect the control cabinet and its accessories to the various field devices to be controlled, to form a fully functional system.

Removable caps shall be placed on unused conduits within the control cabinet.

Wire and cable terminations shall only be made at recessed-screw barrier type terminal blocks, unless otherwise specifically noted. No in-line or butt splices shall be made other than at terminal blocks.

Control cabinet equipment shall be mounted on the cage mounting rails, unless otherwise specified.

Equipment, housings, metal conduit, and cabinets (exposed metal, non-current carrying parts) shall be grounded and bonded in accordance with Subsection 732-3.03 and NEC Article 250. The control cabinet’s ground resistance shall be 25 Ohms or less.

Grounding conductors and bonding jumpers shall be connected by exothermic welding, UL listed pressure connectors, UL listed clamps, or other approved UL listed means. Connection devices or fittings that depend solely on soldering shall not be used. Sheet metal screws shall not be used to connect grounding conductors to enclosures.

(B) Control Cabinet

The contractor shall furnish and install silicone caulking or other approved sealant around the base of the control cabinet to form a watertight and dust-proof seal.

(C) Control Cabinet (Pole Mounted)

The Control Cabinet (Pole Mounted) shall be mounted securely using manufacturer-recommended pole mounting brackets or stainless-steel banding. Installation shall not compromise the structural integrity of the pole. The control cabinet shall be installed level and at a mounting height that allows safe access for operation and maintenance.

The contractor shall coordinate with the Engineer prior to installation to confirm cabinet location, mounting height, and fiber connection requirements.

A hole shall be field-drilled in the pole at the cabinet mounting location to allow cabling to enter directly into the cabinet. The hole shall be properly sized, deburred, and treated to prevent corrosion. A grommet or protective bushing shall be installed at the hole to protect cables.

Grounding and bonding shall be provided in accordance with applicable electrical codes and project requirements.

The contractor shall ensure that the completed installation maintains the NEMA 3 rating of the enclosure. All unused openings shall be sealed.

(D) Control Cabinet (Wall Mounted)

The Control Cabinet (Wall Mounted) shall be securely mounted to the wall in the location shown on the plans in the inspection building or as directed by the Engineer, using anchors appropriate for wall construction. The contractor shall install the cabinet plumb and level and at a mounting height that allows safe access for operation, maintenance, and it shall be readily accessible to authorized POE personnel while remaining protected from vehicle impact and unauthorized access.
The contractor shall coordinate with the Engineer prior to installation to confirm cabinet location, mounting height, and fiber connection requirements.

(E) Junction Box Removal and Replacement with New Control Cabinet (Pole Mounted)

The work consists of removing an existing electrical junction box located on the roof of the Administration Building and furnishing and installing a new Control Cabinet (Pole Mounted). The control cabinet will be mounted on a support post of the vehicle inspection canopy structure, as required to accommodate ongoing construction activities. The cabinet location on the canopy support post shall serve as the final permanent location upon completion of all project improvements.

The new Control Cabinet (Pole Mounted) shall function as a splice point between existing field-installed cables associated with truck sorting and weigh-in-motion (WIM) systems and new cables required to serve temporary equipment during construction. The control cabinet shall also serve as the permanent junction point for future extension of these systems to their ultimate equipment location within the Administration Building.

The systems served by this control cabinet include equipment owned and operated by IRD, which provides advanced truck sorting and weigh-in-motion information along I-10 in advance of the Port of Entry.

The contractor's work includes removal and disposal of the existing junction box, furnishing the new control cabinet, mounting the control cabinet to the canopy support post, and providing all required mounting hardware, brackets, supports, grounding, and incidental materials necessary for a complete and secure installation. The contractor shall coordinate the control cabinet location and mounting details with the Engineer to ensure compatibility with the canopy structure and to maintain continuity of system operations.

Extension of existing rigid metal conduits under the canopy to the new control cabinet is included in the contractor's scope of work and will be paid for under item 7320130.

Furnishing, installation, pulling, splicing, termination, testing, and commissioning of all cables within those conduits and within the new control cabinet will be performed by others and not included in the contractor's scope of work.

The contractor shall provide physical access, cabinet space, and mounting accommodations necessary to allow others to install and perform cable installation and splicing operations. No cable work, system interconnection, testing, or activation of truck sorting or weigh-in-motion systems is required under this item.

Any work not explicitly described herein related to cables, splicing, terminations, system functionality, or operational performance of truck sorting or weigh-in-motion systems shall be performed by others and is excluded from the contractor's scope.

(F) Control Cabinet Assembly Testing Requirements:

Control cabinet assemblies shall successfully pass the following tests, demonstrating that they operate properly when assembled and connected to the equipment they serve. The contractor shall make corrective actions for equipment failing a test at no additional cost to the Department. All the time for the tests and time taken for the failures shall be completed within the contract time. No additional time will be given for test failures.

For each control cabinet installed, the contractor shall test each cabinet using the Control Cabinet Assembly Test Form provided on the ADOT website and submit a complete and organized set of forms in electronic PDF format to the Engineer.

Method of Measurement:

Control Cabinet will be measured as a unit for each control cabinet assembly installed and successfully tested.

Control Cabinet (Pole Mounted) will be measured as a unit for each control cabinet assembly installed and successfully tested.

Control Cabinet (Wall Mounted) will be measured as a unit for each control cabinet assembly installed and successfully tested.

Basis of Payment:

The accepted quantity of Control Cabinet, measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, including mounting hardware, internal supports, coordination, and testing.

The accepted quantity of Control Cabinet (Pole Mounted), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, including mounting hardware, internal supports, coordination, and testing.

The accepted quantity of Control Cabinet (Wall Mounted), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, including mounting hardware, internal supports, coordination, and testing.

Foundation for the control cabinet will be measured and paid for under their respective bid items.

ITEM 7340105 CONTROL CABINET FOUNDATION

Description:

The work under this item consists of the installation of control cabinet foundation at the location identified in the plans.

Materials:

Materials shall conform to the requirements of Subsection 731-2 of the specifications and ADOT ITS Standard Drawing FM-3.23.

Concrete shall be Class S and shall have a required 28-day compressive strength of 3,500 pounds per square inch.

The contractor shall furnish all necessary materials and equipment to construct the foundations including anchor bolts, mounting hardware, caulking, wire, cable, connectors, conduit and associated fittings, concrete, ground rods and grounding conductors, studs, and other items necessary to install the foundations.

Anchor bolts shall conform to the requirements of Subsections 606-2.05 and 1004-4 of the specifications. Anchor bolts shall be used, as shown in the ADOT ITS Standard Drawings FM-3.22.

Construction Requirements:

The foundation for Control Cabinet shall be constructed similar to what is shown in the ADOT ITS Standard Drawing FM-3.23. Foundation and bolt patterns and other details may vary based on individual manufacturer requirements.

The contractor shall furnish and install all wire, cable, connectors, and other incidental materials through the foundation to the cabinet necessary to connect all equipment to be incorporated in or connected to the work to form a properly operating and fully functioning unit.

The contractor shall construct foundations similar to the requirements of Subsection 731-3.02 of the specifications. The contractor shall stake all locations and receive the Engineer's approval of cabinet location and orientation prior to excavation of the foundation. If the cabinet is to be located on a greater than 2:1 slope, the placement of the foundation shall be offset from the pull box along the mainline conduit or other structure so that they are not in a perpendicular line to the roadway.

(A) Electrical Equipment:

All equipment, housing, metal conduit, and cabinets (all exposed metal, non-current carrying parts) shall be grounded and bonded in accordance with the NEC, Article 250. Grounding conductors or bonding jumpers shall be connected by exothermic welding, UL listed pressure connectors, UL listed clamps, or other approved UL listed means. Connection devices or fittings that depend solely on solder shall not be used. Sheet metal screws shall not be used to connect grounding conductors to enclosures.

Splices shall not be made in cables and wiring that is part of the work. Terminations shall be only at recessed-screw, barrier type terminal blocks unless otherwise specifically noted in each instance. No in-line splices shall be made at any point in the work other than at such terminal blocks.

All field wires, power service, and communication cable shall be wired to the cabinets in accordance with the design.

(B) Grounding and Reinforcing:

The contractor shall meet the requirements of 732-3.03 of the specifications to bond the cabinet to ground.

All cabinet foundations shall have a copper clad steel ground rod with a diameter of at least 5/8-inch, in the foundation. The ground rod shall be installed so that it extends into the surrounding undisturbed earth for a minimum of 10 feet. The ground rod shall be driven into place through the sleeve in the foundation. The ground rod shall extend approximately 3-inches above the foundation. The ground rod shall be connected to the cabinet and the grounding system using ground clamps on the rod and an approved lug connector in the cabinet.

The cabinet’s ground resistance shall be 5 Ohms or less.

If the contractor prefers to use an electrolytic grounding system, it must meet the following specifications. The electrolytic grounding system must be 100-percent self-activating/sealed and maintenance free. The ground system shall hygroscopically extract moisture from the air to activate the electrolytic process; no additions of chemicals or water are permitted. The electrolytic ground shall not use any hazardous material to improve grounding performance. The electrolytic system must be UL listed with a minimum life expectancy of 30 years.

Foundations shall be monolithic with the exposed surfaces formed and finished to present a neat, smooth appearance. The bottom of each foundation shall rest on undisturbed earth and the top shall be level. This shall include concrete pads.

Forms for the concrete shall be rigid and securely braced in place. Templates shall be used to properly position and hold in place necessary conduit, anchor bolts, and the ground rod.

Immediately prior to pouring the concrete, both forms and the earth shall be thoroughly moistened, and the concrete allowed to cure at least 12 hours and shall be hardened sufficiently to prevent damage before the forms are removed. The contractor shall backfill and build slope per the plans.

The contractor shall install the new cabinets and transformers and the associated accessories to the new foundation to form a fully functional system. Caulking is required along the base of the cabinet.

Method of Measurement:

Control Cabinet Foundation will be measured as a unit for each foundation constructed.

Basis of Payment:

The accepted quantity of Control Cabinet Foundation, measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for work, complete in place, including the cost of excavation, concrete, conduit, grounding systems, anchor bolts, caulking, connectors, backfilling, and grading.

ITEM 7360110 LUMINAIRE (HORIZONTAL MOUNT) (INSTALL ONLY):

Description:

The work under this item shall consist of installing relocated horizontal mount light emitting diode (LED) luminaires as shown on the project plans and as specified herein.

Materials:

All horizontal mount LED luminaires that were salvaged by the removal operation performed under Item 2020175 (See Item 2020175) shall be used for this work. If the fixture is damaged during removal, the contractor shall replace it in kind to and install per the plans.

Each luminaire shall include 7-pin photocell with shorting cap.

The luminaire and all components shall be rated for operation in ambient temperatures from -40 degrees Celsius to + 50 degrees Celsius (-40ºF to 122ºF). All components shall be UL listed and comply with applicable ANSI standards.

Construction Requirements:

The luminaires salvaged through the removal operation performed under Item 2020175 shall be installed on the new light poles at the locations shown on the plans, in accordance with the requirements specified herein and to the satisfaction of the Engineer.

The luminaire shall mount to a standard 2” (2-3/8” Outside Diameter) pipe tenon. The mounting shall allow at least ± 2.5 degrees of adjustment for leveling.

The horizontal mount LED luminaires shall be installed in accordance with manufacturer recommendations.

Method of Measurement:

LED luminaires will be measured as a unit for each luminaire installed.

Basis of Payment:

The accepted quantities of LED luminaires, measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place, including mounting hardware, and electrical wiring.

ITEM 7370410 ELECTRICAL SYSTEM (LANE CONTROL SIGNAL SYSTEM):

Description:

The work under this item shall consist of furnishing and installing a complete Lane Control Signal System for directing commercial vehicle movements at the Port of Entry (POE). The system includes signal indications, signal poles, foundations, control wiring, and manual control devices. The system shall provide visual lane control instructions to commercial vehicle drivers at the weigh scale, scale, and bypass approach lanes. All signal indications shall be manually operated by POE staff, including the weighmaster and inspection personnel, as described herein.

The Lane Control Signal System shall include two functional components:

(1) Primary Scale Signal Indication

(2) Scale Lane and Bypass Lane Indications

All work shall be performed in accordance with these specifications and sections 730, 731, 732, 733, and 734 of the specifications and ADOT Standard Drawings.

Materials:

(A) General

Signal indications shall be standard 12-inch LED signal indications conforming to the ADOT Standard Specifications. Signal heads shall be two-section assemblies displaying red and green circular indications.

Signal poles shall be Type A and Type G signal poles in accordance with ADOT Standard Drawings and Standard Specifications. Pole foundations shall be designed and constructed in accordance with ADOT requirements. Signal poles and foundations shall be included in this item.

A control cabinet in the inspection building shall be used to house terminal blocks, power distribution, and control wiring necessary to operate all lane control signal indications.

Manual control devices and control wiring shall be provided as specified herein.

All conductors provided under this item shall be copper and rated for the intended application.

The following materials shall be furnished and installed under this item and shall conform to the ADOT Standard Drawing and specifications:

- Pole (Type A) (10') – 1 Each
- Pole (Type J) – 1 Each
- Pole Foundation (Type A) – 1 Each
- Pole Foundation (Type J) – 1 Each
- Mast Arm (40 Ft.) (Straight or Tapered) – 1 Each
- Traffic Signal Face (Type E) – 3 Each
- Traffic Signal Mounting Assembly (Type II) – 2 Each
- Traffic Signal Mounting Assembly (Type III) – 1 Each
- Conductors (4–Conductor IMSA 19-1 Cables & No. 10 Ground) – Lump Sum
- Toggle Switches – 3 Each
- Miscellaneous Cabinet Equipment – Lump Sum

(B) Control Wiring

All signal indications described herein shall be wired to a common control location in the weighmaster booth. Wiring from the traffic signal faces to the weighmaster control location shall be included in this item.

Control wiring under this item shall include only wiring necessary for manual signal operation and interconnection between manual control devices (toggle switches) and the signal heads. Toggle switches and mounting hardware shall be included in this item.

Conduit and pull boxes shall be provided under separate bid items.

(C) Toggle Switches

Toggle switches shall be heavy-duty, maintained-contact type, clearly labeled to indicate function, and mounted in approved enclosures or panels accessible to authorized POE staff. Toggle switches shall be rated for a minimum of 15 amperes at 120 volts AC and shall be listed by a nationally recognized testing laboratory.

Toggle switches shall be provided at locations designated for the weighmaster and inspection personnel. Toggle switches shall be of the two-position (ON/OFF) type, providing positive mechanical detent in each position. Switch handles shall be metal and sized for repeated manual operation by POE personnel.

Toggle switches shall be mounted in NEMA 4 rated enclosures when installed in areas subject to moisture, dust, or wash-down conditions. Enclosures shall be constructed of corrosion-resistant material and provided with gasketed covers.

Each toggle switch shall be clearly labeled to indicate the signal function controlled, including the associated lane or signal indication and the corresponding red and green indication states.

Construction Requirements:

The work under this item shall include the installation, mounting, interconnection, and operational configuration of the Lane Control Signal System, including signal indications, signal poles and foundations, manual control devices, and associated control wiring, in accordance with the Contract Documents and specifications, complete and operational as specified.

(A) Primary Scale Signal Indication:

Provide one (1) two-section 12-inch LED signal head displaying red and green circular indications mounted on a Type A signal pole. The signal shall be located such that it is clearly visible to commercial vehicle drivers positioned on the weigh scale.

The signal indication shall normally display a red indication. The weighmaster shall manually toggle the indication to green using a dedicated control switch to instruct the commercial vehicle driver to proceed from the scale. The signal shall display green for a minimum of 10 seconds and return to a red signal indication. At all other times, the red indication shall remain illuminated.

The signal pole and foundation shall be included in this item.

(B) Scale Lane and Bypass Lane Indications

Provide two (2) two-section 12-inch LED signal heads mounted on a traffic signal mast arm supported by a Type J signal pole. One signal head shall indicate whether the scale lane is open or closed, and the second signal head shall indicate whether the bypass lane is open or closed.

A green indication shall indicate that the respective lane is open to commercial vehicle traffic. A red indication shall indicate that the respective lane is closed. Both signal indications shall be manually operated by the weighmaster using dedicated toggle switches.

The mast arm, signal pole, and pole foundation shall be included in this item.

(C) Toggle Switches

Toggle switches shall be installed at locations designated for the weighmaster/inspection personnel, or directed by the Engineer. Switch mounting height and location shall provide safe, convenient, and unobstructed access for authorized POE staff.

Wiring from the traffic signal heads to the toggle switches shall be included in this item and shall be neatly routed, secured, and terminated in accordance with the Contract Documents. Conductors shall be identified and labeled to correspond with the controlled signal indication.

Toggle switches shall directly control the corresponding signal indications such that operation of the switch results in immediate and positive change between red and green signal displays. No automatic operation is permitted. The green times for the primary signal indication shall

be timed to avoid continuous green indication if the toggle switch is not reverted to red by the respective officers.

All toggle switches shall be tested for proper operation after installation and prior to final acceptance.

(D) Control Wiring

All signal indication wiring shall be routed to the weighmaster booth for termination. Conductors shall be neatly routed, secured, and permanently labeled to identify the associated signal indication and control function.

The weighmaster booth shall serve as the common point of interconnection between the signal indications and the manual toggle switches. Equipment inside the weighmaster booth shall be arranged to allow safe access for inspection, troubleshooting, and future maintenance without modification to the associated wiring.

(E) Testing

Upon completion, the contractor shall demonstrate proper operation of all lane control signal indications and manual controls to the Engineer and POE staff prior to final acceptance.

Method of Measurement:

Electrical System (Lane Control Signal System) will be measured on a lump sum basis as a single complete unit of work.

Basis of Payment:

The accepted quantities of Electrical System (Lane Control Signal System), measured as provided above, will be paid for at the contract lump sum price, complete in place, which shall be full compensation for the work complete in place, including traffic signal heads, signal poles, pole foundations, toggle switches, control wiring, and mounting hardware.

Conduit and pull boxes will be measured and paid for under their respective bid items.

No additional compensation will be made for coordination, labeling, or testing, the cost being considered as included under this item.

ITEM 7370452 MISCELLANEOUS ELECTRICAL (VIDEO SURVEILLANCE SYSTEM)

Description:

The work under this item shall consist of installing, mounting, connecting, testing, supporting, and placing into service a complete IP-based Video Surveillance System (VSS) in accordance with the Contract Documents and as directed by the Engineer.

The Video Surveillance System shall support continuous monitoring, recording, and playback of video from closed-circuit television (CCTV) cameras, including visible-spectrum, infrared

(IR), and thermal-imaging camera types, to provide reliable operation under varying lighting and environmental conditions.

The contractor shall furnish and install all required cameras, network recorders, power infrastructure, media converters, communications cabling, and field mounting hardware, and shall install all Department-furnished equipment required for system operation.

The Department will furnish and configure all network switches and Video Management Software (VMS). The contractor shall not configure network devices, switches, VLANs, or VMS settings, but shall provide all physical mounting, power connections, grounding, and cable terminations necessary to support Department configuration activities.

The Video Surveillance System shall be compatible with existing Department Traffic Operations Center (TOC) monitoring, maintenance, and operational practices.

The Video Surveillance System shall be compatible with Department-furnished central monitoring workstations and authorized remote client access used by the Department Traffic Operations Center (TOC).

The Video Surveillance System shall be scalable and capable of supporting a minimum of forty (40) cameras initially, with the ability to expand system capacity by not less than twenty-five percent (25%), subject to equipment capabilities.

(F) References:

The Video Surveillance System shall comply with the following standards:

FCC Part 15, Class A
IEEE 802.3 – Ethernet Standards
ONVIF Profiles S, G, and T
NEMA 250 – Enclosures for Electrical Equipment
NFPA 70 – National Electrical Code

(G) Performance Requirements:

The system shall support dual-stream video recording capability, at a minimum, consisting of:

(3) High-resolution stream: Minimum 1080p (1920 × 1080) at 30 frames per second

(4) Low-resolution stream: Minimum 480p (640 × 480) at 10 frames per second

Video retention periods shall be configured by the Department in accordance with operational requirements. All recorded videos shall include timestamps and associated metadata.

(H) Reliability

System components shall support continuous operation under outdoor environmental conditions encountered at the project site. Cameras shall provide usable imagery from full

daylight conditions through 0 lux (total darkness) using integrated infrared or thermal capabilities, where such features are provided by the camera type.

Materials:

(A) General:

The following materials shall be furnished and installed under this item and shall conform to the requirements shown on the plans and specified herein:

- WV-S8574L i-PRO 4 Head Camera – 12 Each
- WV-S8573L i-PRO 3 Head Camera – 3 Each
- WV-X25700-V2LN i-PRO Exterior Dome Camera – 13 Each
- WV-X35402-F2L i-PRO Indoor Dome Camera – 3 Each
- WJ-NX510K i_PRO Network Recorder – 1 Each
- WJ-HXE410 i-PRO Extension Unit – 1 Each
- PoE Injectors – 8 Each
- Media Converters – 6 Each
- CCTV Camera Cabling – Lump Sum
- Associated mounting hardware – Lump Sum
- Miscellaneous Cabinet Equipment – Lump Sum

(B) Department-Furnished Equipment

The Department will furnish the following equipment to the contractor for installation:

(1) Video Management Software (VMS), furnished and licensed by the Department.

(2) Field Hardened Ethernet Switch (AZNET)

Department-furnished equipment will be provided to the contractor for installation and integration. The contractor shall be responsible for receiving, handling, storing, protecting, installing, interconnecting, and testing all Department-furnished equipment as part of a complete and operational system. The contractor shall contact Jason Velge at jvelge@adot.gov or at (520) 827-0380 (cell) to coordinate the order and installation of the Field Hardened Ethernet Switch.

The Department will perform all configuration of network equipment, switches, NVRs, storage devices, and VMS.

(C) Contractor-Furnished Equipment

The contractor shall furnish all remaining materials, labor, equipment, and incidentals required to install, physically integrate, test, and place the Video Surveillance System into full operation, including:

(1) Closed-Circuit Television (CCTV) Cameras, consisting of four (4) camera types, furnished complete with camera-specific housings and manufacturer-recommended mounting accessories:

i. WV-X35402-F2L - Indoor camera (Administration Building), as shown on the plans.

ii. WV-X25700-V2LN Outdoor dome camera (POE exterior areas and Inspection Building)

iii. WV-S8573L or WV-S8574L Outdoor multi-directional cameras (POE exterior areas)

(2) Power-over-Ethernet (PoE) injectors, 2-port or 8-port.

(3) Media Converters. Media converters shall provide a minimum of DC 54 V: 470 mA/Approx. 25.4 W (Class 4 device).

(4) Network and Recording Equipment, including the following:

i. Network Video Recorder (NVR): WJ-NX510K

ii. Storage Extension Unit: WJ-HXE410

(5) Category 6 (Cat 6) Ethernet cabling between media converters or PoE switches and the CCTV cameras, including terminations and labeling.

(6) Power infrastructure, raceways, disconnects, grounding, bonding, and surge protection required to provide power to cabinets and field equipment.

(7) Conduit systems, pull boxes, fittings, and supports, along the walls and ceiling of the inspection building and administration buildings, except where re-using existing.

(8) Mounting hardware and accessories including brackets, fasteners, anchors, and supports. Contractor shall coordinate all mounting brackets and types with the Physical Security staff and architect prior to purchasing any equipment. Mounting brackets and types vary depending on each camera placement and location.

(9) 19-inch equipment racks for mounting Department-furnished switches, NVRs, and storage equipment.

(10) Uninterruptible Power Supply (UPS) units for rack-mounted equipment.

Construction Requirements:

(A) Pre-Installation Coordination

Prior to installation of CCTV equipment, the contractor shall coordinate with the Engineer and Physical Security staff to schedule installation, integration support, and testing activities. Coordination shall include confirmation of camera locations, cabinet and rack readiness, power availability, communications equipment and cabling completion, and access requirements. The contractor shall provide advance notice to the Engineer of proposed installation and testing dates to allow for Physical Security participation. Installation and

testing activities shall be sequenced to support Stand-Alone Testing (ST), Subsystem Testing (SST), and System Acceptance Testing (SAT) without disruption to existing Department operations.

(B) Installation

Install all equipment in accordance with manufacturer recommendations and approved submittals. Outdoor cameras shall be mounted on corrosion-resistant hardware with sealed cable entries. All cabling shall be neatly routed and labeled in accordance with TIA/EIA-606. The contractor shall install communications equipment at the locations specified in the plans.

(C) Wiring and Connections

Provide all new raceways required for camera and equipment connections. No splices shall be permitted in Cat 6 cabling between cameras and network equipment.

(D) Submittals

Submit product data, shop drawings, rack layouts, camera locations, and cable routing details for review. Provide test documentation and operation and maintenance manuals upon completion.

(E) Testing

The contractor shall support Stand-Alone Testing (ST), Subsystem Testing (SST), and System Acceptance Testing (SAT). Testing shall verify proper installation, power delivery, connectivity, and camera operation. ADOT will perform configuration-dependent testing activities.

Final acceptance of the Video Surveillance System shall be subject to successful completion of System Acceptance Testing and approval by the Engineer.

(F) Documentation

The contractor shall provide documentation of all installed equipment, cable routing, rack layouts, and test results.

Record drawings shall be provided showing final camera locations, cabinet locations, equipment rack layouts, and conduit routing.

(G) Training

The contractor shall provide a minimum of 4-hours of on-site comprehensive training to a minimum of six (6) designated Department personnel covering installed hardware, physical maintenance, and system overview, excluding network and VMS configuration.

(H) Warranty

The contractor shall provide a minimum one-year warranty on all contractor-furnished materials and workmanship.

Method of Measurement:

Miscellaneous Electrical (Video Surveillance System) will be measured on a lump sum basis as a single complete unit of work.

Basis of Payment:

The accepted quantity of Miscellaneous Electrical (Video Surveillance System) will be paid for at the contract lump sum price, which price shall be full compensation for the work, including CCTV cameras, network video recorder, extension unit, PoE Injectors, media converters, cabling, racks testing support, documentation, training, and installation of Department furnished items which include ethernet switches and the video management software.

Control cabinets, conduits, pull boxes, and fiber optic cable will be measured and paid for under their respective bid items.

ITEM 8050003 SEEDING (CLASS II)

The work under this item shall consist of furnishing all materials, preparing the soil, applying Class II seed, establishing, and maintaining the seeded areas along with final mulch cover.

Areas to be seeded are those disturbed or unvegetated areas listed herein, shown on the plans, called for in the contractor's erosion/sediment control plan, Nonpoint Source (NPS) pollution control plan, Stormwater Quality Protection Plan (SQPP), Stormwater Runoff Pollution Control Plan, Decentralized Stormwater Management Plan, Stormwater Runoff Mitigation Plan, Stormwater Management Plan (SWMP), Biotechnical Erosion Control Plan, Post-Construction Stormwater Management Plan (PCSMP), Integrated Vegetation Management Plan (IVMP), Functional Landscape Ecological Restoration Plan, Assisted Migration Plan (AMP), or designated by the Engineer. All construction support activities disturbed unpaved temporary construction access, unpaved on-site staging, unpaved on-site material storage, and unpaved on-site stockpiling areas shall ultimately be seeded unless otherwise stabilized by equivalent permanent stabilization measures. If not seeded, the equivalent permanent stabilization measures shall be evaluated by a Construction Professional Landscape Architect (PLA) and approved by the Engineer. Unless otherwise prohibited by environmental permit, seeding is required to stabilize the unpaved disturbed dry area within the Waters of the U.S. Seeding area below the Ordinary High-Water Mark (OHWM) shall exclude any definable low flow channel(s). The seeding area below the OHWM shall also exclude the area directly under bridge(s).

Seeding may be included as part of a landscape project as specified in Section 807 or used for erosion control as part of a Storm Water Pollution Prevention Plan (SWPPP) as specified in Subsection 104.09 of the specifications, or both.

In either case, seeding shall be accomplished in two (2) stages. The first stage shall consist of tillage; furnishing and applying compost, chemical fertilizer, and sulfur; furnishing and planting the contract-specified seed mix; and furnishing, applying, and affixing final mulch cover. The second stage, beginning after the first stage has been accepted by the Engineer, shall be a 45-calendar-day period during which time the contractor shall be responsible for maintaining and stabilizing the seeded and mulched areas, and restoring damaged or eroded areas.

Seeding construction shall be completed before Substantial Completion. The 45-calendar-day seeding maintenance period, including any re-seeding work if required after Initial Seeding Construction Acceptance, shall be completed before project Final Acceptance.

Seeding used as part of a SWPPP shall be completed before Substantial Completion, or sooner as required in the SWPPP. The 45-calendar-day seeding maintenance period, including any re-seeding work if required after Initial Seeding Construction Acceptance, shall be completed before project Final Acceptance.

No time extension will be granted for seeding not completed as specified herein.

Seeding areas below the OHWM shall be exempted from the 45-calendar-day maintenance period requirement.

An on-site pre-activity seeding construction meeting shall be coordinated by Construction PLA. The necessity of half-acre (0.5 acre) sample demonstrative area of Class II Seeding shall be verified for the seeded areas greater than five (**>** 5) acres excluding shoulder build-up areas (edge of pavement build-up areas). The contractor shall guarantee in writing to furnish all suitable equipment for soil tillage, seeding, and mulching during pre-activity seeding construction meeting as evaluated by a Construction PLA, as well as approved by the Engineer.

2.0 Materials:

2.01 General:

The contractor shall avoid persistent herbicide residues contamination in the soil. Soil sterilant herbicides, especially bare-ground herbicides with long-lasting soil persistence, shall be prohibited for use in all unpaved project areas that will be seeded. Pre-emergence herbicides shall be prohibited from unpaved project areas that will eventually be seeded.

Appropriate documentation, as specified below, shall be submitted to the Engineer a minimum of 30 calendar days before the start of a scheduled seeding activity. No materials shall be delivered to the site until the documentation has been approved by the Engineer.

Unless otherwise specified, Certificates of Compliance conforming to the requirements of Subsection 106.05 of the specifications shall be provided for all materials.

The contractor shall also provide tests from accredited laboratories for all materials, as specified herein. Should the contractor perform its own testing, such test results shall also be provided to the Engineer.

2.02 Seed:

(A) General Requirements:

The species, variety, and strain of seed (designated elsewhere herein as contract-specified seed) shall be as shown on the plans or as specified herein. The contract-specified seed shall be obtained from seed suppliers through harvesting of wildland collections, or field-grown seeds grown prior to or during the contract period.

A Certificate of Analysis for each seed species shall be furnished to the Engineer at least four (4) weeks prior to the seeding construction. No seed shall be furnished to, or delivered to, the project until approved by the Engineer and Roadside Development. The Certificates of Analysis shall contain the following information for each seed sample: the test results of the Fifty States Noxious Weed list, all seeds including weed seeds listed, purity and germination, tetrazolium test results, when used and any pathology found to be present. The sample testing, when available for the native plant species, shall use the rules for testing seeds published by the “Association of Official Seed Analysts” or the “Society of Commercial Seed Technologists.”

If the samples indicate species listed as noxious, restricted, or invasive, the lot will be rejected or evaluated for use on the project. The list of noxious, restricted, or invasive species is located at Roadside Development and linked to the following website:

http://www.azdot.gov/business/engineering-and-construction/roadway-engineering/roadside-development

Within 30 calendar days after the award of contract, the contractor shall submit the name of the seeding subcontractor to be used, along with written confirmation from seed suppliers and/or collectors, on their letterhead, that the source(s) for the contract-specified seed has been secured. A minimum of three (3) separate confirmation letters from seed suppliers, providers, and/or collectors shall be presented through the Engineer for a Construction PLA’s evaluation within the context of reliable sources. If any of the contract-specified seed is expected to be unavailable prior to the time specified for seeding, in accordance with Subsection 2.02(B) below, the contractor shall notify the Engineer at this same time.

The seed shall be delivered to the project site unmixed in standard, sealed, undamaged containers for each seed species. Each container shall be labeled in accordance with the appropriate provisions of the Arizona Revised Statutes and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the scientific genus, species, subspecies/varieties or strains of seed, the percentage of germination, purity, weed content, and testing information. Unless otherwise approved by Roadside Development Section through the Engineer, the date of analysis for Tetrazolium Test (TZ) shall not be more than 15 months prior to the delivery date from a seed provider/supplier. A Certificate of Analysis from an accredited seed-testing laboratory, and conforming to Subsection 106.05 of the specifications, shall accompany each container of seed.

Unless otherwise approved by Roadside Development through the Engineer, weed content of the contract-specified seed mix shall not exceed 0.5 percent (≤ 0.5%).

In addition to Federal Seed Act Regulations, unless otherwise approved by Roadside Development through the Engineer, the contamination of seed lots from the following noxious / invasive plant species shall not be permitted.

NOXIOUS / INVASIVE WEEDS WATCH LIST FOR THE CONTAMINATED SEED LOTS	
SCIENTIFIC NAME	**COMMON NAME**
Amaranthus retroflexus	Redroot Amaranth / Redroot Pigweed / Red-Rooted Pigweed / Rough Pigweed
Bassia scoparia **(syn.** *Kochia scoparia***)**	Kochia / Fireweed
Bothriochloa bladhii **(syn.** *Andropogon bladhii / Andropogon caucasicus / Andropogon intermedius / Bothriochloa caucasica / Bothriochloa intermedia***)**	Caucasian Bluestem
Bothriochloa ischaemum	Yellow Bluestem
Brassica tournefortii	Sahara Mustard / Mediterranean Mustard / Mediterranean Turnip / Prickly Turnip
Bromus tectorum	Cheatgrass / Downy Brome / Broncograss / Downy Chess / Soft Chess / Drooping Brome
Cynodon dactylon **(syn.** *Capriola dactylon***)**	Bermudagrass / Devilgrass
Centaurea melitensis	Malta Star-thistle / Napa Star Thistle / Tocalote
Cenchrus spinifex **(syn.** *Cenchrus incertus / Cenchrus pauciflorus / Cenchrus parviceps***)**	Field Sandbur / Coastal Sandbur / Common Sandbur
Chorispora tenella	Crossflower / Purple Mustard / Blue Mustard / Musk Mustard / Beanpodded Mustard / Tenella Mustard
Cuscuta spp**.**	Dodder / Angel Hair / Devil's Hair / Devil's Ringlet / Goldthread / Hairweed / Lady's Laces / Strangleweed / Witch's Hair / Amarbel
Eragrostis lehmanniana	Lehmann Lovegrass
Euphorbia esula	Leafy Spurge / Green Spurge / Wolf's Milk
Euphorbia prostrata **(syn.** *Chamaesyce prostrata / Euphorbia chamaesyce***)**	Prostrate Spurge / Prostrate Sandmat / Ground Spurge / Blue Weed
Onopordum acanthium	Scotch Thistle / Cotton Thistle
Pennisetum ciliare **(syn.** *Cenchrus ciliaris***)**	Buffelgrass / African Foxtail Grass
Physalis spp**.**	Ground Cherry / Jerusalem Cherry / Strawberry Tomato
Salsola kali subsp**.** *tragus* **(syn.** *Salsola iberica***)**	Russian Thistle / Tumbleweed

NOXIOUS / INVASIVE WEEDS WATCH LIST FOR THE CONTAMINATED SEED LOTS	
SCIENTIFIC NAME	**COMMON NAME**
Setaria faberi	Japanese Bristlegrass / Giant Foxtail
Setaria pumila **(syn.** *Chaetochloa glauca / Chaetochloa lutescens / Panicum glaucum / Setaria glauca***)**	Yellow Foxtail / Pigeon Grass / Yellow Bristlegrass
Setaria viridis	Green Bristlegrass / Pigeon Grass / Wild Millet / Green Foxtail
Solanum physalifolium **(syn.** *Solanum physalifolium / Solanum sarachoides / Solanum villosum***)**	Hoe Nightshade / Argentine Nightshade / Green Nightshade / Hairy Nightshade

The contractor shall provide all seed tag labels to the Engineer. No payment will be made for seeds until tag labels and Certificates of Analysis from all seeds to be used on the project have been submitted as specified.

Both the contractor and the seed supplier shall store seed under dry conditions, at temperatures of between 35 °F and 120 °F, and out of direct sunlight. Prior to using the seed, the contractor, as well as seed supplier, shall both provide a certification letter to the Engineer verifying that the seed was stored as specified herein.

Legume seed shall be inoculated with appropriate bacteria cultures approved by the Engineer, in accordance with the culture manufacturer’s instructions.

Tetrazolium staining shall be acceptable to test for germination and hard seed. Cut or fill testing will not be allowed. As directed by the Engineer, seeds with an expiration date past the acceptable test date or not meeting the specified conditions for storage shall be retested by the contractor. The Engineer may perform random sampling of seeds throughout the project. Mixing of the specified seed at the project site shall be under the supervision of the Engineer.

Application rates of seed as specified are for Pure Live Seed (PLS). PLS is determined by multiplying the sum of the percent germination of seeds, including hard or dormant seeds, by the percent purity.

Diversified seed mix species and the PLS rates are shown in Table 1 below**:**

TABLE 1			
DIVERSIFIED SEED MIX—for All Unpaved Disturbed Areas, Unvegetated Areas, Receiving Pervious Areas (RPA), Decentralized Stormwater Management Areas, and/or Designated Areas			
Botanical Name	**Common Name**	**PLS Rate (Pounds Per Acre)**	**Per Pound Value for Substitution (see text)**

Asclepias tuberosa	Butterfly Milkweed	2	$250
Aristida purpurea	Purple Threeawn	2	$40
Bothriochloa barbinodis	Cane Beardgrass	1	$45
Bouteloua curtipendula cv. Vaughn *	Sideoats Grama	3	$13
Bouteloua eriopoda	Black Grama	0.5	$130
Bouteloua gracilis cv. Hachita	Blue Grama	1	$15
Baileya multiradiata	Desert Marigold	2	$75
Bouteloua rothrockii	Rothrock Grama	0.5	$60
Calliandra eriophylla	Fairy Duster	2	$100
Coreopsis tinctoria	Plains Coreopsis	2	$20
Digitaria californica	Arizona Cottontop	1	$45
Dalea purpurea	Violet Prairie Clover	1.5	$50
Distichlis stricta **(syn.** Distichlis spicata**)**	Desert Saltgrass	0.5	$60
Encelia farinosa	Incienso Brittlebush	5	$40
Eragrostis intermedia	Plains Lovegrass	0.2	$100
Eschscholtzia mexicana	**Mexican Poppy**	1	$40
Gaillardia aristata	**Blanket Flower**	2	$20
Gaillardia pulchella	**Firewheel**	0.75	$20
Hilaria berlangeri	Curly Mesquitegrass	3	$45
Lesquerella gordonii	Gordon's Bladderpod	1	$40
Lupinus bicolor	Miniature Lupine	2	$65
Lupinus sparsiflorus	Desert Lupine	1	$90
Lupinus succulentus	Arroyo Lupine	3	$30
Oryzopsis hymenoides **(syn.** Achnatherum hymenoides**)**	Indian Ricegrass	3	$20
Penstemon parryi	Parry's Beardtongue	2	$90
Sporobolus airoides	Alkali Sacaton	0.3	$30
Sphaeralcea ambigua	Desert Globemallow	1	$55
Senna covesii	Coues' Cassia	3	$50
Sporobolus cryptandrus	Sand Dropseed	0.2	$10
Setaria macrostachya	Plains Bristlegrass	1	$25
Trifolium willdenovii	Tomcat Clover	1	$90
Vulpia microstachys	Small Fescue	0.5	$40
Zinnia acerosa	Dwarf White Zinnia	0.5	$150

Estimated Per Acre Subtotal Value for Seeds Only	$ 2,780.00

***** Niner may be furnished if Vaughn is determined by Roadside Development as unavailable from seed sources.

(B) Seed Substitution:

No substitution of the contract-specified seed will be allowed unless evidence is submitted documenting that the contractor has made a diligent effort to obtain the contract-specified seed from either seed suppliers or collectors, and that the contract-specified seed will not become available prior to the time specified for seeding in the contractor's approved construction schedule.

The contractor may also request a substitution if the lowest price available for the contract-specified seed is greater than two (2.0) times the value shown in Table 1. The contractor shall provide documentation from a minimum of three (3) seed suppliers or collectors supporting such a request. Documentation shall include copies of the invoices from each supplier or collector. Only those invoices obtained within three (3) weeks of the time specified for seeding in the contractor's approved construction schedule will be acceptable.

Should a substitution of the contract-specified seed be requested for one of the two (2) reasons specified above, and the contractor's documentation is approved by the Engineer, the Department's Roadside Development Section will specify an alternate seed within five (5) working days of the Engineer's approval of the contractor's documentation. The alternate seed will only be allowed when there is an insufficient quantity of the contract-specified seed, as determined in the previous two (2) paragraphs, for the areas to be seeded as called for herein or as required for erosion control. The contractor shall obtain and apply the alternate seed, as required, to all such remaining areas. Unless otherwise approved by the Engineer, the approved alternate seed will only be allowed until such time that contract-specified seed meeting the availability and price requirements specified herein can be provided.

For each pound of contract-specified seed not provided by the contractor, the value indicated in Table 1 will be deducted from the contract amount. The price per pound for the alternate seed selected by the Department, as specified above, will be determined in accordance with Subsection 109.04(D)(2) of the specifications. No additional adjustments will be made for substituting the alternate seed, the costs being considered as included in the contract item for seeding.

No payment will be made for areas seeded with unapproved seed. No payment will be made for areas seeded until the entire approved seed mix (including all authorized seed substitutions/adjustments) is executed.

2.03 Tacking Agent:

Tacking agent shall be a naturally occurring organic compound and shall be non-toxic. The tacking agent shall be a product typically used for binding soil and mulch in seeding or erosion

control operations. Approved types shall consist of mucilage or gum by dry weight as active ingredient obtained from guar or plantago. The tacking agent shall be labeled indicating the type and mucilage purity.

The contractor shall have the tacking agent swell volume tested by an approved testing laboratory using the USP method. The standard swell volume shall be considered as 30 milliliters per gram. Material shall have a swell volume of at least 24 milliliters per gram. Certified laboratory test results for homogenous consistency shall be furnished to the Engineer for each shipment of tacking agent to be used on project areas. Tacking agent rates shall be adjusted to compensate for swell volume variation. Material tested with lesser swell volume shall have the tacking agent rate increased by the same percentage of decrease in swell volume from the standard 30 milliliters per gram. Material tested with greater volume may reduce tacking agent rates by the same percentage of increase in swell volume from the standard 30 milliliters per gram. Tacking agent shall be pure material without starches, bentonite, or other compounds that would alter the swell volume test results of mucilage, or the effectiveness of the tacking.

2.04 Thermally-Refined Wood Fiber:

Wood cellulose fiber mulch shall conform to the requirements of Subsection 805-2.03 of the Standard Specifications, except as modified herein, and shall be from thermo-mechanically processed wood, processed to contain no growth germination inhibiting factors. The mulch shall be from virgin wood, manufactured, and processed so the fibers will remain in uniform suspension in water under agitation to form homogenous slurry. Paper products will not be considered as virgin wood. The thermally-refined wood fiber mulch shall have the properties shown in Table 2 below:

TABLE 2	
Virgin Wood Cellulose Fiber	90% min.
Recycled Cellulose Fiber	10% max.
Ash Content	0.8% +/-0.3%
pH	4.5 +/-1.0
Water Holding Capacity	10 : 1 (water : fiber) Min.

2.05 Weed Free Straw Mulch:

(A) General:

Straw mulch including barley straw shall conform to the requirements of Subsection 805-2.03 of the Standard Specifications, except as modified herein, and shall be from the current season's crop. A letter of certification from the supplier shall be required stating that the straw was baled less than twelve (12) months from the delivery date. Additionally, a bill of sale for straw material shall be presented for a Construction PLA's evaluation within context from reliable sources through the Engineer.

All straw, including hydraulically applied straw, shall be free from noxious weeds in compliance with the standards and procedures of the North American Weed Management Association (NAWMA) or the Arizona Crop Improvement Association (ACIA). The contractor

shall provide documentation, including a transit certificate, and appropriate labels and/or marking twine, from the ACIA or NAWMA that straw materials to be used for mulch are free of noxious weeds. The straw shall be accompanied by the certification, labels and/or marking twine at the time of delivery to the project site. Straw delivered to the project without such information will be rejected and promptly removed from the project.

Rye straw and oat straw will not be acceptable.

(B) Weed Free Straw Mulch for Hydraulic Application:

Hydraulically applied straw mulch shall be wheat, barley, or rice straw processed into various particle sizes, mixed with water and tacking material, and applied as a non-clogging slurry using a hydroseeder. A minimum of 70 percent (70%) of wheat, barley, or rice straw in the mix shall be not less than 1/2 inch ± 1/4 inch in length. Straw particles may be longer provided that the particles can be used with the selected hydroseeder without clogging. Hydraulically applied straw mulch, as furnished by the manufacturer, may contain up to ten (10) percent paper or cotton materials in dry weight. Hydraulically applied straw mulch shall also contain 20 percent (20%) of wood fiber in dry weight. The combined dry weight percentage of paper, cotton, and wood fiber materials together shall be not less than 15 percent (15%) nor more than 30 percent (30%) of the hydraulically applied straw mulch. The date of installation of hydraulically applied straw mulch cover shall be less than twelve (12) months from the date of production. The date of production of hydraulically applied straw mulch material shall be presented for a Construction PLA's verification through the Engineer. All hydraulically applied straw mulch material shall also meet the requirements of Subsection 805-2.05 (A) stated above.

2.06 Slow-release Chemical Fertilizer and Sulfur:

Chemical fertilizer shall conform to the requirements of Subsection 805-2.06 of the specifications and shall be the kind hereafter specified. Fertilizer shall be composed of a mixture of one part sulfur-coated urea 25-4-8, one-part monoammonium phosphate 11-52-0-, and one-part methylene urea 38-0-0. The sulfur-coated urea, a blended fertilizer 25-4-8, shall have approximately 80 percent (80%) of the nitrogen defined as slow release, and contain five percent (5%) Iron, ten percent (10%) sulfur and trace amounts of zinc and manganese. The result shall be a 24-18-2 chemical blended fertilizer, as specified herein.

In addition to the fertilizer mixture, agricultural sulfur compounds, comprised of between 80 percent (80%) and 96 percent (96%) sulfur, shall be applied at the rate specified in Section 3.02. Chemical fertilizer and sulfur shall not be applied to the seeding area below the OHWM.

2.07 Water:

Water shall be free of oil, acid, salts, or other substances which are harmful to plants. All non-potable water shall be tested for its suitability for seeding/planting with the water quality-related concerns of salinity, pathogens, and contaminants. The water quality testing result shall be presented for a Construction PLA's evaluation through the Engineer. An Arizona Guide to Water Quality and Uses (web link: ***https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1610.pdf***)

Figure 8, Water Quality and Uses Triangle shall be considered as reference for testing result evaluation and approval.

Water Quality Standards for seeding on construction projects that reach or exceed one-contiguous-acre (≥ 1 contiguous acre**)** permit threshold soil/ground disturbance defined under current Arizona Pollutant Discharge Elimination System (AZPDES) Construction General Permit (CGP) and/or National Pollutant Discharge Elimination System (NPDES) CGP**:**

(A) On Arizona Non-Native Americans Land **(Non-Tribal)**, water quality for seeding construction within 0.25-mile buffer zones of Impaired and/or Outstanding Arizona Waters (OAWs) shall meet the standards of current AZPDES CGP, as well as requirements of these Special Provisions.

The web link of ADEQ's eMaps within the State of Arizona:
https://www.azdeq.gov/emaps

(B) Water quality for seeding construction within Arizona Native Americans Land **(Tribal)** shall meet the standards of EPA-established or approved Total Maximum Daily Loads (TMDLs) under current NPDES CGP, as well as requirements of these Special Provisions.

The web link of EPA-established or approved TMDLs within the State of Arizona:
https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools

The source of water shall be approved by a Construction PLA through the Engineer prior to use.

2.08 Compost:

Compost in bulk or furnished in containers or bags, shall consist of composted organic vegetative materials, and may contain worm castings. No animal manures or city biosolids shall be used in the composting or added to the compost. Prior to being furnished on the project, compost samples shall be tested for the specified microbiological and nutrient conditions, including maturity and stability, by a testing laboratory approved for testing organic materials. During pre-activity seeding construction meeting, compost test written results submitted to the Engineer for approval shall be within nine (9) months from the date of the official lab test.

Compost material shall be dark brown in color with the parent material composted and no longer visible. The structure shall be a mixture of fine and medium size particles and humus crumbs. The maximum particle size shall be within the capacity of the contractor's equipment for application to the constructed slopes. The odor shall be that of rich humus with no ammonia or anaerobic odors.

Bulk Compost shall also meet the requirements of Table 3:

TABLE 3	
Cation Exchange Capacity (CEC)	Greater than 45 meq/100 g
Carbon : Nitrogen Ratio (C : N)	Less than 20 : 1
pH (of extract)	5.0 – 8.5
Organic Matter Content	Greater than 30%
Total Nitrogen (not added)	Greater than 1%
Micronutrients (added)	S, Ca, Mg, Na, Fe, Al, Mn, Cu, Zn, B
Maturity Index	Greater than 50% on Maturity Index at a 10 : 1 ratio
Stability Indicator, CO_2 Evolution: Biologically Available C (BAC)	Less than 4mg CO_2-C/g OM/day is desirable. From 4 through 8mg CO_2-C/g OM/day is acceptable. Greater than 8mg CO_2-C/g OM/day is not acceptable.
The CEC lab testing method shall refer to EPA9081 at the web link: *http://epa.gov/osw/hazard/testmethods/sw846/pdfs/9081.pdf*	

Bulk compost is preferred and shall be applied to areas designated for seeding at the specified rate of 15 cubic yards per acre prior to final tillage for incorporation into the soil seedbed. Unless otherwise approved by the Engineer, bulk compost shall be engaged to all areas where equipment can be operated for final tillage in order to incorporate into the soil seedbed. Bulk compost may be substituted with hydraulically applied compost for small sized projects that cover less than five (< 5) acres of Class II Seeding as evaluated by a Construction PLA, as well as approved by the Engineer.

The volume of bulk compost shall be measured and documented for Construction PLA's verification and approval through the Engineer.

In areas where bulk compost cannot be applied by broadcast methods, compost shall be applied hydraulically as per the approval of the Engineer. Hydraulically applied compost shall be applied at the rate of 5 cubic yards (or 135 cubic feet) per acre to mini-benched slopes or on other approved areas for incorporation into the soil seedbed. For seeding areas 3:1 and flatter where bulk compost cannot be employed, hydraulically applied compost shall be utilized at the rate of 5 cubic yards (or 135 cubic feet) per acre as per the approval of the Engineer. Hydraulically applied compost may also be combined with seed, soil amendments, and fertilizer in the same slurry prior to the final mulch cover with the approval of the Engineer.

The volume of hydraulically applied compost shall be measured and documented for Construction PLA's verification and approval through the Engineer.

Hydraulically applied compost shall meet the requirements of Table 4 below:

TABLE 4	
Cation Exchange Capacity (CEC)	Greater than 40 meq/100 g *
Carbon : Nitrogen Ratio (C : N)	Less than 20 : 1
pH (of extract)	5.0 – 8.5
Organic Matter Content	Greater than 35%
Total Nitrogen (not added)	Greater than 1%
Micronutrients (added)	S, Ca, Mg, Na, Fe, Al, Mn, Cu, Zn, B
Stability Indicator, CO_2 Evolution: Biologically Available C (BAC)	Less than 4mg CO_2-C/g OM/day is desirable. From 4 through 8mg CO_2-C/g OM/day is acceptable. Greater than 8mg CO_2-C/g OM/day is not acceptable.
Moisture Content by Weight	From 15% through 25%
The CEC lab testing method shall refer to EPA9081 at the web link: *http://epa.gov/osw/hazard/testmethods/sw846/pdfs/9081.pdf*	

* When CEC is from 50 meq/100 g through 55 meq/100 g, in order to be approved, the contractor may add 100 pounds additional Hydraulically Applied Compost per acre to compensate for the lower-than-standard CEC value.

Compost shall not be applied to the seeding area below the OHWM. The choice between bulk compost and hydraulically applied compost shall be evaluated, as well as coordinated by a Construction PLA according to specific project conditions with the approval of the Engineer.

2.09 Soil Conditioners:

Soil conditioners, when required, will be as shown in the Special Provisions.

3.0 Construction Requirements:

3.01 General:

Seeding Operations:

At least two (2) weeks prior to beginning seeding, the contractor shall complete and submit a batch mix and seed application form to the Engineer for approval. The batch mix form will be supplied by the Engineer.

After acceptance of the form stated above, the Engineer and contractor in coordination with Construction PLA shall determine a half-acre (0.5 acre) sample demonstrative area to be seeded and mulched prior to applying seed to the remainder of the project. Both regular straw mulch and hydraulically applied straw mulch shall be applied to the sample demonstrative area, as determined during on-site pre-activity seeding construction meeting. Both straw

mulches shall be representative of the materials proposed for use on the project. If the seeding and mulching procedures, as well as outcomes, are acceptable by Construction PLA, the contractor shall begin seeding operations as specified herein. Photographic Documentation of half-acre (0.5 acre) sample demonstrative seeded/mulched area shall be recorded and submitted to a Construction PLA, as comparative standard representation (mandatory visual reference) for Seeding Acceptance under Subsection 3.07 stated below.

The contractor shall notify the Engineer at least two (2) days prior to commencing any phase of seeding operations for the remainder of the project.

The equipment and methods used to distribute seeding materials shall provide an even and uniform application of seed, mulch, and other materials at the specified rates.

It is the contractor's responsibility to furnish all suitable equipment for soil tillage, seeding, and mulching at no additional cost to the Department.

Unless specified otherwise in the Special Provisions, seeding operations shall not be performed on undisturbed soil outside the clearing and grubbing limits of the project or on steep rock cuts.

The contractor shall coordinate the seeding operations with the grading operations to determine mobilization frequency as embankment and cut slopes are finished throughout the duration of the project. Seeding shall be done during suitable weather and soil conditions (soil–water and soil–temperature regimes) for tillage and placement of materials. Seeding operations shall not be performed below 35 degrees Fahrenheit (°F). Seeding operations shall not be performed when wind exceeds ten (10) miles per hour or, in the opinion of the Engineer, conditions would prevent uniform application of materials or would carry seeding materials into areas not designated for seeding. If wind exceeds ten (10) miles per hour, the seeding operation shall be evaluated by a Construction PLA and approved by the Engineer. If approved, the contractor shall perform seeding operation close to the ground surface with a hydro-seeding hose and hand-held hose-end sprayer nozzle or other equivalently effective seeding methods to guarantee all seeding materials are applied on the target area without being blown away by wind. The contractor is responsible for protecting ambient air and water quality during the seeding operation.

The contractor shall not expose an area greater than 750,000 square feet (≤17.22 acre) at any one location within the project limits until the seeding proposed for that portion of the project has been installed and accepted by the Engineer. Seeding shall be accomplished within 14 days after slopes and disturbed areas have been completed. Seeding operations shall comply with Subsection 104.09 and the applicable portions of Section 203 of the specifications, and as directed by the Engineer.

Frequent mobilizations may be required to accomplish seeding as specified herein. The Department will consider the cost of such multiple mobilizations to be included in the price bid for the seeding. No adjustments will be made to the contract for the number of seeding mobilization activities. Should the contractor fail to provide seeding for a sub-area as specified herein, the Engineer will immediately notify the contractor of such non-compliance. Should the contractor fail to immediately remedy the unstabilized area, the Engineer may suspend work until such seeding stabilization has been completed or proceed to provide the necessary

seeding stabilization. The entire cost of such work will be deducted from the monies due or to become due to the contractor. In addition, no adjustment to the contract time will be made for suspensions resulting from the contractor's failure to provide seeding for a sub-area within the time periods specified herein.

3.02 Tillage:

Where equipment can operate, the area to be seeded shall be prepared with a ripper bar, chisel plow, or with other devices to provide thorough soil cultivation to the depth specified below. It is the contractor's responsibility to furnish all suitable equipment for soil tillage at no additional cost to the Department.

Where equipment is not suitable for operation, hand tillage and/or other manual methods shall be utilized as approved by the Engineer. Tillage depth shall follow the requirements specified herein in accordance with assessment/measurement from a Construction PLA, as well as acceptance by the Engineer.

For areas too steep to be prepared for seeding after the slope has been completed, as determined by the Engineer, tillage shall be accomplished with appropriate equipment as the slope is being constructed. On slope areas, all tillage shall be horizontal and parallel to the contours of the areas involved in order to create a roughened surface condition to reduce stormwater runoff velocity and volume. All seeding areas suitable for tillage shall be pre-tilled to promote on-site stormwater infiltration and alleviate stormwater surface runoffs, as a part of stormwater peak flow and Volume Reduction Approaches (VRAs). All seeding areas suitable for tillage shall be adequately pre-tilled to minimize pollutant loads anticipated in nonpoint source stormwater runoffs. All project areas eroded shall be restored to the specified condition, grade, and slope as directed prior to seeding.

Cut slopes shall be prepared with ridges and deep tillage or shall be mini-benched so as to detain rainwater/moisture close to its source. On fill slopes, the operations shall be conducted in such a manner as to form minor ridges thereon to assist in retarding runoff associated erosion/pollution and favor germination of the seed through detaining rainwater/moisture close to its source.

Except as specified herein, slopes shall be constructed in accordance with Subsection 203-3.03(B) of the specifications. Cut slopes flatter than 3:1 (horizontal to vertical) shall be tilled a minimum of 12 inches in depth, and fill slopes flatter than 3:1 shall be tilled to a six-inch minimum depth. All slopes steeper than 3:1, and areas which could potentially be affected by underground utilities, shall be tilled to a minimum six (6) inches in depth, and left in a roughened surface condition as they are constructed.

Track-walking or imprinting of rocky new fill slopes through mechanical methods in lieu of tillage may be allowable if accepted by a Construction PLA, through the Engineer. All final impression marks generated by track-walking or imprinting shall be horizontal and parallel to the contours of slope areas involved in order to create a roughened surface condition and reduce stormwater runoff velocity, enhance erosion/sediment control, as well as energy/velocity dissipation.

Tillage shall be a minimum of two (2) inches in depth for the first ten (10) feet from the toe of AC wedge including shoulder build-up areas (edge of pavement build-up areas) or from the outside edge of curb and gutter.

Care shall be taken during the seeding operations to prevent damage to existing trees and shrubs in the seeding area in accordance with the requirements of Subsection 107.11 of the specifications.

Tillage may require passing the equipment over the area several times to provide thorough soil cultivation. Furrows from the village shall be no more than 12 inches apart. No work shall be done when the moisture content of the soil is unfavorable to tillage.

All competitive vegetation shall be uprooted prior to seeding and the soil shall be left in a friable roughened surface condition free of clods or large stones over four (4) inches in any dimension, and other foreign material that would interfere with the seeding operation. Exposed stones larger than four (4) inches shall be removed and disposed of in an approved manner prior to grading and seeding. Invasive and non-native weed species shall be eradicated according to the MISCELLANEOUS WORK (CONTROL OF NOXIOUS PLANTS) of these Special Provisions whenever applicable.

All disturbed soil areas covered with existing chipped wood materials and/or native plant residues, which will not interfere with the tillage operation, shall be tilled for incorporation into the soil along with chemical fertilizer, as well as soil amendments (sulfur and compost) prior to final tillage and seeding.

Regardless of the method of seeding application, all areas prepared with tilling shall have chemical fertilizer and soil amendments (sulfur and compost) uniformly applied and incorporated (disked) into the soil prior to final tillage and seeding.

Chemical fertilizer and sulfur shall be applied at the rate of 200 pounds each per acre. Bulk compost shall be applied at the rate of 15 cubic yards per acre.

Unless otherwise approved by the Engineer, bulk compost shall be applied using broadcast methods to all areas where equipment can be operated. For areas where bulk compost cannot be applied by broadcast methods, as evaluated by a Construction PLA and determined by the Engineer, compost shall be applied hydraulically at the rate specified in Section 2.08 above. Hydraulically applied compost shall not be combined with final mulch cover in the same slurry. However, seed, sulfur and fertilizer may be utilized together with hydraulically applied compost in the same slurry with the approval of the Engineer. Final mulch cover shall be installed on top of all seeded areas as a separate construction sub-phase.

Slopes 3:1 and flatter shall have fertilizer, sulfur, and compost tilled/disked into a minimum of the top four (4) inches of the surface. Slopes steeper than 3:1 shall have fertilizer, sulfur, and compost uniformly broadcast for incorporation into the soil as directed by the Engineer. Unless otherwise operated together with hydraulically applied compost for the approved locations, fertilizer and sulfur shall not be applied hydraulically to areas for seeding.

Tillage shall not be applied for the seeding area below the OHWM.

For mini-benched slopes, fertilizer, compost, and sulfur shall be applied at the specified rates with no tillage or incorporation.

Seeding shall not initiate until all tillage areas and/or mini-benched slopes are accomplished as approved by a Construction PLA through the Engineer.

3.03 Seeding:

(A) General:

Drill seeding with straw mulch shall be considered as the preferred method of seed application when practicable. Unless otherwise approved by the Engineer, drill seeding shall be used for all areas with slopes of 3:1 or less.

Hydroseeding shall be the alternative method for seed distribution for slopes in excess of 3:1, and where drill seeding is not practicable or suitable for soil conditions and seed types, as determined by the Engineer.

Seeds not suitable for drill seeding and hydroseeding methods shall be broadcast manually. Areas to be seeded manually shall be completed after the final soil tillage and prior to any drill or hydroseeding.

Regardless of the seeding method(s), the contractor is responsible to guarantee intimate seed-soil contact. Seed application on top of straw mulch cover or hydraulically applied straw mulch cover shall be rejected. To guarantee intimate seed-soil contact, seed application on top of existing exposed chipped wood materials and/or plant residues ground cover shall be rejected.

Final straw mulch cover or hydraulically applied straw mulch cover shall be applied on all seeded areas, as specified in Sections 3.04 and/or 3.05, within 24 hours of seed application. The seeding application shall be accomplished prior to installation of straw mulch cover or hydraulically applied straw mulch cover. Combining the seed application process with the mulching process will not be acceptable. By implementing Low Impact Development (LID) source-control measure, the contractor shall install a final straw mulch cover or hydraulically applied final straw mulch cover to minimize raindrop splash erosion and wind erosion/dust, as close as possible at the source of disturbance to protect all seeded areas. Thermally-refined wood fiber shall not be utilized solely as final mulch cover to protect all seeded areas. Seeds shall be neither exposed nor visible after the installation of straw mulch cover or hydraulically applied straw mulch cover.

Unless otherwise specified in the Special Provisions, Class II seeding areas shall not be watered after planting.

(B) Drill Method:

After the tillage and incorporation of fertilizer, sulfur, and compost is completed and accepted by the Engineer, seed shall be planted with a drill seeder capable of accurately metering the

specific seed mix. Use of a drill seeder shall not damage the prepared seedbed and shall provide a soil cover over the planted seed.

Seed shall be planted approximately 1/4 inch deep, with a maximum depth of 1/2 inch. The distance between the furrows produced using the drill process shall not be more than eight (8) inches. If the furrow openers on the drill exceed eight (8) inches, the area shall be drilled twice. Seeding shall be done with grass seeding equipment with double disc openers, depth bands, packer wheels or drag chains, rate control attachments, seed boxes with agitators and separate boxes for small seeds. Seed of different sizes shall be sowed from at least two (2) separate boxes adjusted or set to provide the planting rate as specified.

(C) Hydroseed Method:

Areas and seed types not suitable for drill-seeding, as determined by the Engineer, shall be hydroseeded. The contract-specified seed shall be applied in a slurry containing 200 pounds of thermally-refined wood fiber and a minimum of 40 pounds tacking agent per acre. Seed shall not be in the slurry for more than 30 minutes. Hydroseeded areas shall have 100 percent (100%) coverage from all directions as evaluated by a Construction PLA, as well as approved by the Engineer. Hydroseeded areas shall also be mulched, as specified in Sections 3.04 or 3.05, within 24 hours of application of the seed.

(D) Manual Application:

Manually applied seeds shall be broadcast evenly to produce uniform distribution over the seeded areas.

3.04 Applying Straw Mulch as Final Mulch Cover on Top of Seeded Areas:

(A) General:

Within 24 hours after each area is planted, straw mulch shall be uniformly applied at the minimum rate of 2 1/2 tons per acre for areas to be crimped and tacked, and minimum two (2) tons per acre for tacked-only areas. Except for edge of pavement build-up areas, and unless otherwise specified by the Engineer, straw mulch shall be applied to all seeded areas. Areas to receive hydraulically applied straw mulch, if directed by the Engineer, shall be mulched in accordance with Section 3.05.

During seeding and mulching operations, care shall be exercised to prevent drifting and displacement of materials. Mulch material, which is placed upon trees and shrubs, roadways, structures, and upon any areas where mulching is not specified, or which is placed in excessive depths on mulching areas, shall be removed as directed. Mulch materials which are deposited in matted condition shall be loosened and uniformly spread to the specified depth over the mulching areas. Any unevenness in materials shall be immediately corrected by the contractor. In addition, the contractor shall minimize production of dust or other airborne particulate matter during application of straw mulch, either by moistening the straw, modifying equipment with misters, or through other means approved by the Engineer.

Except as specified in the next paragraph, straw mulch applied to seeded areas shall be immediately affixed by crimping and tacking after application. No mulch shall be applied to seeding areas which cannot be crimped and/or tacked by the end of each day. Any drifting or displacement of mulch before crimping and/or tacking shall be corrected by the contractor at no additional cost to the Department.

Crimping shall not be required for areas that are steeper than 3:1. Crimping may also be waived, when specifically directed by the Engineer, for drill seeded or hydroseeded areas with rocky conditions or other areas deemed unsuitable by the Engineer for crimping. Straw mulch applied to such areas shall only be tacked, as specified in Subsection 3.04(C) below.

Prior to the application of a tacking agent, protective covering shall be placed on all structures and objects where stains would be objectionable. All necessary precautions shall be taken to protect the traveling public and vehicles from damage due to drifting spray.

(B) Anchorage by Crimping:

Except as specified above in 3.04(A), crimping shall be required for all straw mulched areas. Straw mulch shall be anchored into the soil with a heavy disc. Discs shall be flat and serrated, with at least 1⁄4-inch thickness having dull edges, and spaced no more than nine (9) inches apart. Straw mulch shall be anchored to a depth of at least two (2) inches and shall not be covered with an excessive amount of soil. Anchoring operations shall be across the slopes where practical, with no more than two (2) passes of the anchoring equipment. Immediately following the crimping operation, the crimped area shall be tacked as specified in Subsection 3.04(C) below.

(C) Anchorage by Tacking:

Straw mulch shall be anchored by tacking, using a slurry consisting of a minimum of 150 pounds of tacking agent, 500 pounds of thermally refined wood fiber mulch, and 300 gallons of water per acre. The contractor may increase the quantities of components to ensure the stability of the straw mulch to provide erosion control during the 45-calendar-day maintenance period at no additional cost to the Department.

3.05 Hydraulically Applied Straw Mulch with Tacking Agent as Final Mulch Cover on Top of Seeded Areas:

Areas seeded but not practical for straw mulch, as determined by the Engineer, shall have hydraulically applied straw mulch with tacking agent applied at the variable rates shown in Table 5 below.

TABLE 5

Slope (H:V)	Hydraulically Applied Straw Mulch (pounds per acre – dry weight)	Tacking Agent (pounds pure mucilage per acre – dry weight)	Thermally-Refined Wood Fiber (pounds per acre – dry weight)
Flat to 6:1	2,000	150	400

From greater than 6:1 to 3:1	2,500	150	500
Greater than 3:1	3,000	200	600
Erosive Soil Slopes or Highly Erosive Areas*	3,500	250	700
* As determined by Engineer			

The contractor shall submit a batch (tank) mix quantity schedule for mulch application to the Engineer for approval prior to mixing hydraulically applied straw mulch, thermally-refined wood fiber, and tacking agent in a slurry. Batch mixing and coverage will be monitored throughout the seeding operations. The contractor shall coordinate the mixing and application operations with the Engineer in advance of all mixing. Fertilizer or seed shall not be mixed into any slurry for temporary erosion control mulch application. To guarantee intimate seed-soil contact, seed shall not be mixed into any slurry with hydraulically applied straw mulch as final mulch cover.

3.06 Shoulder Build-up Areas — Edge of Pavement Build-up Areas:

Seeding shall be applied to all new earthen and milled asphaltic concrete edge of pavement build-up areas. Edge of pavement build-up areas shall be tilled two (2) inches deep from the toe of AC wedge to the toe of the edge of pavement build-up area prior to seeding.

After the two-inch tillage is complete, compost, fertilizer, seeding, and mulching shall be done in three (3) separate steps. For the first step, fertilizer and compost shall be broadcast evenly over both types of edge of pavement build-up areas. For the next step, seed shall be applied by hydroseeding for both types of areas. For the third step, seeded edge of pavement build-ups comprised of milled asphaltic concrete shall have hydraulically applied straw mulch and tacking agent applied, and earthen edge of pavement build-up areas shall have straw mulch or hydraulically applied straw mulch applied, with a tacking agent in either case. No crimping shall be required.

The application rate of hydraulically applied straw mulch and tacking agent shall be as specified in Table 5 above.

3.07 Seeding Acceptance:

After application, the Engineer will inspect seeded areas or sub-areas for conformance to the contract requirements. The contractor shall correct, to the satisfaction of the Engineer, any areas not conforming to the specifications. The 45-calendar-day seeding maintenance period will begin upon Initial Seeding Construction Acceptance of an area by a Construction PLA through the Engineer.

The contractor shall maintain and stabilize each area or sub-area, including edge of pavement build-up area(s), for a minimum period of 45 calendar days, after Initial Seeding Construction Acceptance, as evaluated by a Construction PLA, as well as approved by the Engineer. Any areas damaged from erosion, or those that have less than 90 percent (< 90%) of the remaining

final mulch cover, shall be re-seeded, re-mulched, and re-tacked at no additional cost to the Department. The Construction PLA shall assess the seeded area in comparison to the pre-established half-acre (0.5 acre) sample demonstrative area for Class II Seeding to determine the necessity of re-seeding, re-mulching, and re-tacking.

A new 45-calendar-day maintenance period for an area is not required after re-seeding work; however, the initial or original period remains in effect.

4.0 Method of Measurement:

Seeding (Class II) will be measured by the acre, to the nearest one acre of ground surface seeded. Measurements will be along the ground surface for the areas seeded and mulched, as approved by the Engineer.

5.0 Basis of Payment:

During pre-activity construction meeting, the contractor in conjunction with Engineer shall verify and be in agreement with the quantity of seeding areas as evaluated by a Construction PLA. The quantity of areas to be seeded shall be in compliance with environmental requirements.

The accepted quantities for Seeding (Class II), measured as provided above, will be paid in two (2) phases corresponding to the application stage and the 45-calendar-day maintenance stage.

Upon completion of the application stage through evaluation by a Construction PLA and acceptance by the Engineer in the presence of contractor, the contractor will be paid 70 percent (70%) of the contract bid price per acre for the completed work. Such price will be considered full compensation for furnishing and applying the contract-specified seed mix, fertilizers, soil amendments, tillage, mulch materials, and tacking agent, all required testing, as well as all equipment and labor required to complete the work as specified herein.

Upon completion of the 45-calendar-day seeding maintenance stage, and acceptance by a Construction PLA through the Engineer, the contractor will be paid the remaining 30 percent (30%) of the contract bid price per acre for the completed work. Such price will be considered full compensation for seeding maintenance, including all equipment, labor, and materials required to correct deficiencies in seeded, mulched areas, as specified herein.

No measurement or payment will be made for any of the mobilizations required to apply and stabilize the seeding for each area or sub-area, as specified herein, the cost being considered as included in the contract price for Seeding (Class II).

No measurement or payment will be made for traffic control for work during the 45-calendar-day seeding maintenance period.

An adjustment to the contract will be made if a contractor-requested seed substitution is approved as specified in Subsection 2.02(B) above.

ITEM 8080696 CONCRETE PIPE PLUG (C-13.76)

Description:

The work under this item shall consist of constructing the pipe plug in accordance with the project plans and as specified in these special provisions.

Materials:

Materials shall be Class “B” Portland cement concrete and cement plaster as shown in ADOT standard drawing C-13.76 and in accordance with section 1006 of the specifications.

Construction Requirements:

Construction shall be in accordance with ADOT standard drawing C-13.76.

Method of Measurement:

Concrete Pipe Plug (C-13.76) will be measured as a unit for each Pipe Plug installed.

Basis of Payment:

The accepted quantities of Concrete Pipe Plug (C-13.76), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place.

SECTION 810 — EROSION CONTROL AND POLLUTION PREVENTION

810-2.03 **Riprap and Rock Mulch:** the Gradation C Rock Mulch table of the Standard Specifications is revised to read**:**

Gradation C Rock Mulch (fractured/crushed rocks in angular shape)	
Sieve Size	**Percent Passing**
3.75 Inch	100
3 Inch	55 — 85
2 Inch	15 — 55
1 Inch	0 — 15

ITEM 8101018 EROSION CONTROL (STABILIZED CONSTRUCTION ENTRANCE/EXIT GRAVEL PAD):

Description:

The work under this item shall consist of installing the Erosion/Sediment Control Gravel Pad Best Management Practice (BMP) for Stabilized Construction Entrance/Exit as shown on the project plans, specified herein or determined in the field.

Materials:

The rock mulch shall be Gradation C, angular in shape and conform to the requirements of Subsections 803-2.03 and 810-2.03 of the Specifications. The Bulk Specific Gravity (Saturated Surface Dry) shall be determined in accordance with the requirements of AASHTO T 85 and shall be a minimum of 2.4. Unless otherwise directed by the Engineer, natural river-run materials, especially the rounded natural river rocks/cobblestones and pebbles are not acceptable.

The nonwoven very high survivability geotextile fabric shall conform to the requirements of Subsection 1014-4.04(A) of the Specifications.

Construction Requirements:

The bed for the rock mulch shall be shaped and leveled to provide even surfaces and at a depth to accommodate the rock size and depth of rock mulch as specified on the project plans.

The contractor shall install geotextile fabric when water is applied for construction vehicle/equipment cleaning on gravel pad.

If called out in the plans/details or as directed by the Engineer, the contractor shall add track-out control measure of panel(s) / plate(s) / grate(s) such as corrugated steel panel(s), shaker plate(s), rumble plate(s), rattle grate(s), rumble grate(s), or rattle plate(s), on top of gravel pad, at no additional cost to the Department. When installed, the contractor shall maintain the track-out plate(s) / grate(s) control measure in a stable and safe working condition for the duration of the contract time.

The contractor shall remove and dispose of all rock mulch and geotextile fabric when project gravel pad is no longer in use. The gravel pad area shall be backfilled, graded and compacted in accordance with the requirements of Subsection 202-3 of the Specifications.

Method of Measurement:

Item 8101018 — Erosion Control (Stabilized Construction Entrance/Exit Gravel Pad) will be measured by the square yard installed.

Basis of Payment:

The accepted quantities of Item 8101018 — Erosion Control (Stabilized Construction Entrance/Exit Gravel Pad), measured as provided above, will be paid for at the contract price per square yard, which price shall be full compensation for the work including excavation, backfill, grading, and compaction, complete in place.

No measurement of direct payment will be made for removal of the gravel pad and re-grading of the area to pre-construction conditions, the cost considered as included in the cost of contract item.

ITEM 9020129 CHAIN LINK FENCE GATE (26’ ACCESS CONTROL GATE, KEY CARD CONTROLLED)

Description:

The work under this item shall consist of furnishing and installing a complete and fully operational motorized chain-link gate system to match existing perimeter fencing. The gate shall be fully operational using an RFID key card reader system. The gate shall incorporate standard security features including battery backup and card reader access, designed for integration with other statewide security measures.

Materials:

(A) General:

Materials shall conform to the materials requirements indicated on the project plans and these Specifications.

(B) Motor:

The motor for the sliding gate system shall be heavy-duty, capable of handling frequent operations and heavy loads. It shall be designed for smooth and quiet operation.

The motor’s power rating, measured in horsepower (HP), shall range from 1.0 HP to 1.5 HP, ensuring it is adequate to handle the gate’s weight and expected operational load.

The motor shall include a manual override function to allow manual operation of the gate in case of power failure or motor malfunction.

Compatibility with a battery backup system is essential to maintain operation during power outages.

Safety sensors, including photoelectric sensors or infrared beams, must be compatible with the motor to detect obstacles and prevent the gate from closing on people, vehicles, or objects.

Adjustable speed settings shall be available to control the gate’s opening and closing speed.

To extend the lifespan of the motor and gate components, the motor shall include a soft start/stop feature, which helps reduce wear and tear by minimizing sudden jolts during operation. This feature is intended to prolong the lifespan of the motor and gate components.

The motor must include an automatic locking mechanism to enhance security.

The motor shall be pad-mounted per manufacturer requirements. The motor shall have a cover that is UV-resistant for heat, corrosion, and rust resistance.

(C) Access Control Gate Downstream Board and Electronics

The sliding gate system shall include a weatherproof control panel designed to house all electronics responsible for managing gate operation, access control, and safety features, compliant with UL 325 and UL 508A standards.

The access control gate downstream board must be equipped with programmable timers and settings to allow for automatic closing and speed control. Additionally, the system shall incorporate a manual override function to enable manual operation of the gate during power outages or system failures, ensuring continuous access and security.

The cable connecting the access control gate downstream board and the port of entry I.T. MDF room shall be an RS-485/OSDP twisted pair cable with a drain wire and shield. The cable shall be a minimum of #18 AWG shielded cable. The maximum length of the cable shall not exceed 2,000 feet. The cable connecting the downstream board and the key card reader shall comply with manufacturer requirements. The cables connecting the downstream board and the gate motor shall comply with manufacturer requirements.

All components within the control panel must conform to NEMA 4/4X standards for enclosure protection, IEC 60529 for ingress protection ratings, and be installed following NFPA 70 National Electrical Code guidelines. These standards ensure that the control panel and electronics provide reliable, safe, and durable performance in outdoor environments.

(D) RFID Key Card Reader

The gate system shall incorporate an RFID key card reader for authorized access control.

a. Performance Requirements:

- Reader shall support 13.56 MHz contactless smart card technology.
- Reader shall be capable of reading credentials compliant with:
  - ISO/IEC 14443 Type A and Type B
  - Secure smart card formats supported by ADOT PSO systems
- Reader shall not require proprietary credentials that cannot be managed within ADOT's access control platform.
- Reader shall be fully compatible with ADOT PSO access control panels flashed and configured for Pro-Watch–based systems, or other ADOT-approved enterprise access control platforms.
- Reader shall communicate using industry-standard signaling suitable for panel integration.
- Reader shall not require cloud-based authentication, third party credential hosting, or vendor managed access databases.
- Operating temperature range: 22F to +150°F (30°C to +65°C) minimum.
- Humidity: 0–95% non-condensing.
- Enclosure rating:
  - Minimum IP65 for outdoor installations.
- UV-resistant housing suitable for long-term outdoor exposure in Arizona.

b. Hardware Requirements:

- Reader housing shall be vandal-resistant polycarbonate or metal.
- Reader faceplate shall be scratch- and impact-resistant.
- Visual indicators:
  - Multicolor LED to indicate ready, granted, and denied states.
- Audible indicator:
  - Configurable buzzer (enable/disable via panel programming).
- Operating voltage: 12–24 VDC
- Reader wiring shall be suitable for installation in conduit and outdoor-rated where exposed.

c. Key Card Reader Pedestal:

- Provide a vehicle-height gooseneck pedestal specifically designed for RFID card reader mounting.
- Pedestal shall be suitable for outdoor installation adjacent to vehicular lanes, or gates.
- Pedestal shall support single-device mounting.
- Nominal mounting height to centerline of reader:
  - 42 inches above finished grade
- Pedestal shall have a factory-applied, outdoor rated powder coat.
  - Color shall be black or grey unless otherwise specified by ADOT
- Pedestal shall have a rigid protective hood mounted or integrated into pedestal above the reader.
  - Hood shall be compatible with the reader and pedestal mounting configuration.
  - Finish shall match pedestal finish

(E) Battery Backup System:

The gate shall include a battery backup system, ensuring functionality during power failures. The battery backup system shall match the voltage requirements of the motor in the gate.

The battery backup system shall allow for automatic switchover to battery power in the event of a main power failure, with a recharge time of less than 12 hours once power is restored. The system shall include overload protection, short circuit protection, and low battery warnings with visual and audible alerts.

The system shall include maintenance-free, sealed lead-acid (SLA) or lithium-ion batteries with a capacity sufficient to provide up to 72 hours of intermittent gate operation. The batteries shall be housed in a weather-protected enclosure with an IP65 rating or higher, constructed from corrosion-resistant materials such as stainless steel or UV-resistant composite plastics. The enclosure must feature integrated insulation and thermostatically controlled ventilation to maintain an internal temperature range of -20°C to 50°C (-4°F to 122°F), providing protection against both extreme heat and cold.

The system shall also support remote monitoring and diagnostics to check battery health, charge status, and overall integrity. The battery backup enclosure shall be lockable and

tamper-resistant to prevent unauthorized access, with appropriate mounting options for secure installation.

The entire system must comply with relevant safety and quality standards such as UL, CE, and NEMA, ensuring consistent performance and reliability in the remote rural environment.

(F) Chain Link Fence / Sliding Gate

Materials for the gate / fence shall conform to Subsection 902-2 of the Standard Specifications and include the following:

Provide chain-link fence infill for a 6-foot-high, 26-foot-long motorized sliding gate.

Chain-link fabric shall be 9-gauge galvanized steel wire minimum, 2-inch mesh, knuckle-knuckle selvage.

Gate frame shall include top and bottom horizontal steel members and one intermediate horizontal stiffener at mid-height, creating maximum unsupported fabric heights of 3 feet.

Top and bottom frame members of the motorized sliding gate shall consist of rectangular steel tubing sized to resist bending, wind, and operational loads. Provide minimum 2-inch by 3-inch steel tubing with 11-gauge wall thickness for top and bottom frame members. Members shall be continuous for the full gate width, fully welded at corners and intersections with vertical members, and designed to support gate weight, roller reactions, and dynamic forces from motorized operation.

Provide horizontal and vertical stiffener members within the motorized sliding gate frame to support chain-link fabric and control deflection. Vertical stiffeners shall consist of 2-inch by 2-inch steel square tubing, 14-gauge minimum, installed full height and spaced not more than 6 feet on center. Horizontal stiffeners shall consist of 2-inch by 2-inch steel square tubing, 14-gauge minimum, installed at mid-height between top and bottom gate frame members.

All stiffener members shall be continuously welded to adjoining frame members and designed to resist wind and dynamic loads associated with motorized gate operation.

Fabric shall be secured with steel tension bars at vertical edges and 9-gauge galvanized ties at horizontal members spaced 12 inches on center maximum.

Fabric and stiffeners shall be designed to withstand wind loads per ASCE 7 and dynamic forces from motorized gate operation.
All connections and fasteners must be zinc-coated for rust prevention and tamper-resistant to prevent unauthorized access.

(G) Gate Sign

A 30-inch wide by 24-inch tall, reflectorized sign shall be mounted in the center of the gate, facing out of the POE (westward) with the words “AUTHORIZED / VEHICLES / ONLY” on

three lines of text. ADOT sign code R5-11. The sign shall be black letters on white high intensity prismatic background.

(H) Gate Track and Roller System

The gate shall operate on a heavy-duty rail and wheel system to facilitate smooth and reliable sliding action. The track and roller system shall include a heavy-duty track made from galvanized steel or aluminum to guide the gate along its path. Provide durable posts set in concrete footings at the opening and closing positions for additional support and alignment.

The sliding gate shall be equipped with rollers and wheels designed to ensure smooth, reliable operation and long-term durability. The rollers and wheels shall be constructed from corrosion-resistant materials such as galvanized steel or heavy-duty nylon, with each component capable of withstanding outdoor environmental conditions, including extreme temperatures and moisture. The rollers must incorporate sealed ball bearings to minimize friction, reduce wear, and ensure quiet operation. Each roller assembly shall be engineered to support the full weight of the gate, providing stability and smooth movement along the track. The rollers and wheels must be compatible with the gate's track system and conform to ASTM F626 and ASTM F2200 standards for durability, operational safety, and performance.

The design shall allow for easy adjustment and replacement, facilitating maintenance.

(I) Key Card Reader Pedestal and Foundation

The contractor shall install a ground-mounted pedestal and foundation constructed of durable material with a weather-resistant finish to ensure long-term outdoor performance. The pedestal shall be designed to mount the key card reader securely at a minimum height of 42” above grade, providing easy accessibility for gate access control.

Construction Requirements:

(A) General:

Construction shall be in accordance with the requirements of Subsection 902-3 of the specifications.

Installation of the gate shall follow manufacturer guidelines and ASTM F1184 standards for gate construction and operation, ensuring proper alignment, balance, and operational efficiency. Compliance with local codes and regulations is mandatory.

Installation of the chain-link gate shall ensure compatibility with the existing fencing line.
The contractor shall coordinate with ADOT Physical Security for card reader integration. Card reader access must be installed and configured to provide secure access to authorized

personnel, integrating with statewide security to allow employees at San Simon and other facilities across the state seamless access.

Mount the surveillance camera at an appropriate height and angle to cover the entire gate area. Surveillance camera and its mounting are paid for separate from this bid item.

The contractor shall install all electrical components in accordance with NFPA 70 National Electrical Code guidelines, promoting safety and reliability. Additionally, the installation must include safety features such as photoelectric sensors, edge sensors, and emergency stop buttons to prevent accidents and ensure secure operation.

Proper alignment, tensioning, and anchoring of the fence and gate components shall be verified prior to acceptance.

The contractor shall install the key card reader pedestal at a location that allows easy accessibility from the driver's side of a standard passenger vehicle. The pedestal shall be placed within reach for a person to operate the key card reader without leaving their vehicle. Placement shall account for proper alignment with the sliding gate access path.

Documentation of materials, component specifications, and installation procedures shall be maintained and presented upon completion.

Modify the existing fence to remove the sections where the new gate will be. Connect existing fence to the new gate end posts. Install fence end posts at the locations where the existing fence will be terminated to make room for the new gate. Fence modifications are considered incidental to this bid item.

Testing Requirements:

(A) Functional Test:

Upon completion of the installation, functional testing shall be performed to confirm that the gate opens and closes smoothly and fully along its track without obstructions. This test must be conducted at least 10 times to ensure consistent performance. The gate should move smoothly along the track without any jerking or stopping prematurely. The opening and closing speeds should be measured to ensure they meet the specified requirements, and adjustments should be made using the control panel settings. The timing of automatic closing settings shall also be verified to ensure alignment with the programmed schedules.

(B) Safety Test:

Obstacle detection shall be tested by placing objects in the path of the closing gate to ensure photoelectric and infrared sensors detect the obstruction and stop or reverse the gate. Edge sensors must be tested by applying gentle pressure to the safety edges during gate movement to confirm that the gate stops and reverses when activated. Additionally, the emergency stop button shall be tested to verify it immediately halts gate operation and remains responsive until reset.

(C) Battery Backup System Test:

The battery backup system must be tested to ensure it provides reliable power during outages. Power failure simulation involves disconnecting the main power to confirm that the battery backup activates automatically, allowing normal gate operation. The battery runtime test should operate the gate using battery power over an extended period of 24 hours with multiple cycles to ensure adequate power for continuous operation. The recharge time test must measure the time taken to fully recharge the battery once main power is restored, verifying that it meets the specified recharge time of less than 12 hours.

(D) Documentation and Reporting:

Documentation shall include the manufacturer's cut sheet, maintenance guidelines and operational instructions for future reference.

Method of Measurement:

Chain Link Fence Gate (26' Access Control Gate, Key Card Controlled) will be measured as a unit for each gate furnished, installed, and successfully tested.

Basis of Payment:

The accepted quantity of Chain Link Fence Gate (26' Access Control Gate, Key Card Controlled), measured as provided above, will be paid for at the contract unit price for each, which price shall be full compensation for the work, complete in place and successfully tested.

The contract unit price includes the gate controls and motor, battery backup, roller system, modifying the existing fence and other components, key card reader, pedestal and foundation, conduit, cabling, testing, and other work necessary to provide a complete and functional Chain Link Fence Gate system.

The sign mounted on the gate will be paid for under its respective bid item.

The surveillance camera will be paid for under Bid Item 7370452.

(923OJTNGL, 06/18/26)

SECTION 923 BLANK: the title and text of the Standard Specifications is revised to read:

SECTION 923 ON-THE-JOB TRAINING WITHOUT GOALS:

923-1 Description:

The contractor may provide On-The-Job training (OJT) aimed at moving minorities, women, and disadvantaged trainees into journeymen in various types of construction trades or job classifications in accordance with 23 CFR Part 230, Part 230.111 and Part 230, Appendix B.

It is the intention of these Special Provisions that training be provided in the construction classifications/crafts rather than for office support positions. Some off-site training is permissible as long as the training is an integral part of an approved training program and does not comprise of a significant part of the overall training.

923-1.01 General:

Training and upgrading of minorities and women toward journeyman status is the primary objective of these Special Provisions. Accordingly, the contractor shall make every effort to enroll minority, women, and disadvantaged trainees (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that it has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with these Special Provisions. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. Trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. The ratio of apprentices and OJT Trainees to journeymen shall not be greater than permitted by the terms of the approved training program being utilized.

No employee shall be employed as a trainee in a classification in which they have successfully completed a training course leading to journeyman status, or in which they have been employed as a journeyman. The contractor shall satisfy this requirement by including appropriate questions in the employment application or by other suitable means. The contractor shall maintain documentation that shows the employee’s work and training history.

923-1.02 Definitions:

Banking-Carryover Hours:

OJT hours completed by a trainee are eligible to be credited to a future project. Banked-Carryover hours will only be credited when the same trainee that completed the excess hours is used on the future project.

Classification/Craft:

Type of occupational category, trade, or job being done by a trainee on a federal-aid funded highway construction project.

Disadvantaged Persons:

A person who meets one of the following:

(1) Receives, or is a member of a family and/or household, which receives cash payments under a Federal, State, or local income-based public assistance program;

(2) Is a member of a family and/or household that receives (or has been determined within the 6-month period prior to registration for the program involved to be eligible to receive) Food Stamps/EBT card under the Food Stamp Act of 1977;

(3) Is a foster child on behalf of whom State or local government payments are made;

(4) Does not have a high school diploma or GED; or

(5) Is from a family whose total annual household income is below the federal poverty limits.

Journeyman:

A person who is capable of performing all the duties within a given job classification or craft.

OJT Trainee:

A person who is:

(1) A minority, woman, or disadvantaged individual enrolled in an approved training program; or

(2) Any other individual enrolled in an approved training program, whose training hours are, approved by the Department, and can be credited as OJT hours.

Small Business and Workforce Development (SBWD):

SBWD is responsible for oversight of the OJT program, which targets under-represented segments of the U.S. workforce, including minorities, women and disadvantaged individuals. SBWD assesses OJT hour goals on contracts and monitors them to ensure that trainees receive the required number of training hours

923-1.03 Computation of Time:

In computing any period of time described in this OJT special provision, the day from which the period begins to run is not counted, and when the last day of the period is a Saturday, Sunday or Federal or State holiday, the period extends to the next day that is not a Saturday, Sunday, or Federal or State holiday. In circumstances where the Department's offices are closed for all or part of the last day, the period extends to the next day on which Department's offices are open.

923-1.04 OJT Training Programs:

The minimum length and type of training for each classification will be established in the training program selected by the contractor and approved by the Department and FHWA. The Department and FHWA will approve a program if it is reasonably calculated to meet equal employment opportunity obligations and qualifies the average trainee for journeyman status in the classification concerned by the end of the training period as defined in the training program.

The Department recognizes the following OJT Training programs:

(A) OJT Programs approved by FHWA or the Department of Labor (DOL) prior to the start of the trainee commencing work.

(B) Registered union or other approved apprenticeship programs registered with the Bureau of Apprenticeship, U.S. DOL, Employment and Training Administration, Bureau of Apprenticeship and Training or the Arizona Apprenticeship Office, Arizona Department of Economic Security programs recognized by the Bureau.

Approval of a training program other than those specified above to be used for the contract must be approved by the Department or FHWA prior to the trainee commencing work on the classification covered by the program. Contractors intending to submit a training program for approval prior to the start of a contract must submit the program as soon as possible after notification of contract award as approval of a training program may take up to four weeks. Several FHWA approved training program templates for specified classifications are available on the SBWD website.

The contractor shall furnish each trainee with a copy of the Training Program the trainee is enrolled in, and other documentation related to the training program. The contractor shall provide training that develops the skills outlined in the training program. Multiple OJT training programs can be used on the project.

All training programs shall be administered in a manner consistent with the equal employment obligations of federal-aid highway construction contracts. The Department reserves the right to request documentation that the contractor’s training program fulfills these obligations.

The trainee will be paid the appropriate trainee Davis-Bacon wage rates for training classifications/crafts on federally-funded projects. The contractor shall compensate trainees not less than the rate outlined in the approved training program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination.

The contractor shall provide for the maintenance of records and furnish/submit required information and reports documenting its performance under these Special Provisions. Such records shall be available at reasonable times and places for inspection or review by the Department and FHWA.

923-1.05 OJT Liaison:

The contractor shall designate an OJT Liaison who shall be responsible for monitoring and administering the contractor’s OJT Program and monitoring the trainees’ progress. The OJT Liaison may have other responsibilities for the contractor. The OJT Liaison shall serve as the point of contact for the Department regarding information, documentation, and conflict resolution relating to the contractor’s OJT program.

923-2 Online Resources:

OJT System Website:
https://adot.dbesystem.com

SBWD Website:
https://azdot.gov/business/small-business-and-workforce-development

923-3 Requirements:

923-3.01 Documentation:

Documentation related to OJT training can be found on the Department's SBWD website. The contractor shall complete and submit the following information to the Department:

(A) OJT Enrollment and Progression:

(1) OJT Enrollment:

OJT Enrollment information shall be submitted through the Department's online OJT System by the contractor at least 5 days prior to a trainee's start date. OJT Enrollment information shall be completed and includes the trainee's name and address, employment status, gender and ethnicity, training program (s), and classification/craft.

SBWD will review the OJT Enrollment information within 5 days, and if approved, hours will be retroactively credited to the date the OJT Enrollment information is received by SBWD.

To receive OJT credit, apprentice's current apprentice certificate or proof of registration from a union or approved apprenticeship program shall be uploaded into LCPtracker by the contractor within 5 days of the apprentice's start date, in addition to completing the OJT enrollment information in the online OJT System.

If the Arizona Apprenticeship Office Representative's signature is missing from the apprentice certificate, the contractor shall also upload the apprentice's US Department of Labor, Office of Apprenticeship Certificate to LCPtracker. The contractor shall not receive training credit or reimbursement until the certificate is uploaded.

(2) Progression of Training and Change of Status:

Progression of Training-Level Up and Change of Status shall be submitted through the Department's online OJT System each time a trainee advances, progresses to another training level or milestone in his/her training program, or has a change of job classification. Hours will be retroactively credited to the date the information is received.

Hours that exceed the maximum indicated in the program for a certain level will not be credited. Once a level is completed, the trainee should be moved to the next level towards journeymen status.

923-3.02 Training Program Completion:

Once the trainee completes the required number of levels and hours of training for the same classification or craft, or completes an approved training program, the trainee is considered

to have completed the training program it is enrolled under. The contractor shall not receive OJT credit for hours exceeding the maximum number of training hours required for completion of the selected training program.

Once a trainee completes a specific training level for a classification or craft, the contractor shall not be permitted to submit that trainee for enrollment or reimbursement at that same level within the same classification or craft, however the same trainee can be enrolled in a different classification or craft.

The contractor shall provide documentation showing the type and length of training satisfactorily completed to each trainee and the Department upon successful completion of a training program.

For an apprenticeship program, the Apprenticeship office will issue a certificate of completion in said craft, a DOL certificate, and a journeyman's card.

923-3.03 Banking-Carryover Hours:

At the completion of the project, the contractor may submit a Banking-Carryover Hours request in the Department's online OJT System, to carryover training hours for a specific trainee on the project to be used on a future project. Banked hours that are carried over to a project may lower the required number of training hours the contractor is required to complete on that project. The trainee shall be placed on a subsequent project with the intent that the trainee is progressing towards completion of a training program. Banked hours cannot be transferred to other trainees. No additional payment will be paid for banked hours carried over to other projects.

923-3.04 OJT Project Completion and Banked Hours Request:

OJT Completion and Banked Hours documentation shall be submitted within 60 days of completion of training. Any hours to be banked shall be shown on the documentation.

923-4 Method of Measurement:

OJT training hours will be measured by the hour to the nearest half hour.

Measurement of hours will be made as the OJT trainee completes hours on the project. Hours are considered complete if the trainee performs hours on the project, is OJT enrolled, and provides required training by the program.

No measurement for payment will be made for trainee hours in which OJT enrollment information has not been received and approved by the Department.

923-5 Basis of Payment:

The accepted quantities of hours, measured as provided above, will be paid for at a unit price of $3 per hour for training provided to trainee/apprentice in accordance with an approved training program.

Payment for offsite training may only be made when the contractor does one or more of the following and the trainees are concurrently employed on a federal-aid project;

(A) Contributes to the cost of the training,

(B) Provides the instruction to the trainee

(C) Pays the trainee's wages during the offsite training period.

923-6 Monitoring:

(A) Monthly Reporting:

Contractors shall report monthly hours for each trainee in the online OJT System by the 15th of the month following the month of training hours completed.

(B) Site Visits:

The Department may conduct periodic monitoring site visits to the worksite to review OJT Program compliance, during working hours on the project. The Department will notify the OJT liaison at least 24 hours prior to a site visit if the OJT Liaison is required to be at the site visit. The site reviews may include, among other activities, interview of trainees, the contractor, and its employees. The contractor shall cooperate in the review and make its employees available. The contractor's OJT Liaison shall be reasonably available to meet with Department staff as well as be available to respond to periodic emails and phone calls from the Department to check on the progress of OJT Trainees. The Department will make efforts to ensure minimal disruption to the work and coordinate site visit times with other Department divisions, as applicable (for example, Davis-Bacon interviews).

ITEM 9240023 FORCE ACCOUNT WORK (ELECTRICAL PANEL, SSVE INSTALL)

Description:

The work under this item shall consist of coordination and paying all necessary fees for permits, hookup to the local utility company to install a complete, functioning electrical service to power the new inspection building and ITS infrastructure as shown on the project plans.

Construction Requirements:

All work shall conform to the requirements of Sulphur Springs Valley Electric (SSVE) Cooperative. The contractor shall contact SSVE representative, Ryan Reese, at (520) 384-5469 to coordinate power service and construction requirements. The work order number with SSVE is WO100916.

The contractor shall provide to the Engineer, for review and approval, copies of all agreements between the utility company and the contractor. The contractor may proceed with those agreements after Engineer approval. If the contractor proceeds prior to or without Engineer

approval, the Engineer may withhold reimbursement to the contractor. The contractor shall also submit equipment specifications for approval of the service entry station (SES) requirements prior to ordering the equipment.

Upon billing, the contractor shall pay the cost for the electrical service hook-up installations and any monthly payment if required.

Measurement and Payment:

Electrical Panel, SSVE Install will be measured and paid for in accordance with the requirements of Subsection 109.04 of the specifications.

The Department will reimburse the contractor for all direct expenses billed to the contractor by the utility companies. Payment for the billing invoices will be the actual cost as shown on the invoice(s) submitted by the contractor plus a five percent mark-up, as follows:

Sub-total = Invoice x 1.05

Also, an amount equal to 65 percent of the Sub-total, as determined above, multiplied by the applicable sales tax rate will be added to the Sub-total. Finally, an amount equal to 0.50 percent of the Sub-total will be added for the Performance and Payment Bond. The total contractor payment (TCP) will be as follows:

TCP = (Sub-total) + (0.65 x Sub-total x sales tax rate) + (0.005 x Sub-total).

Such payment shall be full compensation for each utility service, complete in place as specified herein.

ITEM 9240050 MISCELLANEOUS WORK (WELL SITE RELOCATION AND CONNECTION)

Description:

The work under this item consists of removing existing well equipment and reinstalling it in the newly drilled well, including pump removal and reinstallation, piping reconnection, electrical and instrumentation relocation, conduit installation, fencing adjustments as shown on the plans, and minor electrical improvements necessary to provide a complete operational well installation, complete in place.

Materials:

All Materials used in the plumbing connection and installation of well site electrical improvements shall conform to materials identified in the project plans. 1.5” 316 SS waterline shall be used in the plumbing and reconnection with the new well location. 1.5” 316 SS 90^{o} fittings shall be located as identified in the project plans. The existing well pump shall be relocated and placed in the new well. 1” Sch 40 PVC Conduit shall be used for all underground conduit in the electrical relocation as identified in the plans. Provide PVC-coated GRC or approved alternative for all conduit stub-ups. Provide GRC for all above-grade conduits.

Provide weatherproof GFCI receptacles for all outdoor areas, improving existing provisions where required.

Construction Requirements:

The contractor shall relocate the existing pump and associated piping and electrical and instrumentation equipment from the existing well site to the new well location as shown on the plans. The contractor shall route power from the existing source indicated on the plans and shall make all terminations, grounding, and reconnections complete in place. Upon completion of installation, The contractor shall test the relocated equipment and connections to verify proper operation and shall correct deficiencies at no additional cost to the Department.

Method of Measurement:

The furnishing and installation of the existing well pump and plumbing connection in the new well shall be measured as lump sum.

Basis of Payment:

The accepted quantities of the well site relocation and connection as measured and provided above shall be paid for at a lump sum price, which price shall be full compensation for the work complete in place.

ITEM 9240052 MISCELLANEOUS WORK (ABANDON EXISTING WELL STRUCTURE)

Description:

The work under this item consists of abandoning the existing well in accordance with Arizona Department of Water Resources requirements, including pre-abandonment notifications, sealing and filling operations, surface seal installation, demolition and removal of the existing well pad, final site restoration, and post-abandonment reporting, complete in place.

Materials:

All abandonment materials and mixtures shall conform to the requirements of A.A.C. R12-15-816 and the ADWR Well Abandonment Handbook (2008) (Appendix C), which identifies acceptable materials and mixing ratios for abandonment methods.

Construction Requirements:

A. Well Abandonment

Well abandonment shall be performed only by a licensed well drilling contractor or single well licensee, and The contractor shall comply with A.A.C. R12-15-816.

Except where abandonment is performed in the course of drilling a new well as provided by rule, the well owner shall file a Notice of Intention to Abandon prior to abandonment, and abandonment shall not commence until the authorization process required by ADWR

is satisfied.

Within 30 days after abandonment, the required post-abandonment notifications and completion reports shall be filed as required by A.A.C. R12-15-816 and described in the ADWR handbook.

The contractor shall install the required surface seal in the upper 20 feet of the well in accordance with the ADWR handbook and rule requirements, and the abandonment shall be completed by filling or sealing the well and annular space so the well is not a vertical conduit for water movement.

Unless an alternative method is approved by ADWR for the well's aquifer and vadose zone conditions, The contractor shall utilize the standard abandonment method described by ADWR, including casing removal or re-perforation where required and grout placement from the bottom up using tremie methods as required.

B. Well Pad Demolition and Site Restoration:

Following completion of the well abandonment activities, The contractor shall demolish and remove the existing well pad at the abandoned well location as shown on the plans or as directed by the Engineer.

Well pad demolition shall include the removal of the concrete well pad, foundations, and any associated appurtenances to the limits shown or directed. The work shall also include the removal of exposed piping, conduits, anchors, and embedded hardware associated solely with the abandoned well. All demolished materials shall be removed from the project site and disposed of in accordance with applicable local, state, and federal regulations.

Demolition activities shall be performed in a manner that prevents damage to adjacent utilities, structures, or improvements intended to remain. Any excavations or voids resulting from the demolition and removal of the well pad shall be backfilled with approved material and compacted in accordance with Section 203-5 of the specifications.

Upon completion of backfill operations, the site shall be graded to blend with the adjacent ground surface and shall be left in a neat, stable condition acceptable to the Engineer.

Method of Measurement:

The abandonment of the existing well, including well pad demolition and site restoration, will be measured as a lump sum.

Basis of Payment:

The accepted quantity of abandonment of the existing well will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including

notices, mobilization, abandonment materials, casing treatment if required, tremie placement, surface seals, well pad demolition and removal, backfill, grading, and reporting.

ITEM 9240053 MISCELLANEOUS WORK (GRINDER LIFT STATION INSTALLATION):

Description:

The work under this item consists of furnishing, installing, testing, starting up, and commissioning a complete packaged wastewater grinder pump lift station system, including excavation, bedding, backfill, concrete collar or anti-flotation measures as required by the manufacturer, piping and appurtenances, electrical service, alarm panel installation, and all work necessary to place the system into full operational service, complete in place, as shown on the plans and specified herein. The packaged wastewater grinder pump lift station shall be factory assembled and provided by a single manufacturer in accordance with Appendix A.

Materials:

All equipment, materials, and appurtenances for the grinder pump lift station shall conform to Appendix A, including the pump and motor, basin assembly, unitized level control system, alarm device, discharge piping and internal valves, electrical quick disconnect components, and accessories necessary to provide a complete packaged system.

A stainless steel Unistrut shall be provided for exposed above-grade electrical and instrumentation racks and for conduit supports, unless otherwise shown on the plan.

Excavation, bedding, embedment, backfill, compaction, and surface restoration materials associated with trenching and structural excavation shall conform to Section 203 of the specifications.

Construction Requirements:

A. General

The contractor shall install the packaged wastewater grinder pump lift station and alarm panel at the locations shown on the plans and shall perform the work in accordance with these Special Provisions, Appendix A, and the manufacturer’s written installation instructions.

Shop drawings, product data, wiring diagrams, certifications, and other required submittals shall be provided in accordance with Section 105.03 of the ADOT Standard Specifications.

B. Excavation and Backfill

Excavation, trenching, structural excavation, bedding, embedment, backfill, compaction, and surface restoration shall conform to ADOT Standard Detail C-07.06. This detail establishes excavation control, trenching practices, and compaction requirements, including the requirement to remove accumulated water by pumping or other approved methods and to control surface drainage so water does not enter excavations.

C. Electrical and Controls

The contractor shall provide conduits, wiring, grounding, and power connections complete in place in accordance with the plans. Power to the unit shall be routed from the existing administration building as shown on the plans.

D. Start-Up, Field Testing, and Training

A manufacturer-authorized representative shall inspect the completed installation, perform or witness start-up and field testing, and provide training to the Owner's personnel as required by Appendix A and as necessary to place the system into operation.

E. Bypass Pumping

Where construction activities affect an existing active wastewater system, The contractor shall furnish, install, operate, monitor, and maintain a sanitary bypass pumping system as required to continuously convey existing flows around the work area. The bypass pumping system shall have sufficient capacity to convey anticipated peak flows and shall remain operational for the duration of any work that impacts the active system. The bypass pumping system shall include the pumps, piping, power supply, standby equipment, alarms, and monitoring necessary to prevent service interruptions, sanitary sewer overflows, or unauthorized discharges. Bypass pumping operations shall be coordinated with the Engineer prior to implementation and shall comply with all applicable regulatory requirements. Bypass pumping shall be considered incidental to the lift station installation unless otherwise noted in the contract documents, and no separate payment will be made.

Method of Measurement:

The furnishing and installation of the packaged wastewater grinder pump lift station will be measured as a lump sum.

Basis of Payment:

The packaged wastewater grinder pump lift station will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including testing, start-up services, training, excavation, backfill, and surface restoration.

ITEM 9240054 MISCELLANEOUS WORK (DRY WELL STRUCTURE INSTALLATION):

Description:

The work under this item consists of furnishing and installing a complete dry well infiltration system that receives flow exclusively from the downstream outlet of a water oil separator, including a detention manhole, internal riser piping, capped dry well structure, backflow prevention, excavation, bedding, backfill, surface restoration, and all work necessary to construct a fully functional system, complete in place, as shown on the plans and specified herein.

The dry well system is not intended to receive surface runoff. The only sources of flow to the dry well shall be discharge from the water oil separator and any incidental stormwater infiltration that may occur within the detention manhole despite the raised manhole crown.

Materials

Drywell

The dry well structure shall be a modular subsurface stormwater infiltration system as shown in the plans in Detail 7 and shall be constructed of materials suitable for long-term burial and exposure to treated effluent from a water oil separator. The dry well shall be capped to prevent direct surface inflow, debris entry, or unintended connections.

Manhole

The detention manhole shall be a standard ADOT manhole constructed in accordance with ADOT Standard Detail C-18.10 and section 505 of the specifications. The manhole finished frame elevation shall be set a minimum of 4 inches above surrounding unimproved grade. provide a cast-in-place concrete collar, trowel finished, sloped away from frame in all directions to prevent storm water infiltration.

The influent to the detention manhole shall originate solely from the water oil separator outlet pipe shown on the plans. The 6-inch influent piping to the detention manhole shall be installed at a minimum slope of 3.0 percent and shall include a 1LF vertical drop pipe upstream of the duckbill check valve.

Duckbill Valve

A duckbill-type backflow preventer shall be designed for gravity flow applications and installed on the end of the 6-inch influent pipe within the detention manhole. The valve shall have a maximum cracking pressure of 2-inches of water column or less and shall reliably open under partially full gravity flow conditions.

The valve shall be constructed of a flexible elastomer suitable for treated effluent from a water oil separator and shall be resistant to hydrocarbons, ozone, and biological growth. Acceptable elastomers shall include EPDM or neoprene.

The valve shall be a low-head design that opens to a near full-port configuration to minimize head loss and prevent upstream ponding under normal operating conditions. The valve shall be capable of sealing tightly under reverse head conditions and shall withstand surcharge levels anticipated within the detention manhole without allowing backflow into the upstream water oil separator.

The duckbill valve shall be installed in a horizontal orientation with the discharge directed away from the pipe invert and shall be located to allow full opening of the bill without interference from the manhole bench, invert, or walls.

The valve shall be slip-on or flanged as shown on the plans and shall be secured with continuous stainless steel clamps. Clamps shall be a minimum of Type 304 stainless steel, with Type 316 stainless steel acceptable and preferred.

The valve shall be self-cleaning, shall have no mechanical or moving parts, and shall be capable of sealing around debris without jamming. The valve shall be fully accessible for inspection from within the detention manhole and shall not be encased in concrete or buried in benching.

PVC Piping

PVC piping shall conform to the requirements of Subsection 809-2.01 of the specifications

All piping, risers, fittings, seals, and connectors shall be watertight and compatible with the conveyed flow.

Construction Requirements

The contractor shall install the dry well system in accordance with the project plans, these Special Provisions, applicable ADOT Standard Specifications and Details, and the dry well manufacturer's published installation requirements.

Excavation, bedding, and backfill for the dry well and detention manhole shall be performed to the lines and grades shown on the plans. The bottom of the dry well excavation shall be prepared with clean aggregate bedding suitable for infiltration unless otherwise shown. The dry well modules shall be installed plumb, level, and fully assembled to form a continuous infiltration structure capped at the top.

The detention manhole shall be constructed to receive effluent from the water oil separator and to serve as the sole hydraulic transition point upstream of the dry well. No surface drainage inlets, curb openings, or additional piping connections shall be connected to the manhole.

From the detention manhole, a riser pipe of 2" shown on the plans shall convey flow to the capped dry well. The riser pipe shall be securely connected to the manhole and the dry well structure and shall discharge in a manner that does not erode, scour, or damage the infiltration system.

The duckbill backflow preventer installed on the influent pipe of the detention manhole shall be oriented and supported in accordance with the manufacturer's recommendations and shall remain accessible for inspection. The backflow preventer shall prevent surcharge or backflow from the dry well or detention manhole from entering the water oil separator. Piping from the separator feeding into the detention manhole shall feature a 1-foot drop pipe leading into the duckbill check valve.

All joints, penetrations, and connections shall be sealed to prevent leakage, migration of fines, or unintended inflow. Upon completion, the system shall be backfilled, compacted, and the surface restored as shown on the plans. The completed system shall be left clean and free of debris.

Method of Measurement

The Dry Well Structure Installation will be measured on a lump sum basis.

Basis of Payment

The accepted quantities of Dry Well Structure Installation, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including the ADOT detention manhole with raised collar and frame, dry well system, riser piping, duckbill backflow preventer, excavation, bedding, backfill, and surface restoration.

ITEM 9240055 MISCELLANEOUS WORK (ABANDON EXISTING SANITARY SEWER):

Description:

The work under this item consists of abandoning the existing 4-inch gravity sanitary sewer where indicated on the plans, including cutting, sealing, plugging, and filling the abandoned pipeline with controlled low strength material (CLSM), complete in place.

Materials:

Controlled Low Strength Material (CLSM)

Controlled Low Strength Material used for abandonment shall be a cementitious, flowable fill material and applicable backfill per Detail C-07.06. The CLSM shall be excavatable unless otherwise approved by the Engineer and shall have a maximum 28-day compressive strength not exceeding 200 psi.

CLSM shall be proportioned to allow complete filling of the abandoned sewer without segregation and shall be capable of flowing to fill voids and low points within the pipe.

The contractor shall submit the proposed CLSM mix design and placement method to the Engineer for review prior to placement.

Construction Requirements:

The abandonment of the existing sewer shall be conducted in such a manner as not to damage existing active utilities or any portion of the discharge structure, septic tank, or leach field that is to remain in place. The abandoned sewer to remain and the approved abandonment method shall be noted on the installation record drawings.

The contractor shall abandon the existing 4-inch gravity sewer by cutting, sealing, plugging and filling the abandoned pipeline to the extents shown on the plans with the approved CLSM mix as approved by and to the satisfaction of the Engineer and, in a manner that prevents collapse, settlement, or migration of the abandoned pipe and that does not damage adjacent active utilities or structures to remain.

METHOD OF MEASUREMENT

Abandon Existing Sanitary Sewer shall be measured on a lump sum basis.

BASIS OF PAYMENT

The accepted quantity of Abandon Existing Sanitary Sewer, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work complete in place.

ITEM 9240057 MISCELLANEOUS WORK (WELL INSTALLATION):

Description:

The work under this item consists of constructing a water well which includes installing a 16-inch outside diameter surface casing, drilling a 750-foot-deep, 14-inch diameter borehole, installing nominal 8-inch well casing and screen, and annular materials, developing the well, performing plumbness and alignment testing, conducting a downhole video survey, and constructing the surface completion at the location shown on the project plans and as specified herein.

Materials:

Available information indicates that the subsurface lithology at the well site is expected to consist primarily of clay with intermittent gravel seams to a depth of approximately 560 feet below ground surface, underlain by coarser alluvial deposits and/or conglomerate.

(A) Surface Casing:

The surface casing for the well shall be new low-carbon steel, and manufactured in accordance with ASTM Specification A53 Grade B steel or ASTM Specification A139 Grade B steel. The surface casing shall have a 16-inch outside diameter (O.D.) and have a minimum 0.375-inch wall thickness. The minimum length of the surface casing shall be 21 feet, to allow for a minimum 1-foot stickup above land surface.

Prior to casing installation, the contractor shall submit certified test reports to the Engineer to demonstrate compliance with the physical and chemical properties of the steel surface casing, as specified herein.

(B) Surface Casing Cement Grout Seal:

The surface casing cement grout seal material shall consist of cement slurry containing 5.2 to 6.0 gallons of water per 94-pound sack of Portland cement. The cement shall conform to ASTM Standard C150, Type II (if Portland cement is used) or ASTM Standard C595 Type IL (if Portland limestone cement is used). The cement grout weight shall be measured prior to installation, as an indicator of the cement-water ratio. The cement grout slurry shall not exceed 17.0 pounds per gallon (lb/gal) (approximately 127 pounds per cubic foot, lb/ft^3). The cement grout slurry may contain sand, which shall not exceed 50 percent by volume of the cement. Bentonite may be used as an additive, and must be in powder form and shall not exceed 4

percent by volume of the cement, or cement and sand. Water added for bentonite shall not exceed 1.3 gallons per 1.88 pounds of bentonite (2 percent by weight in cement). Accelerator additives, such as calcium chloride, shall not exceed 2 percent by weight of the cement. If the cement grout is not mixed on site, the contractor must provide the specific constituents of the cement grout to the Engineer prior to placement of the grout. The cement grout slurry shall be mixed thoroughly and must be free of lumps to the satisfaction of the Engineer. Cement grout that does not comply with this specification will be rejected.

The surface casing cement grout seal shall be installed from the base of the surface casing to the land surface, as shown on the plans.

(C) Well Casing Material:

The blank well casing for the well shall be new High Strength Low Alloy (HSLA) casing manufactured from steel conforming to ASTM Specification A606 Type 4. The well casing shall have an $8^{5}/_{8}$-inch O.D. and 0.25-inch wall thickness. The casing shall be new, and free of rust, pits, or other defects. The total length of the blank well casing for the well (including the 2-foot stickup) will be 542 feet. The blank well casing shall be installed from 540 feet below land surface (bls) to 2 feet above land surface, as shown on the plans.

The well casing for the well shall be factory-assembled in not less than 20-foot-long sections (except for the casing section used for the casing stickup). The well casing sections shall contain one spiral seam along the casing axis, and shall contain no more than one circumferential seam per 10 linear feet.

The bottom of the casing shall be capped with a bottom plate consisting of the same steel composition and same wall thickness as specified above. Prior to casing installation, the contractor shall submit certified test reports to demonstrate compliance with the physical and chemical properties of the well casing steel that are specified herein.

(D) Well Screen Material:

The well screen for the well shall be new, HSLA Standard Flo louvered screen manufactured from steel conforming to ASTM Specification A606 Type 4 steel. The well screen shall have an $8^{1}/_{8}$-inch inside diameter (I.D.) and a 0.250-inch wall thickness, with horizontal louvered openings. The horizontal louvered openings shall be factory-installed in the well screen with a minimum $1^{5}/_{8}$-inch slot length, in rows that are spaced approximately 2 inches apart in the vertical direction. There shall be 6 perforations per circle to provide 36 openings per linear foot. The screen slot size shall be 0.060 inches, and the open area of the screen shall be no less than 3.5 square inches per foot. The openings in the screen shall be machine made, horizontal to the axis of the casing, and of a louver form with the aperture facing downward. The well screen shall have a total length of 200 feet and shall be installed from 740 feet to 540 feet bls, as shown on the plans.

The contractor shall obtain from the well screen manufacturer, the screen tensile strength (pounds), collapse strength (psi), screen weight (pounds per linear foot), and maximum recommended hang weight (pounds). This information shall be provided to the Engineer prior to delivery of the well screen to the site.

Prior to the well screen installation, the contractor shall submit certified test reports to demonstrate compliance with the physical and chemical properties of the well screen, as specified herein.

(E) Filter Pack Sand and Disinfectant Material

The filter pack shall be Tacna or equal, consisting of clean, well-rounded grains that are smooth and uniform. The filter pack shall be siliceous with a maximum limit of 2 percent by weight, calcareous material. The filter pack material shall consist of well-rounded particles with an average density of not less than 2.5 grams per cubic centimeter, and have a uniformity coefficient no greater than 1.5. Not more than 1 percent of the material, by weight, shall have a density of 2.25 grams per cubic centimeter or less. The filter pack shall contain no more than 2 percent by weight, thin, flat, or elongated pieces (pieces in which the largest dimension exceeds three times the smallest dimension) determined by hand-packing. The filter pack material shall be free of shale, mica, clay, dirt, loam, organic impurities of any kind, and shall not contain iron or manganese in a form or quantity that will adversely affect the water quality. The filter pack grain size shall be retained by a No. 16 mesh U.S. Standard sieve, and a minimum of 92 percent shall pass a No. 4 U.S. Standard sieve. A minimum of 98 percent of the filter pack shall be retained by a No. 12 U.S. Standard sieve.

Samples of the filter pack and a sieve analysis (percent retained through U.S. Standard sieve numbers 4, 8, 10, 12, 16, 30, 40, 50, 100, and 200) of the filter pack material shall be submitted to the Engineer for review, a minimum of 3 days prior to delivery of the filter pack to the well site. The filter pack material shall be contained in a temporary storage area at the well site in such a manner as to prevent contamination. The filter pack material shall be bagged in approximately 3,000-pound (about one cubic yard) “super sacks”. Each bag must be labeled with its actual weight. Any filter pack material delivered unbagged or unlabeled will be rejected. During installation of the filter pack, an NSF/ANSI/CAN Standard 60 approved granular calcium hypochlorite or similar disinfectant shall be added to the filter pack sand at the rate of ½ pound per cubic yard of filter pack material, based on 70 percent chlorine content. If a lesser strength hypochlorite or other chlorine product is used, the quantity shall be adjusted accordingly. The filter pack shall be installed from the total depth of the borehole at 750 feet bls to 500 feet bls, as shown on the plans.

(F) Bentonite Seal Material:

The bentonite seal material shall consist of sodium bentonite pellets or bentonite chips. The bentonite seal material shall contain no hazardous materials or gypsum. A 50-foot bentonite seal shall be installed above the filter pack from 500 to 450 feet below land surface (bls), as shown on the plans, and prior to installation of the formation stabilizer.

(G) Formation Stabilizer Material:

The formation stabilizer shall consist of clean aggregate or sediment material. The formation stabilizer material must be composed of inert materials, containing no organic or hazardous materials. An acceptable formation stabilizer would consist of clean siliceous pea gravel with 5-foot bentonite seals (chips) installed at 100-foot intervals. A sample of the formation stabilizer material shall be provided to the Engineer for review no less than 24 hours prior to installation. The bentonite seal material shall consist of sodium bentonite pellets or bentonite

chips. The bentonite seal material shall contain no hazardous materials or gypsum. For bidding purposes, 20 feet (total) of bentonite will be installed within the formation stabilizer. The formation stabilizer shall be installed from the top of the bentonite seal at 450 feet bls to the base of the surface casing at 20 feet bls, as shown on the plans.

(H) Cement Grout Material:

The casing cement grout seal material shall consist of cement slurry containing 5.2 to 6.0 gallons of water per 94-pound sack of Portland cement. The cement shall conform to ASTM Standard C150, Type II (if Portland cement is used) or ASTM Standard C595 Type IL (if Portland-limestone cement is used). The cement grout weight shall be measured prior to installation, as an indicator of the cement-water ratio. The cement grout slurry shall not exceed 17.0 pounds per gallon (lb/gal) (approximately 127 pounds per cubic foot, lb/ft^3). The cement grout slurry may contain sand, which shall not exceed 50 percent by volume of the cement. Bentonite may be used as an additive, and must be in powder form and shall not exceed 4 percent by volume of the cement, or cement and sand. Water added for bentonite shall not exceed 1.3 gallons per 1.88 pounds of bentonite (2 percent by weight in cement). Accelerator additives, such as calcium chloride, shall not exceed 2 percent by weight of the cement. If the cement grout is not mixed on site, the contractor must provide the specific constituents of the cement grout to the Engineer prior to placement of the grout. The cement grout slurry shall be mixed thoroughly and must be free of lumps to the satisfaction of the Engineer. Cement grout that does not comply with this specification will be rejected. The casing cement grout seal shall be installed from the top of the formation stabilizer at 20 feet bls to the land surface.

Construction Requirements:

(A) Contractor Qualifications

The contractor shall have no less than five (5) years of local (within the Basin and Range geologic province of Arizona or equivalent) experience using rotary drilling. In addition, the contractor must have successfully completed no less than five (5) separate well installation projects in the Basin and Range area within the past two (2) years, using rotary drilling, and involving installation of water wells with similar casing dimensions and well depths as specified herein. An experience and qualifications summary shall be submitted with the bid submittal. Additionally, a specifications summary of the drilling rig to be used must also be provided with the bid submittal. In lieu of local experience, the contractor may submit equivalent experience from other similar geologic settings.

The contractor shall hold: (1) a valid Arizona Department of Water Resources (ADWR) Well Driller’s License in the rotary drilling category; (2) an Arizona Registrar of Contractor License type A, A-4, A-16, CR-53 or C-53; and (3) all other licenses required by Federal, State, County, or Municipal rules and regulations. Subcontractors may also hold a valid Arizona Well Driller’s License in addition to that of the contractor, but not in lieu of the contractor’s ADWR Well Driller’s License. The contractor shall provide a copy of their Arizona Well Driller’s License with the bid submittal.

(B) Operations

During installation or removal of drill tools or casing, the contractor shall provide and use a drill tool “laydown line” (i.e., a stabilizing cable connected to the tail end of drill pipe, casing or

drill collar, which will allow the pipe to be safely handled during its installation into or removal from the borehole). If such a laydown line is unavailable, the contractor shall maintain no less than three (3) workers on site throughout the well drill tool or casing installation/removal operations (including tripping into or out of the well, making connections, and installation of the well casing or well screen). The laydown line system must comply with Occupational Safety and Health Administration (OSHA) requirements. All operations shall be performed under the direct and personal supervision of an Arizona-licensed well driller. The contractor shall assign a foreman (tool pusher) to oversee all work required by this specification. After selection, the contractor foreman shall provide to the Engineer a written certification that he has read and fully understands this technical specification prior to mobilization to the well site. The contractor shall construct the well in accordance with the Rules and Regulations of the ADWR, Article 8, Well Construction and Licensing of Well Drillers. The well construction shall also comply with all applicable Federal, State, County, and local regulations. Rejection of any materials, work, or equipment by the Engineer shall be at the contractor's expense, and at no cost to the Department. Replacement materials, work, or equipment that are in accordance with these specifications shall be provided at no cost to the Department.

(C) Contractor Responsibilities

Should the well be lost due to any negligent action on the part of the contractor, the well shall be abandoned at no cost to the Department, in accordance with ADWR Article 8, Rule R12-15-816, and a replacement well shall be constructed in the immediate area. The replacement well location will be selected by the Department. The replacement well shall be completed in accordance with all the terms and conditions stated herein. The contractor shall credit the Department for any and all costs associated with the lost well, and this credit shall be applied against any additional contractor charges associated with the drilling and completion of the replacement well.

If the loss of the well was not due to any negligent action of the contractor, the Department may designate a replacement well location and the contractor may submit a change order request for consideration by the Department, which, if approved, will facilitate reimbursement for the replacement well on the basis of contractor's original lump sum Bid. If a work delay, deficiency of work performance and/or a material's deficiency is caused by the contractor failing to comply with any item of these specifications, the contractor shall bear the burden of additional expenses. This includes delays due to equipment failure, if the equipment failure could have been prevented through proper maintenance.

(D) Protection of Site

The contractor shall take all necessary precautions to preserve the well site, as nearly as practical, in its present condition. The contractor shall be responsible for replacing any damaged items.

The contractor shall provide, at its own cost, an adequate roll-off bin to contain all debris and trash collected at the site. All litter and debris will be cleaned up daily and placed in the roll-off bin for off-site disposal.

The contractor is responsible for the location and clearance of all underground utilities using Arizona 811 (previously, Blue Stake), a private utility location service or both. The contractor

shall be responsible for any damage resulting from its failure to identify and avoid underground utilities.

A plastic tarp and berm shall be placed beneath the drilling rig during mobilization to protect the site against oil or hydraulic fluid spills or leaks, and will remain beneath the rig until demobilization. A plastic tarp and berm shall also be placed beneath other stationary equipment such as air compressors and fuel tanks. Compressed air introduced into the wells during drilling, sampling, or well development must be treated by passage through a carbon or coalescing filter to remove organic contaminants (e.g., compressor lubrication oil).

Circulation of drilling fluids shall be conducted using above-ground mud tank(s). During drilling, the mud tank(s) shall be emptied of cuttings at necessary intervals. Drilled cuttings shall be contained on-site in a designated area and may be spread on-site following completion of drilling activities.

Drilling fluids recovered during drilling and well construction shall be contained, transported, and disposed of in a legal manner by the contractor.

Water pumped from the well during development operations shall be conveyed to a location identified by the Department, where it will not cause damage to the property, contamination of other wells or waterways, or creation of a nuisance. The contractor should plan to temporarily contain swab and airlift development water onsite in above-ground portable storage tanks (Baker Tank or equivalent), to allow suspended solids to settle. Once the suspended solids have settled, the clarified water can be pumped to a location specified by the Department, within 300 feet of the well site.

(E) Equipment

The contractor shall furnish and maintain in safe and efficient working condition all equipment necessary to perform the specified work, including a drilling rig capable of performing the specified operations to the specified depths; pumping, testing; and auxiliary equipment as specified or required to complete the described tasks. The contractor shall submit a statement with their bid indicating the drilling equipment to be used. The drilling rig used for the installation of the well shall have a mast capacity no less than 1½ times the string weight of the well casing and screen (approximately 25,000 lb. for this well), and the well shall be installed without the use of a float plate. All equipment requirements specified in this Section shall be provided at the contractor’s expense.

The equipment supplied by the contractor shall include:

- A wireline depth indicator capable of measuring depths equal to the total depth of the borehole, and equipped with a counter device which provides for a depth measurement accuracy of ± 1 foot;
- Devices for measurement of drilling mud viscosity and weight;
- An operating and accurate inclinometer tool;
- An operating and accurate penetration rate indicator (Geolograph or equal);

- An operating and accurate gauge that indicates the hook load (weight) of the drill string;
- A first aid kit;
- A fully recharged and operable type ABC dry chemical fire extinguisher; and
- An operable mobile telephone located at the well site.

The contractor shall also maintain at the well site, or have the ability to rapidly fabricate, commonly used fishing tools (such as overshots, wall hooks, junk baskets, etc.) to accommodate the event that lost tools in the borehole require fishing operations.

In addition, the compressor used for air supply shall be capable of a minimum of 350 pounds per square inch (psi) and 750 cubic feet per minute (cfm). This requirement is for well development. A smaller “air package” can be used during drilling.

Prior to the start of drilling, the contractor shall decontaminate the drill rig and downhole tools by steam cleaning. The contractor will be required to provide a letter of certification of the decontamination of the contractor’s equipment, prior to utilization. The contractor may certify, in writing, the decontamination of critical (downhole) pieces of drilling equipment in lieu of actual steam cleaning, provided the downhole pieces of drilling equipment have not been in contact with any hazardous or toxic materials since the last decontamination. All necessary steam cleaning will be conducted at the contractor's expense.

(F) Delivery, Handling, and Acceptance of Materials

The contractor shall be responsible for the timely delivery of the well casing, well screen and other materials to the drilling site and as required to complete the well installation program. Upon the completion of drilling the borehole and conducting geophysical logging, the contractor shall immediately commence well installation operations.

(G) Water

Water for the drilling of the well will be the responsibility of the contractor. For bidding purposes, water used for drilling, installation, and testing of the well will be acquired from the water tank filled by the current well (55-562328) located within 200 feet of the well site. The contractor shall coordinate directly with the Department to obtain the water. The contractor will be responsible for all piping, connections, ancillary equipment, and labor required to convey the water to the well site for use. The contractor will be responsible for obtaining an adequate flow rate of construction water for all operations under this specification. The contractor will be responsible for all costs associated with transporting water to the well site.

(H) Submittals

The following submittals, samples, certifications, and information listed below shall be provided:

Submittal Item	Required Time of Submittal
1. Statement of drilling equipment to be used, copies of Driller's License and ROC License, experience and qualifications summary	With Bid
2. Certification from drilling foreman, having read and understood the Specifications	Prior to mobilization to site
3. Subcontractor Non-disclosure Agreements	Prior to commencing work by subcontractors
4. Letter of Certification of Decontamination	Prior to equipment use
5. Certified Test Report of surface casing steel	Prior to delivery to site
6. Specific constituents of cement grout seal for surface casing	Prior to placement of grout
7. Certified test report of well blank casing and screen	Prior to delivery to site
8. Screen tensile strength, collapse strength, weight, and maximum recommended hang weight	Prior to delivery to site
9. Filter Pack sieve analysis/sample	Three days prior to delivery to site
10. Bentonite sample	24 hours prior to installation
11. Cement mix design for annular seal	Prior to placement of grout
12. Daily Driller's Report	Daily during operations
13. Driller's Well Completion Report	Within 30 days after well completion (per ADWR requirement) with copy provided to the Engineer
14. Penetration Rate Log	Daily during drilling operations
15. Drilling Fluid Record	Daily during operations
16. Drilling Fluid Control Plan	Prior to start of drilling operations
17. Material Safety Data Sheets	Prior to use of material
18. Formation Sampling Method	Prior to start of drilling
19. Final copies of geophysical logs (including electronic format)	Within 10 working days of logging (field copies to be provided immediately)
20. Affidavit of Compliance with welding provisions	Prior to acceptance of the well
21. Digital copies of the final well video	Prior to acceptance of the well

(l) Reports, Logs, and Records

(1) General

The contractor shall keep an accurate and legible daily log and record of all drilling, testing, and construction, describing all geologic material encountered during drilling, the depths at which changes in formation occur, and all difficulties or unusual conditions encountered. The

logs and records shall also show the method of completing the well, including the lengths of the well casing and well screen installed and the volume of all annular fill and seal materials.

(2) Penetration Rate Log

During the drilling of the borehole, a time log shall be kept showing the actual penetration time required to drill each foot of the borehole. The types of bits used in each interval of the borehole shall be noted on this log and whether designed for soft, medium, or hard formations, including approximate weight on the bit and rotation speed (RPM) of the bit, and any other information that may be requested by the Department. These logs shall be available for review to the Department throughout the drilling program and shall be delivered to the Department upon completion of drilling.

(3) Daily Driller’s Report

During the drilling of the borehole, a detailed driller's report shall be maintained and provided daily to the Department at the well site. The reports shall give a complete description of all formations encountered; number of feet drilled; number of hours on the job; shutdown due to breakdown; drilling fluid additives used; length and type of casing set; volumes of filter pack and annular seal installed, and such other pertinent data as may be requested by the Department. The contractor will submit the reports to the Department daily.

(4) Driller’s Log

During the drilling of the borehole, the contractor shall prepare a detailed driller's log in compliance with the requirements of the ADWR. The log shall include the reference point for all depth measurements, a generalized description of each formation encountered, the depth at which each formation is encountered and the thickness of each formation. A copy of the driller's log shall be furnished to the Department upon completion of drilling, prior to acceptance of the well.

(5) Drilling Fluid Record

During the drilling of the borehole, a log of drilling fluid properties shall be maintained by the contractor. The drilling fluid record will be recorded on an American Petroleum Institute (API)-approved form, and shall document all items listed in Section 3.10. The drilling fluid records shall be available for review to the Department throughout the course of drilling, and the logs shall be delivered to the Department upon completion of each day’s work activities.

(J) Drilling Fluid Control Program

(1) Drilling Fluid Control Plan

The contractor shall provide a drilling fluid control plan to the Department prior to the start of drilling. The plan will outline specific drilling fluid additives the contractor plans to use, how anticipated changes in the drilling conditions will affect the drilling fluid control plan, fluid testing procedures, and equipment that will be used. Drilling fluid additives shall be certified by the National Sanitation Foundation (NSF).

(2) Drilling Fluid Testing

The contractor shall retain an experienced drilling fluid engineer as a Subcontractor. The drilling fluid engineer will be available within a 2-hour travel time of the sites during all drilling and well construction operations. The drilling fluid engineer is expected to periodically, and upon request of the Department, visit the well site to review the drilling fluid program and conduct drilling fluid tests. Drilling fluid tests will be required during periods when any drilling fluid additives (not only clear water) are being circulated in the borehole. Physical and chemical properties of the drilling fluid are to be measured in accordance with the procedures of the API Standard RP 13B, “Standard Procedures for Testing Drilling Fluids.” Samples tested are those collected at the rig discharge line, with care taken to assure a true and representative sample. Drilling fluid tests shall be conducted at a minimum of (1) every 24 circulating hours; (2) when significant changes to the drilling fluid are made; (3) whenever conditions appear to have changed or when problems arise; or (4) at the request of the Department. A Marsh-type viscosity funnel and a mud scale will be available at the well site during all well construction operations and, upon request, will be made available to the Department.

The contractor shall maintain current records at the site at all times to show: (1) the time, depth, and results of all drilling fluid tests; (2) all materials added to the system, (including type, amount, time, and depth); (3) variances or modifications from the agreed upon fluid program such as time, depth, reason, and authorization.

The contractor is responsible for maintaining an adequate supply of drilling fluid additives at the drilling site and for the removal of all drilling fluids and additives from the borehole during development of the well. The above ground mud tanks shall have a total volume no less than that of the maximum borehole volume (approximately 801.7 cubic feet or about 5,997 gallons, based on the final well design). The tank shall contain at least one baffle, to assist with the separation of cuttings and suspended solids from the drilling fluid.

(K) General Requirements

During the drilling of the borehole, and the installation of the well, the contractor will be responsible to minimize the chemical and biological disturbance of the vadose zone and saturated alluvial matrix. The use of certain organic drilling fluid materials (such as starch, guar, or cottonseed hulls) will not be accepted for drilling, although some organic polymer additives may be allowed. Safety Data Sheets (SDS’s) from the manufacturer for all drilling fluid additives must be provided to the Department prior to their use. The Department reserves the right to reject any and all proposed additives.

The contractor shall be responsible for maintaining the quality of the drilling fluid to ensure:

1. Protection of water-bearing and potential water bearing formations exposed to the borehole;

2. Representative samples of the formation materials and groundwater;

3. Maximum development capacity and optimum potential yield of the completed well;

4. Inhibition of the formation and prevention of formation-caused drilling problems (e.g., heaving sands, swelling clays, lost circulation); and

5. Protection of the integrity of the boring during drilling and well installation operations.

(L) General Drilling Methods

Drilling will be conducted by the direct mud rotary or reverse circulation rotary drilling methods. The contractor is responsible for designing and controlling a drilling program that conforms to this specification.

(M) Surface Casing Installation

(1) Surface Borehole Drilling

The surface casing borehole shall be drilled to a minimum 20-inch diameter, to a depth of at least 20 feet below land surface (bls). The surface casing boring may be drilled using a rotary drilling method as described in Section 3.12, or by use of the bucket auger (solid stem auger) drilling method.

During the drilling of the surface casing borehole, the contractor shall collect and preserve for the Department samples of the drilled cuttings collected at 10-foot intervals. The samples shall be placed in 4½-inch by 6-inch cloth sacks (Hubco or equivalent) furnished by the contractor.

(2) Surface Casing Installation

Details for the surface casing construction are shown on the project plans. The surface casing, conforming to Section 2.1, shall be furnished and placed from 1 foot above the ground surface to at least 20 feet bls. The surface casing installation shall be conducted under the observation of the Department.

(3) Surface Cement Grout Installation

Cement grout slurry conforming to the specification in Section 2.2 shall be placed from the base of the surface casing to the ground surface. The contractor shall be responsible to maintain an equalization of pressures to the extent necessary to prevent collapse of the surface casing during cement grout installation. The grout seal shall completely fill the annular space and form a continuous seal between the surface casing and the wall of the borehole. If the reverse circulation rotary drilling method is used, the surface casing grout seal may be placed in two separate installations to completely extend from the base of the surface casing to the ground surface. The surface casing shall be maintained centered in the borehole during and after cement grout installation. A minimum curing time for the surface casing grout seal is 12 hours, with the cement grout obtaining a compressive strength of at least 500 pounds per square inch (psi).

(N) Well Borehole Drilling

(1) Well Borehole Drilling

The borehole shall be drilled to a depth of 750 feet bls, and shall have a 14-inch diameter unless otherwise approved by the Department. The boring shall be drilled using the methods described in Section 3.12, and in compliance with the drilling fluid control program described in Section 3.10 of the specification.

The contractor shall take all diligent care to produce a plumb and straight boring. Single-shot deviation surveys (“A-1 Sureshot” or equal) will be required during drilling of the boring. Single-shot deviation surveys will be performed in the drill string at the addition of every other joint of drill pipe, an equivalent of approximately 60 feet, from the base of the conductor casing to the total depth of the boring, unless otherwise directed by the Department. Surveys will be recorded on a 3-degree target which will be replaced each time a survey is performed. The borehole alignment will be maintained at one-half (1/2) degree or less at all times. If at any single location the survey results indicate that the borehole alignment has exceeded the specified tolerance, the contractor will be responsible for corrective measures to re-align the borehole until a survey indicates alignment is within acceptable limits. All survey results will be recorded on the geolograph logs and the daily drilling forms. Repeat single-shot deviation surveys may be required if requested by the Department to verify the accuracy and repeatability of the tool.

During the drilling of the borehole, the contractor shall collect and preserve for the Department samples of the drill cuttings collected at 10-foot intervals. The contractor shall provide an acceptable means of sampling the drilled cuttings at the discharge pipe. A sump-type or baffle-type sample catching devise shall be provided by the contractor. Each cutting sample shall be carefully collected from the sampling point, and the sample catching device shall be cleaned of all cuttings after each sample is taken.

The samples shall be placed in 4½-inch x 6-inch cloth sacks (HUBCO or equal) furnished by the contractor. In addition, as an on-site visual record of the borehole stratigraphy, each sample shall be laid out in a sample storage area on a waterproof tarp or ground cloth for each sampled interval in descending order. The storage area and ground cloth must allow samples to be maintained in sequence and unmixed with surface material or other samples until they have been examined and logged by the Department. Prior to the start of drilling, the contractor shall submit details of the proposed formation sampling method to the Department, including the specific sampling equipment (e.g., sample collection box) to be used.

During the drilling of the borehole, the contractor shall implement measures to ensure that all fluids, such as water from the aquifer, or drilling fluid (if required) are contained in a manner that prevents contact with the surrounding environment and allows for removal and disposal from the well site. All fluids must be contained in above ground storage tanks, and must be disposed of in a manner approved by the Department.

(2) Geophysics

Geophysical logging from the bottom of surface casing to the total depth of the boring shall be conducted upon completion of the drilling. The geophysical logging company will be contracted by the contractor.

The geophysical logging suite is anticipated to include the following logs:

1. 3-Arm Caliper Log
2. Natural Gamma Ray Log
3. Spontaneous Potential and Resistivity Logs (Electric Logs)

The contractor shall keep the boring full of drilling fluid at all times during geophysical logging to stabilize the borehole and provide log integrity. The contractor shall assist the geophysical logger in rigging of the geophysical survey equipment. The contractor shall ensure that the logging tools can be run to the total depth of the borehole without interference by obstructions or tight sections in the borehole.

(O) Well Installation

The contractor shall install the well in accordance with the final design approved by the Department. Throughout the well installation and development process, the contractor shall be responsible for preventing collapse of the well casing and screen.

(1) Casing and Screen Installation

During the installation of the well casing, the boring shall be kept full of drilling fluid of the type specified in Section 3.10 and be free from any obstructions detrimental to completing the casing installation. The well casing shall be set centered in the borehole so as not to interfere in any way with the grout seal, filter pack, well installation, or maximum efficient operation of pumping equipment within the well casing or screen. The contractor will be required to work continuously, on a 24-hour per day, 7-day week basis, while installing and completing the well.

The well casing and well screen for the well shall be set by the contractor at the depth intervals specified in the final well design. HSLA casing centralizers shall be secured to the well casing at intervals of not greater than 80 feet. The casing shall be hung in suspension until the filter pack and cement grout seal have been installed.

(2) Joints in the Well Casing

Joints in the steel well casing and well screen shall be field welded in accordance with applicable provisions of the American Water Works Association (AWWA) Standard C206 for welded joints. A welding sequence will be followed that will avoid excessive distortion. All well casing joints or overlaps shall be made watertight to prevent the degradation of the water supply by the migration of poor-quality water. All welding shall be performed by an experienced welder. An affidavit of compliance with the welding provisions of this section shall be provided to the Department prior to Department acceptance of the well. The affidavit of compliance will certify that all welding conducted during this project was performed in accordance with all applicable provisions of this Section of this specification.

If the casing or screen sections are butt-welded without the use of welding rings, the ends of the casing lengths shall be ground, or sufficiently scarfed, to remove sharp edges or burrs. The ends of each casing section shall not vary more than 0.010 inch at any point from a true plane at right angles to the axis of the casing. The casing and screen end shall be beveled at one end to allow complete penetration of the welds.

If the casing or screen sections are joined with welding rings, the ends of the casing lengths shall be ground, or sufficiently scarfed, to remove sharp edges or burrs. One end of the casing section shall be furnished with a welding collar of the same wall thickness and have the same physical and chemical properties as the corresponding casing sections. The welding collars shall have a minimum 5-inch length, and shall fit the O.D. of the well casing within 0.0625-inch diametrical clearance. The welding collars shall be delivered to the well site connected to the casing sections at one end with factory-welded connections. The inside edge of the welding collars shall be ground or sufficiently scarfed to remove sharp edges or burrs. Three alignment holes shall be provided in each welding collar (spaced at 120°), to ensure proper abutment of the casing sections. The alignment holes shall be no larger than 1 inch in diameter, and shall be completely filled with fillet welding. The ends of each casing section shall not vary more than 0.010 inch at any point from a true plane at right angles to the axis of the casing.

(3) Filter Pack and Disinfectant Installation

Filter pack gravel, conforming to the specifications of Section 2.5, shall be placed to completely fill the annulus in the specified interval as shown on the project plans. During the time of placement, fluid circulation shall be maintained through a swab block located no less than 40 feet below the fill depth of the filter pack sand. The swab block shall be periodically reciprocated to remove fine-grained material, prevent bridging, and aid in settling the filter pack in the borehole. Drilling fluid shall be maintained throughout the full depth of the well to the land surface and the well casing and screen shall be maintained in tension, until the filter material placement has been completed to the specified level. Care shall be taken to avoid bridging during installation of the gravel.

In accordance with applicable provisions of the AWWA Standard A100 for water wells, before the introduction of filter pack into the well annulus, the drilling fluid shall be reconditioned until it has the following properties:

- Weight – no greater than 9.1 lb/gal (68 lb/ft3);
- Viscosity – no greater than 30 seconds per quart; and
- Sand content – no greater than 1 percent by volume.

The above standards may be exceeded in cases where different drilling fluid properties are required to protect or stabilize the well due to unstable borehole conditions, or other site-specific circumstances. Any variance from the above-listed drilling fluid standards must be approved by the Department.

The filter pack shall be installed through a tremie pipe. At no time shall the bottom of the tremie pipe be located at a distance of greater than 30 feet above the interval being filled during filter pack placement. The level of the filter pack shall be measured periodically during placement with a wireline sounder. Placement of the filter pack will be continuous, except when additional precautions are necessary to prevent bridging, or while a measurement of the filter pack level is being conducted.

The quantity of filter pack material placed in the annulus shall not be less than that of the calculated volume. Upon completion of the filter pack placement, excess filter pack material will

be judged an indication of voids in the gravel envelope and corrective measures shall be undertaken at the contractor's expense.

During installation, the filter pack shall be disinfected using hypochlorite or similar agent constituent with the specifications in Section 2.5. The contractor is responsible for the uniform application of the disinfecting agent throughout the filter pack interval, without relying on subsequent mechanical surging action for dispersing the disinfectant.

(4) Bentonite Seal Installation

A 50-foot bentonite seal complying with Section 2.6 shall be installed in the well annulus immediately above the top of the filter pack interval.

(5) Formation Stabilizer Installation

Formation stabilizer material complying with Section 2.7 shall be installed in the annulus from the top of the bentonite seal to the base of the surface casing.

(6) Cement Grout Seal Installation

The well casing grout seal shall consist of a sand cement slurry conforming to the specification in Section 2.8. The cement grout shall be placed to completely fill the annular space between the well casing and the surface casing, from the top of the formation stabilizer at approximately 20 feet bls, up to the ground surface.

Prior to pumping the cement grout into the well annulus, it shall be passed through a ½-inch slotted bar strainer to remove any unmixed lumps. During cement seal installation operations, the contractor is responsible to maintain cement slurry hydraulic pressures and pumping pressures that will not reach excessive levels and cause casing collapse.

The well casing shall be hung in tension throughout the grouting operation, until the cement grout has cured sufficiently. A minimum curing time for the surface casing grout seal is 12 hours, with the cement grout obtaining a compressive strength of at least 500 pounds per square inch (psi).

(P) Well Development

Well development shall be accomplished by simultaneously swabbing and airlift pumping. A dual or triple flanged closed end swab tool is preferred. The well development for the well shall include an initial quick pass downward, after which the well development shall proceed from the bottom of the screen to the top of the screen, unless otherwise directed by the Department. During swab and air-lift development, the contractor shall maintain a discharge rate sufficient to effectively remove fines and sediment, unless limited by aquifer characteristics, as determined by the Department.

A non-phosphoric dispersant (such as the Johnson Screen product NW-220 or equal) will be added to the well in accordance with the manufacturer’s recommendations, during development operations. The contractor shall provide the Department with an SDS for all chemical additives used for well development at least 3 days prior to their use. The Department must review the specific type and placement method of all chemical additives

prior to their use. Development water shall be contained and/or disposed of by the contractor as specified in Section 3.4. Re-use of discharge water will not be allowed. The specific methods, chemical additives, and equipment used for well development must be reviewed by the Department prior to commencement of development operations.

After this initial phase of development, the contractor shall install an open-ended pipe to the bottom of the well and perform airlifting until the discharge water is clear of sediment and discoloration, to the satisfaction of the Department.

After swabbing and airlifting is complete, all sand, sediment, and foreign material shall be removed from the bottom of the well. The contractor shall provide the necessary equipment and air compressor capable of performing the required swabbing and airlifting without artificially raising the water level in the well boring.

After all sediment is removed from the bottom of the well, the well shall be chlorinated in accordance with AWWA Standard A100, through the drill string and surge block with the end open, starting at the bottom and working up. Approximately 1 gallon of 12 percent sodium hypochlorite per 30-foot interval, shall be placed into solution and injected down the drill string and into the formation, then briefly surged into place. This procedure shall be repeated for each section throughout the screened interval.

(Q) Plumbness and Alignment

Tests for plumbness and alignment shall be made by the contractor during the drilling of the borehole and after completion of drilling the borehole. All plumbness and alignment tests shall be conducted at the contractor's expense. If the well fails the final plumbness and alignment test, the contractor must correct the plumbness and alignment to the satisfaction and approval of the Department.

During the drilling of the borehole, plumbness and alignment tests shall be performed by the contractor using an inclinometer (TOTCO tool or equal) at 60-foot intervals. A 3-degree unit shall be used with the inclinometer.

After the well is constructed, the contractor shall lower a 10-foot-long cylindrical section of pipe ("dummy") into the well, suspended from a wireline, from the land surface to a depth of 750 feet bls. The dummy shall be a continuous cylinder composed of steel or other Department-approved material, with an outside diameter no more than 1.0 inch less than the 8.125-inch inside diameter of the casing. The installation and removal of the dummy must demonstrate no obstructions or tight sections in the well, and the dummy test must not result in any damage to the well casing, screen, or bottom plate.

The Department may waive the requirements of this Section if it is determined that: (1) the contractor has exercised all possible care in constructing the well and defect is due to circumstances beyond the contractor's control; or (2) the utility of the completed well will not be materially affected.

(R) Video Survey

After completion and testing of the well, the contractor shall provide a color video survey of the well. The video survey camera shall include both downward-looking and side-view

capabilities, and the video survey shall be conducted under the observation of the Department. Both the quality and clarity of the well video must be acceptable to the Department. Prior to Department acceptance of the well, the contractor shall provide the digital final well video file to the Department.

(S) Covering Plate and Access Port

After completion of all testing and surveys, the well shall be temporarily capped with an HSLA covering plate with the same composition and the same wall thickness as the well casing. The covering plate will be secured to the top of the well with a water-tight welded seam.

(T) Surface Completion

Upon completion of the well, a cement pad (5 feet x 8 feet x 12-inches), as shown on the plans, shall be installed around the surface casing and must be sloped away from the well casing to direct runoff away from the well. The surface completion must be approved by the Department.

(U) Abandoned Well Clearance (Ground Penetrating Radar)

Prior to drilling and mobilization of the drilling rig, The contractor shall subcontract a qualified company to locate the existing abandoned well (55-637125) in the vicinity of the proposed new well using Ground Penetrating Radar (GPR) or other Engineer-approved methods capable of identifying the abandoned well. The contractor shall perform the survey over an area extending 50 feet in all directions from the proposed well location. Any feature suspected to be an abandoned well within 30 feet of the proposed well location shall be investigated and verified through potholing, as directed by the Engineer. The new well shall not be drilled within 20 feet of an abandoned well. The contractor shall not commence drilling until the location of the abandoned well has been identified or it has been demonstrated, to the satisfaction of the Engineer, that no abandoned well exists within 20 feet of the proposed well location. If an abandoned well is identified within 20 feet, The contractor shall notify the Engineer and Department and suspend work at that location until the proposed well is relocated. Note: available records from the Arizona Department of Water Resources indicate the abandoned well was cemented and the upper approximately 36 inches of casing was removed and backfilled.

Method of Measurement:

Well installation will be measured on a lump sum basis.

Basis of Payment:

Miscellaneous Work (Well Installation) measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place, including well development, and waste disposal.

ITEM 9240058 MISCELLANEOUS WORK (HAZARDOUS MATERIALS SPILL CONTAINMENT BASIN)

Description:

This work consists of constructing a hazardous materials spill containment basin adjacent to parking areas to capture and retain liquid, primarily diesel fuel released from commercial vehicles and prevent discharge to soil, groundwater, or surface waters. The basin shall function as a gravity-driven, non-discharging secondary containment system and shall include excavation, subgrade preparation, plastic liner installation, concrete flatwork, valve installation, interface sealing with adjacent pavement, and all incidental work required for a complete and functional facility.

Materials:

(A) General

Materials shall conform to the materials requirements indicated on the project plans and these Specifications.

(B) Plastic Sheet Liner

The liner for the hazardous materials spill containment basin shall be constructed of a 6 mil (0.006 inch) high-density, impervious polyethylene (HDPE) geomembrane. The HDPE geomembrane shall exhibit chemical resistance to petroleum products, including but not limited to gasoline and diesel fuel.

Construction Requirements:

The contractor shall construct the hazardous materials spill containment basin in accordance with the contract plans and these specifications. Work includes excavation, subgrade preparation, liner installation, protection, testing, and restoration. Construction activities shall be performed in a manner that avoids contamination of surrounding soil or groundwater.

(A) Interface with Pavement and Adjacent Features

Concrete pavement adjacent to the basin shall be constructed to slope toward the containment area. Pavement edges shall be sealed to prevent liquids from migrating beneath the liner or escaping the containment system. Expansion joints, cracks, or utility penetrations adjacent to the basin shall be sealed to maintain containment integrity.

(B) Testing

Liner installation shall undergo inspection to ensure its integrity and functionality. Prior to installation, the subgrade must be inspected and approved to confirm it is free of sharp objects, debris, and any irregularities.

During installation, each seam shall be visually inspected and tested using non-destructive methods such as air pressure testing (according to ASTM D5820) or vacuum box testing to verify seam integrity.

All inspection and testing results shall be documented and submitted along with the project closeout documentation to certify the quality and readiness of the containment basin.

Method of Measurement:

Hazardous Materials Spill Containment Basin will be measured as a lump sum item, complete and in place, including excavation, subgrade preparation, geomembrane liner, concrete flatwork, steel reinforcement, valves, sealing, testing, inspections, and all work necessary to provide a complete and functional system.

Basis of Payment:

The accepted quantities of Hazardous Materials Spill Containment Basin, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work complete in place, including all labor, materials, equipment, testing, inspections, and environmental protection measures required to construct the basin in accordance with the plans and specifications.

ITEM 9240060 MISCELLANEOUS WORK (COALESCING PLATE WATER-OIL SEPARATOR)

Description:

The work under this item shall consist of furnishing and installing a prefabricated coalescing plate water-oil separator (CPI) unit complete with an integral underground pit (vault), including all internal treatment components, access openings, and appurtenances necessary to provide a fully operational system, as shown on the plans and specified herein. The CPI shall be designed as a self-contained unit that incorporates the separator structure and treatment system within a single manufactured assembly installed below grade. The separator shall be capable of receiving pressurized influent from an upstream sump pump system and separating and retaining free oils, grease, and floatable hydrocarbons prior to discharge to the downstream drainage system.

Materials:

(A) General:

The CPI shall be a manufacturer-engineered, prefabricated unit that includes the underground pit, constructed of reinforced concrete or steel, as shown on the plans. Concrete units shall be internally coated with a corrosion-resistant epoxy lining suitable for exposure to petroleum products. Steel units shall be factory coated and protected in accordance with the manufacturer’s standard practices. The CPI shall include removable inclined coalescing plate packs, internal baffles, oil storage compartment, and outlet oil retention devices required to

meet coalescing plate interceptor performance criteria. All materials shall be suitable for buried service and capable of supporting applicable earth and traffic loads.

The CPI shall be hydraulically configured to prevent short-circuiting or bypass of internal treatment components, and all influent flow shall be directed through the coalescing plate assemblies and oil retention devices prior to discharge.

Access openings shall be provided for the CPI to allow inspection, cleaning, and maintenance of all internal basins or compartments. Access shall be arranged such that each basin is reachable for maintenance activities, either directly through a dedicated access opening or indirectly through internal openings in accordance with the manufacturer's design. Access openings shall be located over functional areas including the inlet, separation zone, and outlet, as applicable. The number and location of access openings shall comply with the manufacturer's requirements and applicable safety standards.

The CPI vault and access openings shall be sized and arranged to allow safe inspection, cleaning, and full removal and replacement of coalescing plate assemblies without modification to the structure or removal of surrounding pavement or structural elements.

The CPI shall include high liquid level and leak detection sensors. All level sensors, leak detection devices, and monitoring components integral to the CPI unit shall be furnished and installed by the CPI supplier or manufacturer.

The CPI shall have a minimum capacity of 1000 gallons and shall have three basins.

The CPI shall include a 6-inch inlet pipe and a 6-inch outlet pipe.

The CPI unit, including the integral underground pit and access covers, shall be designed to support vehicular live loads in accordance with AASHTO HS-20, suitable for repeated heavy truck traffic associated with Port of Entry operations.

(B) CPI Vault or Pit

The CPI unit and the associated pit or vault may be provided as an integrated system by a single manufacturer or as separate components supplied by different manufacturers. Where provided separately, The contractor shall be responsible for coordinating the separator and pit to ensure compatibility, proper support, required clearances, access openings, and compliance with the separator manufacturer's installation requirements. The completed installation shall function as a fully integrated system.

(C) Oil-Only Polypropylene Absorbent Pillows

Provide oil-only absorbent pillows manufactured from hydrophobic polypropylene fibers specifically designed to absorb petroleum-based hydrocarbons while repelling water. The absorbent media shall be chemically inert, non-biodegradable, and compatible with fuels, oils, lubricants, and related hydrocarbons commonly encountered in stormwater and industrial drainage systems.

The absorbent pillows shall be oil-only type and shall not absorb water. The material shall selectively absorb hydrocarbons and reject water, allowing the pillows to remain buoyant and

functional when deployed in wet environments. When placed in water, the pillows shall float at the oil–water interface, including when partially or fully saturated with oil, and shall not sink or become waterlogged during normal service conditions.

The contractor shall furnish one complete replacement set of oil-only polypropylene absorbent pillows for the oil-water separator. The replacement shall consist of the same size, and type of absorbent pillow as originally installed. Spare absorbent pillows shall be delivered to the Owner at project closeout.

The contractor shall furnish one pillow retrieval hook to the Owner at project closeout.

(D) Standards

The coalescing plate oil/water separator shall comply with applicable provisions of the Arizona Department of Transportation Standard Specifications. The CPI unit, including the integral underground pit, shall be designed to support applicable earth and traffic loads in accordance with AASHTO requirements.

Precast reinforced concrete components of the CPI unit shall conform to ASTM C478. Precast concrete joints and connections shall provide a watertight structure in accordance with ASTM C913 or ASTM C1227. Structural steel components, where used, shall conform to ASTM A36 or ASTM A572. Coalescing plate media shall be manufactured from corrosion-resistant polymer materials conforming to ASTM D3350 or ASTM D1784. The CPI shall be designed and sized in accordance with manufacturer recommendations for pumped-flow applications.

The CPI unit, including the underground pit or vault, access covers, and load-bearing components, shall be structurally designed and supported by structural calculations demonstrating compliance with applicable earth, hydrostatic, buoyancy, and AASHTO traffic loading requirements. The design and calculations shall be signed by a Registered Engineer licensed to practice in the State of Arizona. Professional engineer–sealed structural calculations may be submitted after initial submittal approval but shall be provided prior to fabrication or installation.

(E) Shop Drawings

Shop drawings for the CPI and vault shall be required.

In addition to shop drawings, The contractor shall submit manufacturer product data, installation instructions, and operation and maintenance documentation for the CPI unit. Submittals shall demonstrate that the unit meets the performance and installation requirements shown on the plans and specified herein.

Construction Requirements:

(A) General

The CPI shall be installed in accordance with the manufacturer’s written instructions. The unit shall be set level on a prepared foundation constructed by The contractor in accordance with manufacturer recommendations and ADOT Standard Specifications.

Excavation, bedding, backfill, and surface restoration shall be performed to provide uniform support and prevent settlement or flotation. The CPI shall be placed on a firm, level, compacted granular base consisting of crushed stone or sand bedding to provide uniform bearing and proper leveling. The thickness and gradation of the granular base shall be in accordance with the separator manufacturer's installation requirements.

Place one oil-only polypropylene absorbent pillow in the final basin of the CPI.

The contractor shall be responsible for providing buoyancy control measures, including additional ballast, deadmen, or anchorage, if required by site groundwater conditions or manufacturer recommendations. Anti-buoyancy provisions shall be installed as necessary to prevent flotation of the CPI unit.

The CPI unit shall be installed such that access openings remain unobstructed and accessible for inspection, cleaning, and maintenance after completion of the work. Final surface restoration shall not impair removal of covers or access to internal components.

(B) System Connection

Influent piping shall be connected to the CPI in a manner suitable for pressurized discharge from the sump pump system and shall include energy dissipation or flow diffusion as required to ensure proper separator performance. All piping connections shall be watertight and installed without imposing stress on the tank or internal components. Prior to placing the separator into service, The contractor shall inspect the unit, verify that all internal components are properly installed, and clean the separator of construction debris. The sump pump system shall be operated to confirm proper flow distribution through the CPI.

(C) Testing

After installation and prior to final acceptance, the CPI shall be tested to verify structural integrity, watertightness, and proper operation. Testing shall be performed in accordance with the manufacturer's written recommendations and applicable ADOT requirements.

The underground CPI unit, including the integral pit, shall be inspected for damage, proper alignment, and level installation. All access openings, joints, penetrations, and piping connections shall be examined to confirm watertight construction. Where required by the manufacturer or Engineer, the CPI shall be filled with clean water to normal operating level and observed for leakage for a sufficient duration to demonstrate watertightness.

Following watertightness verification, The contractor shall demonstrate proper hydraulic and treatment operation of the CPI. The upstream sump pump system shall be operated to introduce flow into the separator, and flow distribution through the unit shall be observed to

confirm that influent enters the CPI as intended and exits without bypassing internal treatment components.

The contractor shall verify that internal baffles, oil retention devices, and coalescing plate assemblies are correctly installed and functional.

The contractor shall test each device to confirm proper operation and reporting including Level sensors, leak detection sensors, or monitoring devices. Any deficiencies identified during testing shall be corrected, and the CPI shall be retested until satisfactory performance is achieved.

Successful completion of testing and demonstration of proper operation, as determined by the Engineer, shall be a condition of acceptance.

Method of Measurement:

Miscellaneous Work (Coalescing Plate Water/Oil Separator) shall be measured on a lump sum basis.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Coalescing Plate Water/Oil Separator), measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including the prefabricated underground vault, internal coalescing plates, access covers, sensors, oil-only polypropylene absorbent pillows, retrieval hook, excavation, foundation preparation, installation, and testing.

ITEM 9240061 MISCELLANEOUS WORK (LIGHTNING PROTECTION SYSTEM):

Description:

This work consists of furnishing and installing a lightning protection system that consists of atmospheric electric-field management devices intended to serve as supplemental lightning risk mitigation components for highway facilities, camera devices, and associated infrastructure.

The devices are intended to passively manage localized atmospheric electric field conditions by transferring low-magnitude electrical currents to the grounding system during elevated atmospheric electric field events. The devices shall be passive or self-contained, shall not require external power, and shall operate continuously without user intervention.

The devices shall function only as supplemental lightning risk mitigation components and shall not eliminate the need for conventional lightning protection, grounding, or surge protection systems where required by code or shown on the plans.

Materials:

The lightning protection atmospheric electric field management devices shall be constructed of corrosion-resistant materials suitable for continuous outdoor exposure. Materials shall be suitable for exposure to rain, wind, ultraviolet radiation, temperature extremes, dust, and other environmental conditions typical of highway and desert environments.

The devices shall be compact and lightweight to minimize structural loading and wind effects. The installed weight of each device, excluding mounting hardware, shall not exceed approximately 20 pounds, unless otherwise approved by the Engineer.

The devices shall be passive in operation and shall not require external electrical power, batteries, active electronic emission, explosive components, or ionizing radiation sources. Mounting hardware and accessories shall be constructed of corrosion-resistant materials compatible with the mounting surface and environmental conditions.

Construction Requirements:

(A) General

Install lightning protection atmospheric electric field management devices at the locations shown on the plans or as directed by the Engineer. Device locations shall be installed to reach and cover all areas that have outdoor CCTV cameras to provide protection to the camera devices. Installation shall be coordinated with other work and shall not interfere with normal facility operations. Installation shall not require interruption of facility power systems.

(B) Mounting

Devices shall be mechanically mounted to structures, poles, or support elements using mounting methods and hardware appropriate for the application. Mounting shall be secure and shall not compromise the structural integrity of the mounting surface.

Installation shall not require structural reinforcement of typical roofs, poles, or support elements unless shown on the plans or directed by the Engineer.

(C) Grounding and Bonding

Each device shall be electrically bonded to the facility grounding system. Grounding and bonding shall comply with the applicable requirements of NFPA 780 and the Contract Documents.

Ground conductors shall be installed in a neat and workmanlike manner, routed to minimize physical damage, and securely connected to grounding electrodes or grounding systems approved by the Engineer.

(D) Submittals

Submit product data for approval prior to installation, including device construction and materials, physical dimensions and weight, and mounting and grounding requirements.

Method of Measurement:

Miscellaneous Work (Lightning Protection System) shall be measured on a lump sum basis.

Basis of Payment:

The accepted quantity of Miscellaneous Work (Lightning Protection System), measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including furnishing, installing, grounding all lightning protection atmospheric electric field management devices, mounting hardware and accessories, grounding and bonding materials and connections handling, shipping, and delivery, manufacturer technical support and guidance.

ITEM 9240063 MISCELLANEOUS WORK (TRUCK WEIGH SCALE – ARCHITECTURAL AND STRUCTURAL):

Description:

The work under this item shall consist of constructing new architectural and structural elements, components, or systems of the Truck Weigh Scale as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Truck Weigh Scale – Architectural and Structural) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Truck Weigh Scale – Architectural and Structural), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240064 MISCELLANEOUS WORK (TRUCK WEIGH SCALE – PLUMBING):

Description:

The work under this item shall consist of furnishing and installing new plumbing infrastructure for the Truck Weigh Scale as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Truck Weigh Scale – Plumbing) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Truck Weigh Scale – Plumbing), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240065 MISCELLANEOUS WORK (TRUCK WEIGH SCALE – ELECTRICAL):

Description:

The work under this item shall consist of furnishing and installing new electrical infrastructure for the Truck Weigh Scale as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Truck Weigh Scale – Electrical) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Truck Weigh Scale – Electrical), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240066 MISCELLANEOUS WORK (ADMINISTRATION BUILDING – ARCHITECTURAL AND STRUCTURAL):

Description:

The work under this item shall consist of removing, modifying, and/or constructing new architectural and structural elements, components, or systems of the Administration Building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Administration Building – Architectural and Structural) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Administration Building – Architectural and Structural), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place, including disposal of removed items.

ITEM 9240067 MISCELLANEOUS WORK (ADMINISTRATION BUILDING – MECHANICAL):

Description:

The work under this item shall consist of removing existing and furnishing and installing new mechanical infrastructure for the administration building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-3 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-3 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Administration Building - Mechanical) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Administration Building - Mechanical), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place, including disposal of removed items.

ITEM 9240068 MISCELLANEOUS WORK (ADMINISTRATION BUILDING – PLUMBING):

Description:

The work under this item shall consist of removing existing and furnishing and installing new plumbing infrastructure for the administration building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Administration Building - Plumbing) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Administration Building - Plumbing), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place, including disposal of removed items.

ITEM 9240069 MISCELLANEOUS WORK (ADMINISTRATION BUILDING – ELECTRICAL):

Description:

The work under this item shall consist of removing existing and furnishing and installing new electrical infrastructure for the administration building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Administration Building - Electrical) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Administration Building - Electrical), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place, including disposal of removed items.

ITEM 9240070 MISCELLANEOUS WORK (ITS RECORD DRAWINGS):

Description:

The work under this item shall consist of preparing record drawings of all installed ITS equipment and shall conform to the requirements of these special provisions.

Materials:

Contractor shall furnish all necessary documentation in hard copy or electronic format necessary to complete this work.

Construction Requirements:

Information shall be shown on these record drawing plan sheets in red ink, depicting the constructed dimensions, elevations, grades and materials including locations of existing underground utilities found during construction. The contractor shall exercise care in handling the record drawing plan sheets and shall return them to the Engineer in like condition. The Engineer will be the sole judge in determining whether the record drawings are acceptable.

Testing results of power meter and OTDR shall be submitted for approval before submitting the Record Drawings. Work under this bid item includes transfer of all information noted by the contractor on the on-site record drawing set described above under this bid item. The minimum requirements for construction record drawing acceptance are as follows:

(A) Project Drawing Quantity Notations:

A project drawing or quantity summary sheet that shows a quantity on it that is incorrect shall be corrected by drawing a neat line through the original quantity and writing in the correct

information. When space on the drawing does not allow room to indicate the corrections, a separate table may be drawn on a separate sheet with reference on both plan sheets to the plan sheet that the table refers to or to the sheet where the table is located.

(B) Existing/New Utilities:

All underground infrastructure utilities, whether depicted on the Plans or not, shall be verified, corrected, or added to the record drawings noting the beginning and ending station/offset location and elevation of utility relative to finished roadway grade or other identifiable ground or permanent roadway/project feature.

(C) Conduit Placement:

All new and existing conduit within the project limits, whether depicted on the Plans or not, shall be verified, corrected, or added to the record drawings, noting what type of conduit and where the conduit run begins and ends. Underground conduit shall be dimensioned from edge of roadway with starting and ending point station numbers.

(D) Pull Boxes:

All new and existing ITS pull boxes within the project limits, whether depicted on the Plans or not, shall be verified, corrected, or added to the record drawings, noting what type of pull box and GPS coordinates accurate to within 1 foot or less. The contractor shall write a unique identification number on the record drawing drawings next to each pull box located as a part of this project. The contractor shall prepare and submit hard copies of a table that documents the pull box type, GPS coordinates, and ID number for all pull boxes located as part of this project.

Distance from pull box to pull box shall be dimensioned on record drawings.

(E) Splice Details:

All fiber optic splices that differ from those specified in the Plans shall be documented in the record drawings.

(F) Fiber Sequential Length:

All fiber distance markings at the ingress and egress of No. 9 pull boxes and equipment cabinets shall be recorded in a table that that references the pull boxes. Included in this table shall be the sequential distance markings of all cables entering and exiting each splice closure and the termination in the field equipment.

(G) Diagrams:

Changes to a diagram in the Plans (i.e. — communication block diagram, etc.) shall be documented in the record drawings.

Additional Electrical Equipment Documentation:

In-Progress Documentation:

In-progress documentation shall be kept current within 14 days after the actual work period until substantial completion. In-progress documentation shall be provided to the Engineer prior to initiation of the required System Acceptance Test (SAT) for that device. In-progress documentation shall include:

Construction Plans

Operation Manuals

Maintenance Manuals

Equipment Assembly Drawings

Cabinet and Rack Wiring Diagrams

Electrical Schematics, Wiring and Logic Diagrams

System Connection Diagrams

Fiber Optic Assignments

Splice Closure Diagrams

Software Documentation

Communications and Operating Protocols

Shop Drawings

Certificates of Compliance

Warrantees

Parts Lists

Bore profile of conduits installed by directional drilling

Acceptable manuals shall contain technical operations, maintenance, and troubleshooting information. Advertising brochures and catalog cuts are not acceptable for manuals.

Final Documentation:

Final acceptance of work in accordance with Subsection 105.20(B) of the Specifications will not be made until the final documentation has been submitted and has been approved by the Engineer. The contractor shall modify the plan sheets to reflect any variations in equipment locations and requirements shown on the plan sheets. The record drawings shall include GPS coordinates, station numbers, and offsets to each field device, referenced to back of curb, edge of pavement or other fixed landmark (barrier, guardrail, bridge wall, etc.) as approved by the Engineer.

Documentation shall be letter-size for all documents or 11 x 17 inch for plan sheets. The contractor shall furnish one copy in electronic PDF format, and two printed copies bound in loose-leaf 3 ring binders, grouped logically with printed label tabs.

GPS data of new and existing electrical equipment within the project limits shall be collected by an Arizona Registered Land Surveyor, for equipment within the scope of work of this project. GPS data shall be high precision corrected, collected with accuracy within 12 inches

or less. The contractor shall submit a transmittal letter stamped by the surveyor, certifying the accuracy of the GPS survey data.

The GPS survey data shall be submitted to ADOT ITS Communications Engineer in an Excel spreadsheet with different worksheet tabs for each ITS equipment type listed below. The Department will inspect the data and import it into the GIS servers.

The following electrical equipment types and fields shall be collected:

Cabinets:

- Coordinates at center of front door
- Cabinet Identification Number
- MU Cabinet number
- Type: CCTV, Gate, TS, Etc.
- Route Number: I-10
- Route direction: EB, WB

Load Center and Meter Pedestal Cabinets:

- Coordinates at center of front door
- Cabinet Identification Number
- MU Cabinet number
- Type: ITS, TS, Lighting Load Center or Meter Pedestal
- Route Number: I-10
- Route Direction: EB, WB
- Street Address:
- Utility Name: Sulphur Springs Valley Electric Cooperative, Inc.

Poles:

- Coordinates of pole foundation
- Route Number: I-10
- Route Direction: EB, WB

Pull Boxes:

- Coordinates in the center of pull box
- Pull box ID
- Type of Pull Box
- Route Number: I-10
- Route Direction: EB, WB

Maintenance Unit (MU) feature numbers shall be obtained from the Engineer. Once the MU numbers are determined, ADOT will provide stickers to the contractor to install on the respective equipment. If existing poles are missing the MU number, the contractor shall leave the GIS attributes blank for that pole.

The contractor shall attach a five-character decal 42” above the baseplate 45º in the direction of oncoming traffic. The number represents the maintenance unit device. Each electrical cabinet, signal and lighting pole and sign structure shall receive a maintenance unit number. Any existing device which is relocated will require a new device number as indicated on the plans or as provided by ADOT Electric Operations.

Conductor and pole schedule shall reflect any changes made such as phase number, number of conductors, size of conductors, circuit numbers, type of signal head, mounting assembly, poles, mast arms and maintenance unit numbers.

Method of Measurement:

ITS record drawings of all installed electrical equipment will be measured as a lump sum.

Basis of Payment:

The accepted quantity of ITS Record Drawings, measured as provided above, will be paid for at the contract unit price, which price shall be considered full compensation for the work.

ITEM 9240071 MISCELLANEOUS WORK (INSPECTION BUILDING – ARCHITECTURAL AND STRUCTURAL):

Description:

The work under this item shall consist of constructing new architectural and structural elements, components, or systems of the inspection building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-1 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Inspection Building – Architectural and Structural) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Inspection Building – Architectural and Structural), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240072 MISCELLANEOUS WORK (INSPECTION BUILDING – MECHANICAL):

Description:

The work under this item shall consist of furnishing and installing new mechanical infrastructure for the inspection building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-3 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-3 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Inspection Building - Mechanical) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Inspection Building - Mechanical), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240073 MISCELLANEOUS WORK (INSPECTION BUILDING – PLUMBING):

Description:

The work under this item shall consist of removing existing and furnishing and installing new plumbing infrastructure for the inspection building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-2 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Inspection Building - Plumbing) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Inspection Building - Plumbing), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240074 MISCELLANEOUS WORK (INSPECTION BUILDING – ELECTRICAL):

Description:

The work under this item shall consist of removing existing and furnishing and installing new electrical infrastructure for the inspection building as shown on the plans and detailed in these specifications.

Materials:

Materials shall conform to the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans

Construction Requirements:

Construction shall be in accordance with the requirements of Appendix F Section 920-4 of the specifications and as shown on the plans.

Method of Measurement:

Miscellaneous Work (Inspection Building - Electrical) will be measured as a lump sum item complete and in place.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Inspection Building - Electrical), measured as provided above, will be paid for at the lump sum contract price, which price shall be full compensation for the work, complete in place.

ITEM 9240111 MISCELLANEOUS WORK (REMOVE AND RELOCATE TEMPORARY CONCRETE BARRIER):

Description:

The work under this item shall consist of removing, salvaging, and relocating the existing temporary concrete barrier (TCB) in accordance with the project plans and as specified herein.

Construction Requirements:

The contractor shall remove and salvage existing TCB per Section 202 of the specifications.

The existing TCB shall be carefully dismantled in such a manner as to prevent any damage to the removed items and relocated per project plans.

Removed TCB can be stored on site prior to reinstallation. Storage location shall be coordinated with the Department prior to the commencement of the removal work and shall not impede POE traffic.

Any damage to the salvaged TCB caused by the contractor's removal and salvaging activities shall be replaced with new equipment at no additional cost to the Department.

At least two weeks prior to installation of the salvaged TCBs at the locations shown on the plans, the contractor shall coordinate with the Engineer for its approval of the installation work.

The salvaged TCBs shall then be installed at the locations shown on the plans in accordance with Section 701 of the specifications.

Method of Measurement:

Remove and Relocate Temporary Concrete Barrier will be measured by the linear foot.

Basis of Payment:

The accepted quantities of Remove and Relocate Temporary Concrete Barrier, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place, including removal, protection, coordination, relocation, and installation of TCB.

ITEM 9240112 MISCELLANEOUS WORK (HDPE FORCE MAIN AND STEEL CASING INSTALLATION):

Description:

This work consists of furnishing and installing approximately 320 linear feet of 2-inch high-density polyethylene (HDPE) force main, including heat-fused joints, fittings, trench

excavation, bedding, backfill, compaction, testing, and all appurtenances necessary to provide a complete and operational system, as shown on the plans and specified herein.

The work shall also include the installation of one force main cleanout complete with a full-port ball valve and enclosure. Steel casing required for the force main shall be included in the force main installation unless otherwise noted.

Materials:

A. HDPE Force Main

The HDPE force main shall be DR-11 HDPE as shown on the plans and shall conform to the HDPE requirements stated in Appendix B where applicable to carrier pipe installation.

B. Steel Casing

Steel casing shall conform to Appendix B, including material grades and welding requirements and the minimum wall thickness requirements for the casing size indicated.

C. Force Main Cleanout Valve

Ball valves used for force main cleanouts shall be full-port ball valves rated for a minimum working pressure of 150 psi and suitable for wastewater service. The valve ball and stem shall be Type 316 stainless steel. The valve body and remaining wetted components shall be constructed of corrosion-resistant materials suitable for buried wastewater applications and resistant to hydrogen sulfide, sewer gases, and moisture.

Materials shall conform to the requirements of Section 809 of the specifications for material suitability and approval and shall comply with applicable AWWA and ASTM standards. Valves shall be suitable for installation within force main cleanout assemblies and shall be approved by the Engineer prior to installation. Refer to Detail 6 in the plan set.

Construction Requirements:

Force Main and Steel Casing:

A. Trenching, Bedding, Backfill, Compaction, and Surface Restoration

Trench excavation, bedding, embedment, haunching, backfill, and compaction shall conform to ADOT Standard Detail C-07.06 . Detail C-07.06 establishes trench width control, bedding and fine grading requirements, over-excavation correction requirements, utility protection requirements, and compaction requirements, and it references ASTM D2321 for embedment and installation practices where applicable.

Surface restoration and trench patching in paved areas shall conform to ADOT Standard Detail C-07.06,

Where steel plates are required for temporary access or to bridge trenches, the plates shall be installed in accordance to ADOT Standard Detail C-07.06 , and the use of plates shall not exceed the time limits or conditions stated in the detail and associated notes as applicable.

B. Steel Casing Installation

The steel casing shall be installed by open cut unless otherwise shown or approved, and the installation shall conform to Appendix B. Appendix B allows trenchless methods as an option when applicable, but the casing and welding requirements remain as specified.

Any water encountered during casing installation and trenching operations shall be disposed of by the contractor in a manner that will not damage public or private property or create a nuisance or health problem, and the cost shall be incidental to the work as described in Appendix B.

C. Carrier Pipe Placement Within Casing

The carrier pipe shall be installed to the line and grade shown and shall not contact or rest on the casing. The carrier pipe shall be supported using casing spacers or approved support methods, with spacers installed at a minimum of three per joint and with spacing not exceeding eight feet, unless otherwise approved. The annular space between casing and carrier pipe shall be left empty unless otherwise directed, and if filling is directed, pea gravel meeting the requirements of Appendix B shall be used.

Casing end closures shall be installed as bulkheads consisting of brick and mortar or concrete with a minimum thickness of eight inches, unless an approved alternate closure is accepted by the Engineer.

D. Force Main Discharge Structure and Gravity Flow Transition

The Force main shall discharge into the existing manhole structure in a manner that provides low speed non turbulent flows. Refer to Detail 11 on the plans for design and materials.

E. Force Main Cleanout

The force main cleanout shall be installed per Detail 6 on Drawing No. U-05.01 of the project plans.

F. Existing Abandoned Sewer Removal

Existing abandoned sewer pipe in conflict with proposed HDPE force main shall be removed. The sewer to be removed by the contractor shall be taken out in accordance with the requirements of the utility owner to the limits shown on the plans.

General

At the downstream end of the force main, the contractor shall retrofit the existing manhole-like discharge structure to accept pressurized force main flow and to transition the discharge to gravity flow into the existing septic tank, as shown in Detail 11.

The force main shall terminate within the discharge structure and shall not remain pressurized downstream of the discharge point.

The HDPE force main shall enter the structure through a cored wall penetration and shall be sealed using a watertight mechanical penetration system suitable for pressurized force main service. Rigid grouting alone shall not be used as the sole sealing method.

A new internal drop assembly shall be furnished and installed within the structure in accordance with the plans. The drop assembly shall include all necessary fittings, elbows, supports, anchorage hardware, and appurtenances required to direct the pressurized force main flow vertically downward and dissipate energy prior to discharge to gravity flow. The internal drop assembly shall be securely anchored to the structure and constructed to control velocity, minimize turbulence, reduce surging, and prevent direct impingement of flow on the gravity outlet pipe or structure walls.

Benching and inverts within the structure shall be constructed or modified as required to smoothly convey flow from the drop assembly to the gravity outlet and to protect the structure and downstream facilities from erosion or structural damage. All modifications shall be watertight and compatible with the existing structure.

The gravity outlet from the discharge structure to the existing septic tank shall be installed at the elevations shown on the plans and shall allow free discharge by gravity.

All unused or abandoned penetrations shall be sealed watertight with non-shrink grout or approved patching material. Upon completion, the structure shall be left clean, smooth, and suitable for operation.

Testing of the force main shall be completed prior to placing the discharge transition into service, and the contractor shall verify that the completed system transitions smoothly from pressurized flow to gravity flow without leakage, vibration, or structural distress.

All work described in this subsection shall be considered included in the force main installation.

Testing and Acceptance

Force main pressure testing shall be completed prior to placing the discharge into service. After testing, the contractor shall verify that flow transitions smoothly from the force main to gravity flow without leakage, vibration, or abnormal surging.

All work described in this section shall be considered included in the force main installation, unless otherwise noted.

Method of Measurement:

The furnishing and installation of the HDPE force main will be measured in Linear Foot and include other items such as appurtenances and clean-outs .

Basis of Payment:

The accepted quantities of the force main and steel casing, measured as provided above, will be paid for at a contract unit price per linear foot**,** which price shall be full compensation for the work, complete in place.

ITEM 9240119 MISCELLANEOUS WORK (PIPE PENETRATION):

Description:

The work under these items shall consist of connecting new pipe to existing drainage structures per Detail D3 at the locations shown on the project plans.

Materials:

Concrete and steel reinforcement shall conform to the requirements shown on the detail and Sections 1006 and 1003 of specifications, respectively. Concrete shall be Class S concrete (f`c = 3,000 psi).

Construction Requirements:

Existing catch basin pipe penetration shall be constructed in accordance with details shown on the Plans and the requirements of Section 601 of the specifications.

Method of Measurement:

Miscellaneous Work (Pipe Penetration) will be measured as a unit for each penetration constructed.

Basis of Payment:

The accepted quantities of Miscellaneous Work (Pipe Penetration), measured as provided above, will be paid for at the contract unit price per each, which price shall be full compensation for the work, complete in place, including concrete and steel reinforcement.

(924CQC, 09/17/20)

ITEM 9240170 - CONTRACTOR QUALITY CONTROL:

Description:

The work under this item shall consist of furnishing all personnel, materials, supplies, facilities and equipment necessary to perform all certification of test equipment, sampling, testing, and other control actions. The work shall also include the preparation of linear control charts, Weekly Quality Control Reports, and other reports and records as described in Subsection 106.04(C) of the Specifications.

Method of Measurement:

Contractor quality control will be measured for payment on a lump sum basis as a single unit of work.

Basis of Payment:

(A) General:

The accepted quantities of contractor quality control, measured as provided above, will be paid at the contract lump sum price, which price shall be full compensation for the work, complete, as described and specified herein.

Partial payments under this item will be made in accordance with the following provisions:

(1) The first partial payment price will be the lesser of 25 percent of the contract lump sum price for contractor quality control, or 1 percent of the original total contract bid amount.

(2) The remaining portion of the lump sum price will be prorated over the duration of the original contract on a monthly basis, and monthly progress payments will be made.

If adjustments to pay items covered under Contractor Quality Control are approved by supplemental agreement, an equitable adjustment to the lump sum amount for Contractor Quality Control may be made. Any adjustment to Contractor Quality Control shall be included in the supplemental agreement and the adjusted amount, less previous payments, will be prorated equally over the remaining contract period, including any related time extensions.

(B) Delinquent Reports:

Failure of the contractor to submit complete and accurate Weekly Quality Control Reports, current to the most recent Wednesday submittal date, will be grounds for the Engineer to deduct monies from the contractor's progress payment.

For each Weekly Quality Control Report that is not complete and accurate, and not submitted to the Engineer by the Wednesday submittal date specified in Subsection 106.04(C)(6), the Department will deduct $2,500.00 from the progress payment for the current month.

For each delinquent Weekly Quality Control Report submitted to the Engineer within 10 days, excluding weekends and holidays, of the original Wednesday due date, $2,000.00 will be returned on the next regular estimate, provided all of the requirements specified herein and in Subsection 106.04(C)(6) have been met, and the report is complete and accurate. No deducted monies will be returned for reports submitted more than 10 days, excluding weekends and holidays, beyond the original Wednesday due date.

All deducted monies which are retained by the Department, as specified above, are liquidated damages.

ITEM 9240181 MISCELLANEOUS WORK (CONTROL OF NOXIOUS PLANTS) (MANUAL / MECHANICAL METHODS):
ITEM 9240182 MISCELLANEOUS WORK (CONTROL OF NOXIOUS PLANTS) (HERBICIDE):

Description:

The work under these items shall consist of surveying, as well as controlling noxious and invasive plant species manually / mechanically and/or with the application of herbicides in the areas designated by the Engineer throughout the duration of the contract, as required in a Noxious Species Control Plan (NSCP) prepared by the contractor as specified herein. When noxious or invasive plant species are determined to be present within the project limits or all anticipated construction zones, the control procedures in the NSCP shall be implemented with the approved weed management measures achieved prior to earth-moving activities in infested areas.

Weed control procedures in the NSCP shall also be implemented during all stages of construction and in advance of seeding. Control of Noxious Plants through herbicide methods shall be accomplished between fourteen (14) and twenty-one (21) calendar days prior to Clearing and Grubbing, as well as construction excavations. Control of Noxious Plants through manual / mechanical methods shall be accomplished within seven (7) calendar days prior to Clearing and Grubbing, as well as construction excavations. Repeated treatments shall resume after Clearing and Grubbing when noxious/invasive plants occur during construction. In addition, all construction-related equipment, materials, and personnel moving in and/or out of the project site shall be inspected and cleaned of noxious and invasive plant species (seeds, seed heads / pods) at no additional cost to the Department.

For projects that include Landscape Establishment, as specified in Section 807 of the Standard Specifications and these Special Provisions, control of noxious and invasive plant species will also be required throughout the Landscape Establishment phase, and shall be included in the contractor’s NSCP.

The contractor shall conduct repeated applications for Control of Noxious Plants throughout the entire contract time including the Landscape Establishment phase when noxious/invasive plants occur. Successive treatments along with multiple mobilizations for Control of Noxious Plants shall be conducted in accordance with invasive weeds’ growing seasons at no additional cost to the Department.

The control of plant species not on the State or Federal Noxious or Invasive lists – especially Forest Service Regional/BLM lists noted below – will be paid only when control is directed by the Engineer based on the original or amended NSCP approved by an ADOT construction Professional Landscape Architect (PLA) licensed in the State of Arizona.

The areas to be designated by the Engineer for Control of Noxious Plants shall be coordinated with an ADOT construction PLA. Unless the project site presents sizable monocultures or pure stands of high-density noxious and invasive plant species, the contractor shall not perform broadcast applications of glyphosate and/or other broad-spectrum non-selective herbicides within the project limits. Spot-treating of identified noxious and invasive plant species patches with appropriate selective herbicides shall be conducted.

For unpaved project areas that will ultimately be seeded with desirable native plant species, the contractor shall avoid persistent herbicide residue contamination in the soil. The application of plant growth regulator (PGR) herbicides, including Pyridine Carboxylic Acid (PCA) herbicides, which do not break down easily, shall be approved by the Engineer in accordance with an ADOT construction PLA's evaluation. Soil sterilant herbicides, especially bare-ground herbicides with long-lasting soil persistence, shall be prohibited for use in all unpaved project areas that will be seeded. Soil sterilant herbicides, including bare-ground herbicides, shall be prohibited for use in all unpaved and/or unstabilized project areas that are prone to soil erosion and/or dust emission. Pre-emergence herbicides shall be prohibited for use in unpaved project areas that will eventually be seeded.

All glyphosate, as well as formulations of glyphosate-based herbicides and/or such products under the brand name / trade name of Roundup shall be cautiously evaluated for use by an ADOT construction PLA and approved by the Engineer in accordance with environmental commitments, along with site-specific concerns regarding sensitive biological resources for native species and habitats.

The selection of appropriate treatment method(s) between herbicide versus manual/mechanical or in combination shall be proposed by the contractor within NSCP and approved by an ADOT construction PLA through the Engineer consistent with type(s), life stage(s), growing season(s), and existing condition(s) of plant species, as well as environmental commitments. The contractor may apply the herbicide method to exterminate noxious plants first and remove the dead noxious plants by using the manual / mechanical method after herbicide treatment is successful. Clearing and Grubbing shall not be applied to remove the dead noxious/invasive plants, as well as contaminated soil seed bank if the method will spread the reproducible components of noxious/ invasive plants. The manual / mechanical method shall be applied instead. The reproducible components of noxious/ invasive plants shall include, but are not limited to roots, stems, seeds, seed heads, or seed pods according to various types and life stages of plant species.

Materials:

General

The contractor shall accurately follow all applicable herbicide label requirements and prevent adverse environmental effects. The herbicides to be used and the methods of application shall conform to US Environmental Protection Agency (EPA), Arizona Department of

Agriculture, and/or Arizona Department of Environmental Quality (ADEQ) requirements, and the product's label instructions, as approved by the Engineer. If herbicides are to be applied to potential or delineated Waters of the US as defined under Section 404 of the Clean Water Act, the contractor shall file a Notice of Intent (NOI) and Notice of Termination (NOT) to EPA and/or ADEQ for compliance with the National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit and/or Arizona Pollutant Discharge Elimination System (AZPDES) Pesticide General Permit (PGP).

All herbicides used on the project, including stump treatment herbicide(s), shall be in compliance with NPDES and/or AZPDES PGP(s). The PGP NOI(s) shall be filed for herbicide(s) utilized within the Ordinary High-Water Mark (OHWM) of Jurisdictional Waters of the U.S.

All materials to be used shall be listed and protocol information provided in the Noxious Species Control Plan, as specified below. The contractor shall provide the herbicides container with the original chemical label for inspection and confirmation of the chemicals used. All containers shall be disposed of as recommended by the manufacturer.

Herbicides proposed in the plan for use on projects within transportation easements on BLM and/or USFS Lands shall be in conformance with the following current environmental documents including: "Environmental Assessment for ADOT Herbicide Treatment Program on Bureau of Land Management Lands in Arizona", which is available at ***https://eplanning.blm.gov/eplanning-ui/project/34810/510*** or the "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona" which is available at: ***http://www.fs.usda.gov/main/r3/landmanagement/projects*** . The Environmental Documents include a list of approved Herbicides, Mitigations and Best Management Practices (BMPs), which shall be included, as appropriate, by the contractor in the submitted NSCP.

Web links to environmental documents for noxious weeds and invasive plant species treatment for the six (6) National Forests within Arizona**:**

(1) Final EIS **(**Environmental Impact Statement**)** and Record of Decision for Noxious Weed Treatment on the Coconino, Kaibab, and Prescott National Forests: ***http://www.fs.usda.gov/project/?project=30***

(2) Coronado National Forest EA (Environmental Assessment) for Noxious Weed Treatments: ***http://www.fs.usda.gov/detail/coronado/landmanagement/resourcemanagement/?cid=stelprdb5123160***

(3) Apache-Sitgreaves National Forest Integrated Forest-Wide Noxious Terrestrial and Aquatic Weed Management Plan: ***https://www.fs.usda.gov/project/?project=4967***

(4) Tonto National Forest Integrated Treatment of Noxious and Invasive Weeds: ***https://www.fs.usda.gov/project/?project=4454*****;** Additional information on invasive species requirements for the Tonto National Forest is available at:

http://www.fs.usda.gov/detail/tonto/landmanagement/resourcemanagement/?cid=fsbdev3_018789 .

Arizona Department of Agriculture NOXIOUS WEEDS **(**under the authority of Arizona Revised Statutes, Administrative Code R3**-**4**-**244 Regulated and Restricted Noxious Weeds, as well as R3**-**4**-**245 Prohibited Noxious Weeds**)** web link:
https://agriculture.az.gov/pestspest-control/agriculture-pests/noxious-weeds

Furthermore, the USDA Southwestern Region Weed Field Guides web link is accessible below:
https://www.fs.usda.gov/detail/r3/forest-grasslandhealth/invasivespecies/?cid=stelprd3813522

The USDA New Invaders of the Southwest is attainable within the web link below:
https://docslib.org/doc/7815112/new-invaders-of-the-southwest

The USDA Field Guide for Managing Buffelgrass in the Southwest is obtainable through the web link below:
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd563017.pdf

All materials used shall be in accordance with the approved NSCP and Pesticide Use Proposal **(**PUP**)**.

Construction Requirements:

The contractor shall develop a NSCP for state and federal listed noxious and invasive plant species, and other undesirable plant species shown on the list posted on the Roadside Development web site **(** ***https://azdot.gov/node/5372*** **)**, for approval by an ADOT construction PLA. Four (4) copies of the proposed NSCP in standard three (3) ring binders shall be submitted to the Engineer within seven (7) calendar days after the Execution of Contract. The ADOT construction PLA shall review and respond to the proposed NSCP within ten (10) calendar days upon receiving the submittal. If requested, additional copies may be submitted for review and comments by Native American Community governing body designated representative as approved by the Engineer. Native American Community governing body designated representative shall also review and comment the proposed NSCP within thirty (30) calendar days upon receiving the submittal. The contractor proposed NSCP shall include as minimum the following information applicable to the project area, location and conditions listed below:

(1) A list of Noxious and Invasive Species and other Roadside Development approved plant species that would be anticipated for control based on existing vegetation and the project biotic communities. The weed species shall include but not be limited to the TABLE **– I** listed below**:**

TABLE – I	
Scientific Name	**Common Name**
Cynodon dactylon **(syn.** *Capriola dactylon***)**	Bermudagrass / Devilgrass
Solanum elaeagnifolium	Silverleaf Horsenettle / White Nightshade / Silverleaf Nightshade
Salsola kali subsp**.** *tragus* **(syn.** *Salsola iberica***)**	Russian Thistle / Tumbleweed

(2) The methods of control of noxious and invasive plant species including herbicide stump treatment shall be determined based on the species present within the project limits prior to earth moving activities as well as subsequent project construction phases before seeding. Pre-emergent herbicide shall NOT be applied to all project seeding areas. The contractor shall provide information / methods on how the application of herbicides will NOT harm the expected desirable seed species germination and establishment as specified in Section 805 of these Special Provisions.

(3) The proposed method(s) of control and extermination treatment between herbicide versus manual/mechanical or in combination to be utilized for each anticipated plant species suitable for the specific stage of plant development.

(4) The herbicides, method and frequency of application, and rates to be used for each listed plant species.

(5) Copies of herbicide and surfactant labels and Safety Data Sheet (SDS) for all chemicals proposed for use.

(6) Procedure for collection, removal, containment, and disposal of noxious and invasive plants. All components of noxious and invasive plants such as roots, stems, leaves, flowers, seeds, seed heads, or seed pods shall be subject to collection, removal, containment, and disposal at no additional cost to the Department.

(7) Methods and procedures to be followed to protect existing, transplanted, and new emerging vegetation in seeded areas.

(8) Responsible Applicator and required Arizona Department of Agriculture Pest Management Division Licensing information, as specified in Section 806.

(9) Record procedures to be followed to document control work completed.

(10) Record procedures to be followed for reporting all chemicals used annually within transportation easements on BLM or USFS Lands within two (2) months or September 30th of each calendar year (whichever is sooner) to an ADOT construction PLA.

(11) Projects on transportation easements on BLM or USFS Lands shall include a completed Pesticide Use Proposal (PUP) form for all proposed herbicide uses prepared

for submittal to the appropriate BLM Field Office or National Forest for approval. An example of a completed PUP for the project area will be provided to the contractor for use in preparing their PUP upon request to the ADOT construction PLA.

(12) Projects on transportation easements within Native Americans (Tribal) Land shall include a completed PUP form for all proposed herbicide uses prepared for submittal to the appropriate representative of tribal government (governing body) for approval. An example of a completed PUP for the project area will be provided to the contractor for use in preparing their PUP upon request to the ADOT construction PLA.

(13) When applicable, other information and explanations are required in the PUP or to implement the NSCP.

(14) Process to be used for amending the NSCP to add additional plants or treatments that may be required as the project progresses.

(15) A copy of the original Special Provisions for Control of Noxious Plants that the contractor bid on shall be attached to the NSCP.

(16) Plans and methods to protect Threatened and Endangered Species in accordance with the Environmental Mitigations section of the contract documents.

(17) Plans and methods for controlling of noxious/invasive plants in riparian and aquatic areas:

I – Prevention of herbicide drifted by wind onto non-target native plants or nearby wetlands/watercourses by using low pressure systems and coarse-spray nozzles.

II – Safe and effective use of herbicide chemicals labeled for the vicinity of wetlands/watercourses in prevention of water quality contamination.

The NSCP submitted to the Engineer shall not be implemented until it is approved by an ADOT construction PLA, and the contractor is so directed by the Engineer.

The contractor shall keep a copy of the approved NSCP and furnish the Engineer a copy of the approved NSCP for record keeping. The NSCP copy of the contractor, and Engineer shall be maintained up to date with the contractor providing submittals of completed work activities within five (5) working days following completion of the work for each area directed by the Engineer for control. The NSCP shall be maintained up to date with submittals of the above completed NSCP information for the duration of the project.

The Engineer in consultation with an ADOT construction PLA shall designate/approve the location of the areas to be treated, and when required the frequency of treatment as per the NSCP. Payment will be made for the initial treatment of each area, whether with manual / mechanical methods or using herbicides, and for each subsequent treatment ordered and approved by the Engineer.

The contractor shall document the location and size of the project treatment areas, as well as noxious and invasive plant species that have been treated by the end of each working day. Furthermore, the contractor shall mark up the project layout plans (engineering drawings) with

location and size of the project treatment areas, as well as noxious and invasive plant species that have been treated. Such documentation shall be submitted to an ADOT construction PLA for inspection/evaluation through the Engineer.

The contractor shall begin control of the designated areas within ten (10) working days of the Engineer's notice and complete the treatment within fifteen (15) working days of the notice approved by the Engineer.

If other plant species listed in the Arizona Noxious Weed List, the Forest Service Regional/BLM lists, or the ADOT Invasive and Noxious Plant Species Lists (available electronically at the following Roadside Development web address: ***https://apps.azdot.gov/files/roadway-engineering/roadside-dev/adot-invasive-noxious-plant-species-list-for-construction-projects.pdf***) occur within the project area that are not included in the NSCP, the contractor shall modify the Noxious Species Control Plan to add such species, including acceptable control measures and where applicable a PUP, and submit this information as an amendment of the NSCP to the Engineer and ADOT construction PLA for acceptance. No herbicide Control of Noxious Plants work shall be commenced on Federal lands until the PUP has been entirely completed and approved.

The project areas will be surveyed by an ADOT construction PLA, with the approval of the Engineer, prior to earthmoving activities and following rainfall events and during plant germination and growth periods for listed noxious and invasive plant species. To update NSCP, the contractor shall also furnish field inspection/observation reports for new growth of noxious/invasive plant species between four (4) weeks to six (6) weeks after each rainfall event of 0.5 inches (≥ 12.7 mm) or more. When surveys determine that noxious, invasive, or other designated plants species listed in the NSCP for control are found to be present within the project right-of-way, the contractor shall treat the areas designated by the Engineer in accordance with the approved NSCP. Such treatments shall be completed and approved by the Engineer before ground disturbing or earthmoving activities occur from those areas.

The contractor shall mark those areas receiving manual / mechanical control with an application of a photosensitive dye. Herbicides shall be mixed with a photosensitive dye which will produce a contrasting color when sprayed upon the ground. The color shall disappear between three (3) and five (5) days after being applied. The dye shall not stain any surfaces nor injure non-target plant or animal species when applied at the manufacturer's recommended application rate.

Application of herbicide shall be in accordance with the manufacturer's instructions and the approved NSCP. Responsible herbicide applicators shall be licensed under the appropriate category as required by State Law.

Mowing shall be allowed if it is proven to be a successful permanent control method of annual noxious / invasive plant species as approved by the Engineer. If approved, mowing shall be performed before the annual noxious / invasive plant species are able to set seed. Mowing shall NOT be operated in areas where there are perennial noxious / invasive plant species. Mowing shall NOT be utilized for noxious / invasive plant species that carry existing seeds (seed heads / pods). All project areas and plant species to be mowed shall be carefully evaluated / identified by an ADOT construction PLA with approval from the Engineer.

Unless otherwise called out in the plans/details specified in these Special Provisions, or as directed by the Engineer, the contractor shall remove the identified noxious / invasive woody vegetation to the finished grade level without uprooting it (flush cutting). In order to stop stump regrowth, the applicable remaining stumps shall be promptly treated with suitable herbicide so the identified noxious / invasive woody vegetation will not sprout new growth from the stumps. Herbicide stump treatment shall NOT be conducted to plant species such as common evergreen coniferous shrubs and trees, which will unlikely generate stump regrowth. Manual / mechanical removal of remaining woody vegetation stumps and rootballs in erosive areas shall be avoided to maximum extent practicable (MEP). The removal method and process shall be evaluated by an ADOT construction PLA with approval from the Engineer.

Removal of soil seed bank that has been contaminated by the natural storage of seeds from noxious / invasive plant species shall be required for projects involving soil / ground disturbance from construction excavations or as designated by the Engineer. The contractor shall remove the top three (3) inches of the existing undisturbed surface soil from the project areas infested with noxious / invasive plant species as evaluated / identified by an ADOT construction PLA with approval from the Engineer. All removed contaminated soil seed bank shall be properly disposed of or placed (buried) below the top two feet (2'-0") of the final finished grade as directed by the Engineer. The removal, stockpile, burial, or disposal of contaminated soil seed banks shall be well contained / concealed during construction. The contractor shall then return all soil-seed-bank removal disturbed areas, to an acceptable surface condition (finished grade), as approved by the Engineer.

No earthmoving activities to the treated areas shall be approved until the employed weed management measures have been inspected to be successfully achieved with the approval of the Engineer.

For projects within transportation easements on BLM, USFS, or Tribal Lands, PUPs shall be prepared and submitted to the Engineer and ADOT construction PLA as required in the NSCP. The PUPs will be submitted by the Department to the appropriate BLM Field Office, National Forest, or appropriate representative of tribal government (governing body) and must be approved by the BLM, National Forest, or tribal government (governing body) before being approved by the Engineer.

The contractor shall keep records of all herbicide applications. A copy of this record shall be added to the NSCP and also submitted to the Engineer after each application. The contractor shall be responsible for the proper transport, storage, and application of all materials necessary for herbicide control treatments.

As a part of the integrated management approach, all areas to be treated for noxious and invasive plant species shall ultimately be seeded, landscaped, or permanently stabilized to minimize and prevent weed re-invasion / re-infestation, as specified in these Special Provisions.

Method of Measurement:

Control of noxious and invasive plant species, either manually (mechanically) or with herbicides, will be measured by the square yard (SQ.YD.) of each treated area, as directed and approved by the Engineer.

Basis of Payment:

Listed bid quantities for CONTROL OF NOXIOUS PLANTS are for estimating and bidding purposes. They shall not be guaranteed to the contractor. The intensity for scope of work, project-specific present conditions, particular stages of noxious and invasive plant development, as well as annual rainfall patterns shall be considered / evaluated by the construction PLA and approved by the Engineer in determining final quantities and unit costs to be paid for.

During pre-construction meeting, the contractor in conjunction with Engineer shall verify and be in agreement with the quantity of areas to be treated as evaluated by an ADOT construction PLA. The quantity of areas to be treated shall be in compliance with environmental requirements.

The accepted quantities of control of noxious and invasive plant species, either manually **(**mechanically**)** or with herbicides measured as provided above, will be paid for at the contract unit price for each soil treatment directed and approved by the Engineer. Such price will be considered to include all labor, materials, equipment, and multiple mobilization costs required to complete the work as specified herein. Such price shall also cover collection, removal, containment, and disposal of noxious and invasive plant species. Up to four (4) mobilizations may be required to accomplish control of noxious and invasive plant species as specified herein. The Department will consider the cost of such multiple mobilizations to be included in the price bid for control of noxious and invasive plant species. Adjustments may be made to the contract through negotiation for more than four (**>** 4) mobilization activities as per the approval of the Engineer.

No measurement or payment will be made for treatment of those areas, manually / mechanically or with herbicides, not authorized and approved by the Engineer. No payment will be made for treatment areas not in compliance with the approved PUP/NSCP. No payment will be made for areas treated by herbicide products not in compliance with the approved PUP/NSCP. No measurement or payment will be made for the removal and proper disposal of waste materials; the cost being considered is included in contract items.

No measurement or payment will be made for preparation of the NSCP and, when applicable, the PUP, including the initial submittal and modifications, or for monitoring, the costs being considered are included in contract items.

No separate measurement or direct payment will be made for Control of Noxious Plants under Landscape Establishment as specified in Section 807 of the Standard Specifications and these Special Provisions; the cost being considered is included in the respective contract item of Landscape Establishment.

For projects engaging extensive excavations/backfills, no separate measurement or direct payment will be made for the removal, stockpile, burial, or disposal of contaminated soil seed banks, as well as returning all soil-seed-bank removal areas to an acceptable surface condition (finished grade); the cost being considered is included in the respective contract item(s) of excavations/backfills.

(925SRVY, 05/21/26)

SECTION 925 CONSTRUCTION SURVEYING AND LAYOUT:

925-3.01 **General:** the first paragraph of the Standard Specifications is revised to read:

At the preconstruction meeting, the contractor shall furnish to the Engineer, for approval, the following:

(A) A schedule of hourly survey services rates and classifications for additional survey work, which shall remain fixed and in effect for the entire duration of the work and shall not be subject to renegotiation; and

(B) A written outline detailing the method of staking, marking of stakes, grade control for various courses of materials, referencing, structure control, pavement markings, and any other procedures and controls necessary for survey completion. A part of this outline shall also be a schedule which will show the sequencing of the survey and layout work, throughout the course of the contract, listing a percentage of completion for each month.

925-5 **Basis of Payment:** the fourth paragraph of the Standard Specifications is revised to read:

If additional staking and layout are required as a result of additional work ordered by the Engineer, such work will be paid under items listed in the table below.

Payment will be made utilizing the schedule of rates provided per Subsection 925-3.01. No additional payment will be made for overtime hours. Should such additional work require the contractor to pay travel and subsistence costs for the survey party or survey parties utilized, payment for travel and subsistence will be made under the provisions of Subsection 109.04 of the specifications. The Engineer will determine whether the additional work shall be performed by the contractor or by Department forces.

(1001MATL, 06/17/21)

SECTION 1001 MATERIAL SOURCES: of the Standard Specifications is revised to read:

1001-1 Description:

The work under this section shall consist of the procuring of borrow, topsoil, subbase and base materials, mineral aggregates for concrete structures, surfacing, and landscape plating, from sources either designated on the project plans or in the Special Provisions or from other sources.

1001-2 General:

The contractor shall determine for itself the type of equipment and work required to produce a material meeting the requirements of the specifications.

Sites from which material has been removed shall, upon completion of the work, be left in a neat and presentable condition. Where practicable, borrow pits, gravel pits, and quarry sites shall be located so that they will not be visible from the highway.

The contractor shall provide an environmental analysis, as specified in Subsection 104.12 of the specifications, for any source proposed for use regardless of whether a previously approved environmental analysis exists for the site.

In accordance with Subsection 104.12 of the specifications, the contractor may utilize an existing environmental analysis approved after January 1, 1999, provided that the analysis is updated as necessary to be in compliance with current regulations and with the contractor's planned activities.

It shall be the responsibility of the contractor to conduct any necessary investigations, explorations, and research, on-site and otherwise, before and after submitting the bid proposal, to satisfy itself that the specified quantity and/or quality of material exists in any proposed material source.

The contractor shall not produce material for the project, mobilize crushing equipment or clear a worksite prior to approval of the environmental analysis.

The contractor shall comply with the requirements of the landowner or agency having jurisdiction over the land.

The Department makes no representation regarding quality or quantity of materials in any source.

1001-2.01 Information Available:

The Department maintains a listing of materials sources for which a completed environmental analysis is available and the landowner has allowed the source to be placed on the list. Further information on material sources is available at https://azdot.gov/business/environmental-planning/material-source-guidance.

1001-2.02 Material Sources in Floodplains:

Any development of a material source that is determined to be in a flood plain must meet the requirements of the appropriate local, state, and federal agencies, including as applicable, the U.S. Army Corps of Engineers, Section 404 of the Clean Water Act, ADEQ or Tribal 401 Water Quality Certification, and the National or Arizona Pollutant Discharge Elimination System (NPDES/AZPDES).

If the contractor wishes to procure a material source within a floodplain, the contractor or material supplier shall submit a Floodplain Use Permit application to the appropriate floodplain management agency. The contractor shall submit to the Department documentation that the

Floodplain Use Permit for the material source was approved and signed by the appropriate agency's Floodplain Administrator. The contractor or material supplier shall comply with all the requirements of the Floodplain Use Permit, including renewal of the Permit as needed or required.

The Department will require an engineering report if the material source is situated in the 100 year floodplain of any stream or watercourse, and located within one mile upstream and two miles downstream of any highway structure or surfaced roadway crossing. The engineering report shall be prepared by a professional engineer with expertise in hydrology, hydraulics, river mechanics, and fluvial geomorphology. The engineering report shall address the effects of the potential for structural damages following a 100 year flood event.

All other permits required to obtain a material source shall be furnished to the Department upon request.

Surplus material from agency administered flood control management projects may be used as borrow material only if the contractor submits written evidence to the Engineer that the flood control agency project was fully designed and funded.

Material sources in floodplains located on Native American Tribal Lands will be considered for use on an individual analysis. The analysis shall include a review of applicable land use plans, floodplain management plans, environmental plans, applicable laws and regulations pertaining to Native American Tribal Lands, and an engineering analysis of the effects on any highway facility or structure. The contractor shall obtain from the Bureau of Indian Affairs (BIA) and the Native American Tribal Council all permits, licenses, and approvals for the Department to review.

1001-2.03 Protection and Restoration:

The contractor shall comply with the requirements of Subsections 107.11 and 107.12 of the specifications for protecting and restoring the material source. The contractor shall assume full responsibility to protect and rehabilitate the material source to the satisfaction of the Department and in compliance with the requirements of the Federal Land Management Agency (FLMA) having jurisdiction or by the owner of the material source.

1001-3 Proposed Source:

1001-3.01 Approval Requirements:

(A) General:

The contractor shall notify the Engineer prior to or at the preconstruction conference as to the source that it proposes to use.

The contractor acknowledges that all the conditions set forth in this subsection shall be met prior to the source being approved for use.

Other than sampling and testing, the requirements of this subsection shall be completed prior to initiation of any activities that disturb the existing conditions at the proposed source.

Regulatory changes, specification changes, or other reasons may preclude the approval of a materials source. The contractor acknowledges that the Department may refuse to approve a material source even if the Department had approved the source for other projects.

(B) Specific Conditions for Approval:

The use of a source will require written approval by the Engineer. No approval will be given until the contractor has complied with the following conditions:

(1) The contractor has submitted an environmental analysis, as specified in Subsection 104.12 of the specifications, of the source proposed for use and the Department has reviewed the analysis and satisfied itself that the use of such source will not have an adverse social, economic or environmental impact. The requirements of Subsection 1001-3.01 of the specifications shall be completed prior to initiation of any activities that disturb the existing conditions at the proposed source.

(2) The contractor has furnished the Engineer with evidence that he has secured the rights to the source, including ingress and egress.

(C) Historical and Cultural Resources:

The archaeological survey report of the proposed material source shall be prepared by the contractor's archaeological consultant and shall conform to the requirements of Subsection 104.12 of the specifications.

In the event that prehistoric or historic structures and prehistoric or historic artifacts are encountered during any activity related to the construction of the material source, the contractor shall immediately cease operations within a 50 foot radius of the discovery location and notify the Engineer. In the event that an unmarked human burial and/or funerary remains are encountered during any activity related to the construction of the material source, the contractor shall immediately cease operations within a 100 foot radius of the discovery location and notify the Engineer. The Engineer will contact the Environmental Planning – Historic Preservation Team so that appropriate notification of the discovery is made per state and federal regulations.

After notifying the Engineer, the contractor shall, within good faith, secure the area and take all reasonable measures to protect the historical and cultural resources. No activity shall resume unless authorized by the Engineer. The Engineer will not authorize resumption of any activity until receiving confirmation from the Environmental Planning – Historic Preservation Team that the contractor may commence work.

If the Department determines that the proposed use will have major adverse impact on cultural or historic resources, the Department will not allow the use of the source.

(D) Permit from Navajo Nation:

For projects located on the Navajo Reservation, the Navajo Nation has adopted a permitting system for any sources, regardless of whether on or off the Navajo reservation, which are to supply material for projects located within its boundaries. No material source will be approved

until the contractor submits a copy of the permit from the Navajo Nation allowing materials from the proposed source to be used on the project. For information concerning the permit, the contractor shall contact the Navajo Nation Historic Preservation Office.

(E) Bureau of Land Management Material Sources:

If the contractor elects to pursue the use of material sources on BLM land under Title 30 Code of Federal Regulations, it is at the contractor's sole risk, and the Department bears no responsibility for any delays or costs associated with the request to use material sources on BLM Land.

The Department will not request or pursue any "free-use permit" under Title 23 Code of Federal Regulations or any other arrangement with BLM on this project.

1001-4 Special Access within Right Of Way:

The contractor may submit a request to the District Engineer to approve special access to a controlled access highway if special access is not shown on the project plans.

The request by the contractor shall be accompanied by an environmental analysis and by documents which specify the point(s) of access, the acquisition of right of way, the manner in which access will be attained, the traffic control plan, and crossovers, along with all other appropriate data which will allow the District Engineer to evaluate its request. If the request is approved, a supplemental agreement shall be entered into.

All costs associated with the special access requested by the contractor shall be borne by the contractor, including, but not limited to, cattle guards, fences, gates and restoration work.

When access is not being utilized, gates shall be closed and locked. Upon completion of all operations, the area within the right of way that has been disturbed shall be restored to the condition existing prior to the contractor's operations.

The decision by the District Engineer to deny a request by the contractor will be considered to be final.

1001-5 Fences and Cattle Guards:

Where the haul roads to material sources cross existing fence lines in areas where there is livestock of any kind, temporary cattle guards shall be installed by the contractor at each crossing.

The livestock operator or owner shall be contacted prior to the beginning of any operations and effective measures shall be taken and means provided by the contractor to prevent livestock from straying.

In operations where conditions will exist that are dangerous to livestock of any kind, temporary cattle guards and fence shall be installed around the pit area by the contractor to protect livestock.

Temporary cattle guards and fence installed by the contractor shall be removed and existing fence disturbed shall be replaced or reconstructed and all fence shall be left in as good condition as it was prior to the beginning of work.

(1002PAINT, 06/19/25)

SECTION 1002 PAINT: of the Standard Specifications is revised to read:

1002-1 General Requirements:

All paints specified herein shall be ready-mixed at the manufacturer's plant, except for inorganic zinc rich primer, which shall be mixed by the fabricator or at the project site just prior to application. All paints shall be standard paint products of the manufacturer with published product data sheets and shall comply in all details with the specifications.

Ready-mixed paint shall be homogeneous, free of contaminants, and shall be of a consistency suitable for the use for which it is specified. The pigment shall be finely ground and properly dispersed in the vehicle, according to the requirements for the type of paint, and this dispersion shall be such that the pigment does not settle appreciably, does not cake or thicken in the paint container, and does not become granular, jelled, or curdled. Any settlement of pigment in the paint shall be easily dispersed with a paddle so as to produce a smooth uniform paint of the proper consistency. The manufacturer shall include in the paint the necessary additives for control of sagging, leveling, drying, drier absorption, and skinning.

Lead, lead compounds, soluble barium compounds, or hexavalent chromium compounds shall not be used as raw materials in the paint formulas specified under this section, and shall not be added to any paint formulas specified under this section.

The use of halogenated solvents is not permitted.

Paint shall be furnished in new, unopened air-tight containers, which are clearly labeled with the exact title of the paint, Federal Specification number when applicable, name and address of the manufacturer, product code, date of paint manufacture, and the lot or batch number. The containers shall meet U.S. Department of Transportation Hazardous Materials Shipping Regulations. Precautions concerning the handling and the application of the paint shall be shown on the label of the paint containers.

All of the paints of any coating system consisting of individual paints (such as a primer, intermediate coat, and topcoat), shall be made by the same manufacturer, and shall be designed and sold to be used together as a system.

Only paints and paint systems approved in accordance with Subsection 1002-3 of the specifications and shown on the Department’s Approved Products List (APL) will be allowed for use. Copies of the most current version of the APL are available on the Department’s website from the ADOT Research Center, through its Product Evaluation Program. Paint supplied by an approved manufacturer with a different product code from that which was previously evaluated and approved will require evaluation to determine if it is acceptable.

The contractor shall submit to the Engineer a Certificate of Compliance for each lot or batch of paint supplied, in accordance with Subsection 106.05 of the specifications, prior to its use. Product data sheets listing the paint constituents and their proportions as well as Materials Safety Data Sheets (MSDS) are required for each paint material supplied prior to its use.

All applicable governmental environmental regulations shall be adhered to during cleanup and for the disposal of unused paint.

1002-2 Paint Types:

1002-2.01 Three-Paint Coating System:

(A) General:

A three-paint coating system shall be for use on metallic surfaces, and shall include a primer (Paint Number 1), intermediate coat (Paint Number 2), and topcoat (Paint Number 3) from the same system. All three paints shall be water-based, 100 percent acrylic (acrylic latex) paints, unless a non water-based primer is specified, in which case, the topcoat and intermediate coat must be a water-based acrylic paint.

Each individual paint shall conform to all of the chemical and physical characteristics and properties as declared on the manufacturer's product data sheet. In addition, the paint color shall be as specified in the project plans, and the consistency shall be in accordance with the manufacturer's recommendations. The contractor shall use the checking and calibration procedures found in ASTM D4212 and verify the paint consistency with the Engineer prior to each application.

Each coating is intended for spray application. Limited application can be made by brushing or rolling if approved by the Engineer.

Paint Number 1 - Primer:

This paint shall be used on blast cleaned steel surfaces for the first coat of a three-paint coating which must include Paint Number 2 and Paint Number 3 from the same system.

Paint Number 2 - Intermediate Coat:

This paint for intermediate coats shall be used on primed steel surfaces as the second coat of a three-paint coating system which must include Paint Number 1 and Paint Number 3 from the same system. The paint shall be appropriately tinted to contrast with the prime coat.

Paint Number 3 - Topcoat:

Paint for topcoats shall be used as the third coat of a three-paint coating system which must include Paint Number 1 and Paint Number 2 from the same system.

For topcoats, the gloss shall be as specified on the project plans. The available colors for topcoats shall provide visual matches to the colors given in the Federal Standard No. 595. The colors shall be available in high-gloss enamels, if required.

1002-2.02 Zinc Rich Primer:

Zinc-rich primer shall be a solvent based, one-part, epoxy ester, zinc-rich coating made to contain no less than 89 percent by weight of zinc dust in the dried film. Zinc-rich primer is suitable for limited use on cuts, welds, or damaged galvanized surfaces, as needed to restore the continuity of cathodic protection. Zinc-rich primer shall be certified by the manufacturer to be compatible with any suitable water-based acrylic finish paint.

Zinc-rich primer shall be used where zinc paint is called for elsewhere in the specifications.

1002-2.03 Inorganic Zinc-Rich Primer:

Inorganic zinc-rich primer shall be a solvent-based three-component, inorganic, ethyl silicate, zinc-rich coating for use on steel surfaces which will be exposed to severely corrosive environments. The primer shall be mixed in accordance with the manufacturer's directions by the fabricator or at the project site just prior to application. Inorganic zinc-rich primer shall be made to contain no less than 80 percent by weight of zinc dust in the dried film, and shall be certified by the manufacturer to form a strong bond to properly cleaned and prepared steel surfaces, either sandblasted or galvanized. This primer shall also be certified by the manufacturer to be compatible with any suitable water-based acrylic finish paint.

1002-2.04 Alkyd Primer:

Alkyd primer shall be solvent-based, and shall be designed for ferrous metal surfaces where there are rusting issues which rule out the use of a water-based primer. Such surfaces may include ornamental iron, tanks, fabricated parts, handrails, and objects referred to as "black steel." Alkyd primer shall be certified by the manufacturer to be compatible with any suitable water-based acrylic finish paint.

1002-2.05 Direct-to-Metal (DTM) Combination Primer and Finish Paint:

This paint shall be a water-based acrylic paint specially designed for use as a direct-to-metal (DTM) primer or combination primer and finish. The product shall be certified by the manufacturer to form a strong bond to properly cleaned and prepared surfaces of structural steel and other metallic products such as metal buildings, tanks, and pipes. It shall also be certified to bond with other properly cleaned and prepared surfaces such as galvanized steel, oil-based paints, and alkyd enamels. When used on ferrous metal surfaces where there are rusting issues, the paint shall be rust-inhibitive. Direct-to-metal combination primer and finish paints shall be designed to be usable as a complete two or three coat system. When used as a primer only, the paint shall be certified by the manufacturer to be compatible with any suitable water-based acrylic finish paint.

1002-2.06 Acrylic Emulsion Paint:

Acrylic emulsion paint shall be used on concrete and masonry surfaces, and shall be a water-based, 100 percent acrylic (acrylic latex) paint.

This paint may be tinted by using “Universal” or “all purpose” concentrates.

The color of the final coat of paint shall be as indicated on the project plans. If no color is specified on the plans, the paint color shall approximate that of paint color chip No. 30318, as specified by Federal Test Standard Number 595, when applied to either a concrete test specimen measuring 2 feet by 2 feet, or to the surface of the concrete structure to be painted.

The Engineer will determine color acceptance by visual inspection.

1002-3 Sampling and Testing:

(A) General:

Any lot or batch of paint may, at any time, be sampled and tested for conformance to the specifications and the chemical and physical characteristics and properties as declared by the manufacturer on the product data sheets submitted with the original samples used in the evaluation and approval of the product. Also, complete coating system samples may be required at any time for follow-up evaluation using the performance test method employed in the original evaluation for approval of the system.

(B) Coating Systems for Structural Steel and Other Metallic Surfaces :

Coating systems composed of the paints specified in Subsections 1002-2.01 through 1002-2.05 of the specifications will be tested as complete systems applied to steel panels and weathered in accordance with ASTM G154, and exposure cycle number 4 of ASTM D4587, in the Q-U-V Accelerated Weathering Tester, utilizing UVB 313 lamps. Each system shall have an evaluation rating of 100 or greater after 2000 hours of weathering. The procedure is as follows:

(1) Paint coatings will be applied to cold rolled steel panels (ASTM D609, Type 3, ASTM A366). The paint will be thinned to 75 ± 2 Ku consistency using demineralized water. Three coats, each approximately 2 mils thickness are applied to each of four panels according to ASTM D823. The fourth coated panel from each set will be inscribed with an “X” cut to the steel substrate and extending across the entire coated area;

(2) The exposure cycle used with the weathering tester shall be D = 8 h UV/60 degree C followed by 4 h CON/45 degree C. One panel from each set of four shall be removed at 1000 hours and another at 1500 hours. The last two panels shall be removed at 2000 hours;

(3) Paint systems will be evaluated on the basis of six measures of degradation which may be found to occur under the conditions of exposure. For each measure, a rating scale of one to five points will be applied. A rating of one point indicates the poorest performance and five points indicate the best performance. The rating from each measure is multiplied by a weighting factor which represents the relative importance of that measure. The product is a score for that measure. The sum of the scores for all measures is the overall score for the system. To be acceptable, paint systems shall have an overall score of 100 or higher;

(a) Cracking/Flaking: ASTM D660, ASTM D661, and ASTM D772 are used in combination to determine the rating scale. A weighting factor of three will be applied to the results of these tests;

(b) Blistering/Flaking: ASTM D714 and ASTM D772 are used in combination to determine the rating scale. A weighting factor of three will be applied to the results of these tests;

(c) Corrosion: A rating scale is derived from ASTM D610 for evaluating the degree of rusting. A weighting factor of three will be applied to the results of this test;

(d) Chalking/Erosion: ASTM D4214 and ASTM D662 are used in combination to determine the rating scale. A weighting factor of three will be applied to the results of these tests;

(e) Adhesion: The tape test is based on ASTM D3359 and the rating scale is from the Classification of Adhesion Test Results under Test Method B. A weighting factor of five will be applied to the results of this test; and

(f) Flexibility: ASTM D522, using a 1-1/4 inch mandrel, is employed to determine flexibility. The degree of cracking observed after bending is used to determine the rating scale. A weighting factor of five will be applied to the results of this test.

(C) Paint for Concrete and Masonry Surfaces:

Paint for concrete and masonry surfaces will be tested in accordance with the following procedures:

(1) Resistance to Accelerated Weathering:

The paint will be applied to concrete mortar panels and weathered in a Q-U-V accelerated weathering tester, according to ASTM G154, for 2000 hours utilizing UVB-313 lamps, and exposure cycle number 4 of ASTM D4587. The paint weathered in this manner shall show no appreciable change in color or appearance due to fading, chalking, or material reaction.

(2) Adhesion:

The paint shall be applied to a concrete or masonry test surface approved by the Engineer, in accordance with the application plan specified in Subsection 610-3.03 of the specifications. After a minimum period of 30 days of outdoor exposure, the adhesion of the paint will be measured. Testing will be performed in accordance with the requirements of ASTM D4541, Method E, with a strength of at least 100 pounds per square inch being required. In addition, testing will also be performed in accordance with the requirements of ASTM D3359, Method A, with a rating of 3A or higher being required.

(1003REBAR,12/17/20)

SECTION 1003 REINFORCING STEEL: of the Standard Specifications is revised to read:

1003-1 General Requirements:

Reinforcing steel shall be furnished in the sizes, shapes, and lengths shown on the plans and in conformance with the requirements of the specifications.

Certificates of Compliance conforming to the requirements of Subsection 106.05 of the specifications shall be submitted for epoxy coated reinforcing bars, as well as uncoated reinforcing bars, wire, and welded wire fabric. In addition, for epoxy coated reinforcing bars, Certificates of Compliance shall be submitted from the coating manufacturer and Certificates of Analysis shall be submitted from the coating applicator.

When reinforcing steel is delivered to the project site, the contractor shall furnish the Engineer with a copy of all shipping documents. Each shipping document shall show the sizes, lengths, and weights of the reinforcing steel separately for each structure.

Reinforcing steel shall be free of dirt, oil, paint and grease and shall conform to the requirements of Section 605 of the specifications. Reinforcing steel shall be protected at all times from damage. All reinforcing steel shall be free of dirt, oil, paint and grease. Rust, surface irregularities, or mill scale will not be the cause for rejection, provided the weight, dimensions, cross-sectional area, and tensile properties of a manually wire brushed test specimen are not less than the requirements of the specifications.

1003-2 Reinforcing Bars:

Except when used for wire ties or spirals, steel bars used as reinforcement in concrete shall be deformed and shall conform to the requirements of ASTM A615 for Grade 60 steel. Unless otherwise specified, steel bars meeting the requirements of ASTM A706 may be substituted for ASTM A615 steel bars. When ASTM A706 bars are used, tack welding of the reinforcement will not be permitted unless approved by the Engineer.

Samples of reinforcing bars taken at the supplier's or fabricator's place of business shall be defined as pre-shipment samples, while those samples obtained from stockpile or shipment at the project shall be defined as project samples. A shipment shall be considered any amount of reinforcing bars delivered to a project on any given day, of one transported load.

Reinforcing bars sizes No. 4, No. 5, and No. 6 will be accepted with the submission of a Certificate of Compliance. All other reinforcing bar sizes shall be subject to pre-shipment and project sampling as outlined below.

1003-2.01 Pre-Shipment Sampling:

Prior to shipment of reinforcing bars to the project, the supplier or contractor shall contact Materials Group, Structural Materials Testing Section to obtain a laboratory number referenced to the project number. A random sample shall be taken at the supplier's place of business and delivered to the Structural Materials Testing Section. For bar size No. 14, the sample shall be one piece not less than 42 inches in length, selected at random for each shipment up to 30 tons. For bar size No. 18, the sample shall be one piece not be less than 42 inches in length, selected at random for each shipment up to 50 tons. For all other bar sizes, the sample shall be one piece not less than seven feet in length, selected at random for each shipment up to 20 tons. Samples shall be submitted for each bar size, grade, heat number, and manufacturer in the shipment. The pre-shipment bars that are obtained from the supplier or fabricator must be accompanied by a Certificate of Compliance. The information shown on the certificate must match the bar identification marks. If no Certificate of Compliance is available or the information shown on the certificate is incomplete or inaccurate, the bars will not be accepted for testing.

When the supplier or fabricator makes a shipment to a project, a Certificate of Compliance shall be furnished stating that the material in the shipment is from the same stock as the pre-shipment sample covered by the laboratory number assigned by the Structural Materials Testing Section. Reinforcing bars represented by the pre-shipment sample failing to comply with the specification requirements shall not be used on any project.

1003-2.02 Project Sampling:

The Engineer reserves the right to sample reinforcing bars at any time. Project samples shall consist of one sample bar not less than seven feet in length for all bar sizes. Placement of the reinforcing bars shall not be delayed while the contractor is awaiting test results.

Concrete placement operations shall not begin until satisfactory test results of the project sample bars are obtained.

When the supplier or fabricator makes a shipment to a project from outside the Phoenix or Tucson areas, or not otherwise subjected to pre-shipment sampling, the shipment shall be accompanied by a Certification of Compliance. Before any reinforcing bars from a shipment is to be incorporated into the project work, a project sample shall be taken, tested, and approved by the Structural Materials Testing Section. A project sample shall be taken as soon as practical upon arrival at the job site. A different project sample that is representative of each bar size, grade, heat number, and manufacturer from that shipment will be required. The sampling requirements described for pre-shipment sampling for the Phoenix or Tucson areas shall be used.

1003-3 Wire:

Steel wire used as spirals or ties for reinforcement in concrete shall conform to the requirements of AASHTO M 336. Wire shall be deformed or cold drawn (smooth).

1003-4 Welded Wire Fabric:

Welded wire fabric for concrete reinforcement shall conform to the requirements of AASHTO M 336.

1003-5 Epoxy Coated Reinforcing Bars:

1003-5.01 Steel:

Reinforcing bars shall conform to the requirements of Subsection 1003-2 of the specifications.

Epoxy coated reinforcing bars will be sampled and tested in the same manner as uncoated reinforcing bars. The coating and flexibility of the epoxy coated reinforcing bars will also be tested by the Department for acceptance.

1003-5.02 Epoxy for Coating:

A list of powdered epoxy resins which have passed prequalification tests, as described in ASTM A775, “Epoxy Coated Steel Reinforcing Bars”, is maintained on the Department’s Approved Products List (APL). The powdered epoxy resins selected by the contractor and furnished by the manufacturer shall be of the same material and quality as the resins listed on the APL, and shall be applied and cured in the same manner used to coat the test bars in the original powder prequalification test. Copies of the most current version of the APL are available on the internet from the ADOT Research Center through its Product Evaluation Program.

Prequalification testing may be performed by the National Bureau of Standards, State laboratories, or qualified private laboratories.

The Certificate of Compliance from the coating manufacturer shall properly identify the batch and/or lot number, material, quantity of batch, date of manufacture, name and address of manufacturer, and a statement that the material is the same composition as the initial sample prequalified for use. The certificate shall also state that production bars and prequalification bars have been identically prepared and applied with epoxy powders.

Patching or repair material, compatible with the coating and inert in concrete shall be made available by the epoxy coating manufacturer. This material shall be suitable to repair areas of the coating which were damaged during fabrication or handling in the field.

1003-5.03 Application of Coating:

The coating applicator’s facility shall be subject to approval by the Department. Applications for approval of facilities shall be made to the Department by the coating applicator.

The surface to be coated shall be blast cleaned in accordance with the requirements of the Society for Protective Coatings, Surface Preparation Standard SSPC-SP10, Near White Blast Cleaning.

The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than eight hours elapse between cleaning and coating.

The protective epoxy coatings shall be applied by the electrostatic spray method or the electrostatic fluidized bed method in accordance with the recommendations of the coating manufacturer. The epoxy coating may be applied before or after fabrication of the reinforcing bars.

The epoxy coating shall be applied as a smooth uniform coat. After curing, the coating thickness shall be in accordance with the requirements of ASTM A775. Coating thickness shall be controlled by taking measurements on a representative number of bars from each production lot. Coating thickness measurements shall be conducted by the method outlined in the Society for Protective Coatings Paint Application Standard SSPC-PA2.

The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.

The coating shall not have more than two holidays (pinholes not visible to the naked eye) in any linear foot of the coated item. A holiday detector shall be used, in accordance with the manufacturer's instructions, to check the coating for holidays.

The flexibility of the coating shall be evaluated on a representative number of bars selected from each production lot. The coated bar shall be bent 120 degrees (after rebound) around a six-inch diameter mandrel. The bend shall be done at a uniform rate and may take up to one minute to complete. The test specimens shall be at thermal equilibrium between 68 and 85 degrees F at the time of testing. No cracking of the coating shall be visible to the naked eye on the outside radius of the bent bar.

The contractor shall furnish a Certificate of Analysis from the coating applicator with each shipment of coated steel. In addition to the requirements of Subsection 106.05 of the specifications, the Certificate of Analysis shall state that the coated items and coating material have been tested in accordance with the requirements of this subsection and that the entire lot is in a fully cured condition.

The coating applicator shall be responsible for performing quality control and tests. This will include inspection and testing to determine compliance with the requirements of this subsection for the coating thickness, continuity of coating, coating cure, and flexibility of coating.

The Department reserves the right to have its authorized representative observe the preparation, coating, and testing of the reinforcing bars. The representative shall have free access to the plant, and any work done when access has been denied will be automatically rejected.

If the representative elects, lengths of coated bars may be taken from the production run on a random basis for test, evaluation, and check purposes by the Department.

1003-5.04 Shop Repair:

Epoxy coated reinforcing bars which do not meet the requirements for coating thickness, continuity of coating, coating cure, or flexibility of coating shall not be repaired.

Reinforcing bars with these defects shall be replaced, or alternately stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

Coating breaks due to fabrication and handling shall be repaired with patching material if the defective area exceeds 2 percent of the surface area of the bar in a one-foot length and the damaged spot is larger than 1/4 inch by 1/4 inch.

The repair of coating breaks shall be limited to bars on which the total of the defective coating areas does not exceed 5 percent of the surface area of the reinforcing bar. Bars with greater than 5 percent damage shall be replaced, or alternately stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

1003-6 Prestressing Reinforcing Steel

Prestressing reinforcing steel shall conform to the requirements of Section 602-2.01 of the specifications.

Prestressing steel shall be high-tensile steel wire, high-tensile seven-wire strand or high-tensile alloy bars, as shown in the plans.

High-tensile steel wire shall conform to the requirements of AASHTO M 204.

High-tensile seven-wire strand shall conform to the requirements of AASHTO M 203 for Grade 270. In addition to the 0.5-inch diameter prestressing steel typically shown on the plans, 0.6-inch diameter seven-wire strand may be used for cast-in-place prestressed structures.

High-tensile alloy bars shall conform to the requirements of AASHTO M 275.

All prestressing steel shall be satisfactorily protected from damage by abrasion, moisture, rust, or corrosion and shall be free of dirt, rust, oil, grease, or other deleterious substances.

For every five reels of prestressing steel furnished, one sample not less than six feet long, will be tested by the Engineer. Samples of the furnished reels with the manufacturer’s Certificate of Compliance, a mill certificate, and a test report may be shipped directly by the manufacturer to the Engineer.

1003-7 Dowel Bars for Portland Cement Concrete Pavement

Dowel bars shall be round, plain steel bars of the dimensions shown on the plans conforming to the requirements of AASHTO M 254 with Type B coating. The core material shall conform to the requirements of ASTM A615, Grade 60.

Epoxy coated dowel bars shall also conform to the requirements of Subsection 1003-5 of the specifications.

The contractor shall furnish a Certificate of Compliance that properly identifies the coating material, the number of each batch of coating material used, quantity represented, date of manufacture, name and address of manufacturer, and a statement that the supplied coating material meets the requirements of AASHTO M 254 with Type B coating.

(1005PG, 06/19/25)

SECTION 1005 BITUMINOUS MATERIALS:

1005-3 Bituminous Material Requirements:

1005-3.01 Asphalt Cement: of the Standard Specifications is revised to read:

Asphalt cement shall be a performance grade (PG) asphalt binder conforming to the requirements of AASHTO M 320. Air blown/oxidized asphalt, Polyphosphoric acid (PPA) modification and re-refined/recycled engine oil bottom (REOB) will not be accepted. The pressure aging temperature for all binders, including Terminal Blend rubberized binder and Polymer modified asphalt binder shall be as specified below:

PG Asphalt Binder	Pressure Aging Temperature
PG 70-XX and above	110 ºC
PG 64-XX and below	100 ºC

If Terminal Blend rubberized binder (XX-XXTR+) is used, it shall conform to the requirements of Table 1005-1 and 1005-1a.

If Polymer modified asphalt binder (XX-XXPM) is used, it shall conform to the requirements of Table 1005-1 and 1005-1b.

If, during asphaltic concrete production, it is determined by testing that asphalt cement fails to meet the requirements for the specified grade, the asphaltic concrete represented by the corresponding test results shall be evaluated for acceptance. Should the asphaltic concrete be allowed to remain in place, the contract unit price for asphaltic concrete will be adjusted by the percentage shown in Table 1005-1. Should the asphalt cement be in reject status, the contractor may, within 25 days of receiving notice of the reject status, supply an engineering analysis of the expected performance of the asphaltic concrete in which the asphalt cement is incorporated. The engineering analysis shall detail any proposed corrective action and the anticipated effect of such corrective action on the performance. Within three working days, the Engineer will determine whether or not to accept the contractor's proposal. If the proposal is rejected, the asphaltic concrete shall be removed and replaced with asphaltic concrete meeting the requirements of the specifications at no additional expense to the Department. If the contractor's proposal is accepted, the asphaltic concrete shall remain in place at the applicable percent of contract unit price allowed, and any necessary corrective action shall be performed at no additional cost to the Department.

1005-3.03 Emulsified Asphalt: the fourth paragraph of the Standard Specifications is revised to read:

Emulsified asphalts shall be homogeneous. If emulsified asphalt has separated, it shall be thoroughly mixed to insure homogeneity. If emulsified asphalt has separated due to freezing, it shall not be used. Emulsified asphalt shall not be used after 30 days from production.

1005-3.04 Emulsified Asphalt (Special Type): of the Standard Specifications is revised to read:

Emulsified asphalt (special type) shall consist of Type SS-1 or CSS-1 diluted with water to provide an asphalt content not less than 26 percent. The water used shall be potable. Potable water obtained from public utility distribution lines will be acceptable. The water used shall be free of injurious amounts of oil, acid, alkali, clay, vegetable matter, silt, or other harmful matter. The material shall not be diluted in the field.

1005-3.07 Other Requirements: the tables 1005-1, 1005-1a, and 1005-1b of the Standard Specifications are revised to read:

TABLE 1005-1
ASPHALT BINDER ADJUSTMENT TABLE

Test Property	AASHTO Test Method	Test Result	Percent of Contract Unit Price Allowed
Dynamic Shear of Original Binder: G*/Sin δ, kPa	T 315	≥ 1.00 0.90-0.99 0.70-0.89 < 0.70	100 98 95 88 (1)
Dynamic Shear of RTFO Binder: G*/Sin δ, kPa	T 315	≥ 2.20 2.00-2.19 1.60-1.99 < 1.60	100 98 95 88 (1)
Dynamic Shear of PAV Binder: G*Sin δ, kPa	T 315	≤ 5000 5001-5500 5501-7000 7001-8000 > 8000	100 98 95 89 87 (1)
Creep Stiffness of PAV Binder: S, Mpa	T 313	≤ 300 301-330 331-450 451-600 > 600	100 98 95 89 87 (1)
m-value at 60 sec.	T 313	≥ 0.300 0.270-0.299 0.230-0.269 < 0.230	100 98 90 87 (1)

Notes:

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

(2) Specified properties in AASHTO M 320 for flash point, viscosity at 135 °C, and mass loss are not considered performance related. Specification deficiencies for these properties shall be cause for a work stoppage until specification properties are met, but will not be cause for a pay adjustment.

(3) Should the bituminous material be deficient on more than one property, the pay adjustment will be the greatest reduction to the contract unit price specified considering individual test results.

(4) The information presented in this table does not apply to asphalt cement used for tack coats.

TABLE 1005-1a
Terminal Blend rubberized binder (XX-XXTR+)

Test Property	Test Method	Requirement	Test Result	Percent of Contract Unit Price Allowed
Solubility, %, minimum	ASTM D7553 or ASTM 2042	98	-----	-----
Elastic Recovery, @ 10 ºC, %, minimum	AASHTO T 301	75	75 70 - 74 < 70	100 89 87 (1)

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

Notes:

In case of dispute, ASTM D2042 shall be used to determine the Solubility.

The asphalt binder shall contain a minimum of 8 percent crumb rubber and a minimum of 3 percent SBS (styrene-butadiene-styrene) polymer.

The crumb rubber shall be derived from processing whole scrap tires or shredded tire materials. The tires from which the crumb rubber is produced shall be taken from automobiles, trucks, or other equipment owned and operated in the United States. The processing shall not produce, as a waste product, casings or other round tire material that can retain moisture when stored or disposed of above ground.

Modified binders shall be blended at the source of supply and delivered as a homogenous mixture to the job site.

Modified Binders stored at the asphalt concrete mixing plant for more than two weeks or beyond the supplier recommended shelf life, whichever is less, shall be sampled and tested.

TABLE 1005-1b Polymer Modified Asphalt Binder (XX-XXPM)				
Test Property	**Test Method**	**Requirement**	**Test Result**	**Percent of Contract Unit Price Allowed**
Solubility, %, minimum	ASTM D7553 or ASTM D2042	98	-----	-------
Elastic Recovery @ 10°C, %, minimum	AASHTO T 301	75	≥ 75 70 - 74 < 70	100 89 87 (1)
(1) Reject Status: The pay adjustment applies if allowed to remain in place.				

Notes:

In case of dispute, ASTM D2042 shall be used to determine the Solubility.

Asphalt binder shall contain a minimum of 3 percent SBS (styrene-butadiene-styrene) polymer.

Modified binders shall be blended at the source of supply and delivered as a homogenous mixture to the job site.

Modified Binders stored at the asphalt concrete mixing plant for more than two weeks or beyond the supplier recommended shelf life, whichever is less, shall be sampled and tested.

1005-3.07 **Other Requirements:** the table 1005-1c of the Standard Specifications is hereby deleted.

1005-3.07 **Other Requirements:** the table 1005-3 of the Standard Specifications is revised to read:

TABLE 1005-3 EMULSIFIED ASPHALTS							
Tests On Emulsion	**Test Method**	**Requirement**					
		RS-1	**CRS-1**	**RS-2**	**CRS-2**	**SS-1**	**CSS-1**
Viscosity: Saybolt Furol, seconds, range 77 °F 122 °F	AASHTO T 59	20-100	20-100	50-400	50-400	20-100	20-100
Settlement: 5 days, %, maximum	AASHTO T 59	5	5	5	5	5	5
Sieve: Retained on No. 20, %, maximum	AASHTO T 59 (1)	0.10	0.10	0.10		0.10	0.10
Particle Charge	AASHTOT 59		Pos.		Pos.		Pos.

							(2)
Demulsiability: 35 mL, 0.02 N calcium chloride %, minimum	AASHTO T 59	60		60			
Classification: Uncoated particles, %, minimum	Arizona Test Method 502				55		
Residue: (3) Residue, %, minimum (4)		55	60	63	65	57	57

Notes:

(1) Distilled water shall be used. Two percent sodium oleate solution will not be accepted.

(2) If the Particle Charge Test result is inconclusive, material having a maximum PH value of 6.7 will be acceptable.

(3) Residue will be obtained in accordance with the requirements of Arizona Test Method 504 and shall conform to all the requirements of AASHTO M 320 for PG 64-16, except that for CRS-2 the dynamic shear (G*/Sin δ) on the original residue shall be a minimum of 1.00 kPa and a maximum of 1.50 kPa.

(4) Residue by evaporation may be determined in accordance with the requirements of Arizona Test Method 512; however, in case of dispute, AASHTO T 59 will be used.

1005-3.07 **Other Requirements:** the note (2) of Table 1005-3a of the Standard Specifications is revised to read:

(2) Testing shall be performed on residue by distillation. Testing on residue by oven evaporation will not be accepted.

1005-3.07 **Other Requirements:** the table 1005-5 of the Standard Specifications is revised to read:

TABLE 1005-5

EMULSIFIED RECYCLING AGENTS

Tests on Emulsified Recycling Agent	Test Method	Requirement			
		ERA-1	ERA-5	ERA-25	ERA-75
Viscosity: Saybolt Furol, 77 °F, seconds range	AASHTO T 59	15 - 40	15 - 100	15 - 100	15 - 100
Miscibility	AASHTO T 59	Passes	Passes	Passes	Passes

Sieve Test: %, maximum	AASHTO T 59 (1)	0.10	0.10	0.10	0.10
Particle Charge	AASHTO T 59	Positive	Positive	Positive	Positive
Residue: (2) Residue, %, minimum	(3)	60	60	60	60

Notes:

(1) Distilled water shall be used. Two percent sodium oleate solution will not be accepted.

(2) Residue will be obtained in accordance with the requirements of Arizona Test Method 504 and shall conform to the requirements specified in Table 1005-4.

(3) Residue by evaporation may be determined in accordance with the requirements of Arizona Test Method 512; however, in case of dispute, AASHTO T 59 will be used.

1005-3.07 **Other Requirements:** the Paving Asphalt row of the table 1005-6 of the Standard Specifications is modified to add:

TABLE 1005-6
OTHER REQUIREMENTS

Grade of Asphalt Specification Designation	Range of Temperatures for Application by Spraying, °F (Not applicable for Plant Mixing)	Range of Aggregate Temperatures for Plant Mixing, °F	Basis of Conversion, Average Gallons Per Ton at 60 °F
Paving Asphalt	275 - 400	------	
PG 76-22 PM			231
229			232
PG 70-22 PM			233
230			
PG 64-28 PM			

(1006PCC, 09/21/23)

SECTION 1006 PORTLAND CEMENT CONCRETE:

1006-2.01(A) General: of the Standard Specifications is revised to read:

Cementitious material is defined as an inorganic material or a mixture of inorganic materials that sets and develops strength by chemical reaction with water by formation of hydrates and is capable of doing so under water. In this specification, cementitious materials are defined as hydraulic cement (Portland cement, Portland-pozzolan cement or Portland-limestone cement) and supplementary cementitious materials (fly ash, natural pozzolan, or silica fume).

1006-2.01(B) Hydraulic Cement: the first paragraph of the Standard Specifications is revised to read:

Hydraulic cement shall consist of Portland cement, Portland-pozzolan cement or Portland-limestone cement.

1006-2.01(B) Hydraulic Cement: of the Standard Specifications is modified to add:

Portland-limestone cement shall conform to the requirements of ASTM C595 for blended hydraulic cement with moderate sulfate resistance, Type IL (MS).

1006-2.01(C)(2) Flyash and Natural Pozzolan: of the Standard Specifications is revised to read:

Fly ash and natural pozzolan shall conform to the requirements of ASTM C618 for Class C, F, or N.

TABLE 1006-5 Design Criteria: the column heading of the third column of the Standard Specifications is revised to read:

		Cementitious Material Content: Lbs. per Cu Yd. Minimum - Maximum		

1006-3.02(C) Mix Design Submittal Requirements: the items (16) and (18) of the Standard Specifications are revised to read:

(16) Volume of each material measured to the nearest hundredth of a cubic foot;

(18) Total volume measured to the nearest hundredth of a cubic foot;

1006-7.02(A) General: the fifth paragraph of the Standard Specifications is revised to read:

Concrete shall be sampled in accordance with ASTM C172 for acceptance testing of temperature, slump, unit weight and yield (when required) and air content (when required) as well as for fabrication of test cylinders for compressive strength determination at 28 days except that the concrete shall be sampled once during discharge at the middle portion of the

batch. ASTM C172 includes sampling from stationary, paving and truck mixers, and from agitating and non-agitating equipment used to transport central-mixed concrete and from continuous mixing equipment as described in Specification ASTM C685/C685M. Sampling shall be at the point of discharge from truck mixers. Sufficient care shall be taken to obtain a representative sample by diverting the entire stream of the concrete to prevent segregation. Samples shall be of sufficient size to perform all the required tests and fabricate the necessary test cylinders but in no case less than 1 cubic foot.

1006-7.02(B) Class S and Class B Concrete: of the Standard Specifications is revised to read:

For Class S concrete with a compressive strength requirement less than 4000 psi, or Class B concrete, a strength test will consist of the average strength of two test cylinders. However, if the compressive strengths of the two test cylinders differ by more than 10 percent from the average of the two, the strength test result shall be the cylinder with the highest compressive strength.

For Class S concrete with a compressive strength requirement equal to or greater than 4000 psi, or Class P concrete, the compressive strength of each sample shall be determined by averaging the results of the three test cylinders. However, if the compressive strength of any one of the three test cylinders differs by more than 10 percent from the average of the three, its result shall be discarded and the compressive strength shall be the average of the remaining two cylinders. Should the individual compressive strength of any two of the three remaining cylinders differ by more than 10 percent from the average of the three, the results will be discarded and the compressive strength shall be the strength of the remaining cylinder.

1006-7.03(A)(3) Consistency: the third paragraph of the Standard Specifications is revised to read:

When the concrete is pumped, samples for consistency will be taken as the concrete leaves the mixer.

TABLE 1006-10 Air Entrainment Requirements: the table of the Standard Specifications is revised to read:

TABLE 1006-10
Air Entrainment Requirements

Elevation	Air Entrainment Required	Required Air Content by Volume (%)
3000 feet or above	Yes	4 to 7
Below 3000 feet	Contractor's Option	≤ 7

(1006QCPC, 07/12/05)

SECTION 1006 PORTLAND CEMENT CONCRETE:

1006-4.01 General Requirements: of the Standard Specifications is modified to add:

1006-4.01(A) Contractor Quality Control:

The contractor shall perform the quality control measures described in Subsection 106.04(C). At the weekly meeting, the contractor shall be prepared to explain and discuss how the following processes will be employed.

(a) Aggregate Production, including crusher methods, pit extraction, and washing.

(b) Stockpile Management, including stacking methods, separation technique, plant feed technique, stockpile pad thickness, and segregation prevention.

(c) Mixing and Transport, including mixing time and revolutions, water and concrete temperature, integrity of mixing equipment, sight glass for water, slump meters, batch ticket, and travel time.

(d) Proportioning, including scale calibration, water added, water meter moisture correction, and bin loading.

The contractor shall obtain samples and perform the tests specified in the following table:

CONTRACTOR QUALITY CONTROL TESTING REQUIREMENTS			
TYPE OF TEST	TEST METHOD	SAMPLING POINT	MINIMUM TESTING FREQUENCY
Fine Aggregate for PCC (Class S or Class P)			
Gradation	ARIZ 201	Crusher Belt or Stockpile	1 per 750 CY of Concrete
Sand Equivalent	AASHTO T 176		
Coarse Aggregate for PCC (Class S or Class P)			
Gradation	ARIZ 201	Crusher Belt or Stockpile	1 per 750 CY of Concrete
Class S Portland Cement Concrete			
Entrained Air	AASHTO T 152	At Point of Discharge	1 per 40 CY of Concrete
Slump	AASHTO T 119		

(1011APEAS, 07/18/24)

SECTION 1011 JOINT MATERIALS:

1011-8.03 Field Performance: of the Standard Specifications is revised to read:

The manufacturer of the joint sealant shall demonstrate satisfactory field performance in Arizona, or by AASHTO Product Evaluation & Audit Solutions (formerly NTPEP) field

evaluation, of less than 1 percent total failure (either within the material or the adhesive bond to the joint face) after one year of service, before the material shall be used.

(1014GEOSYN, 07/18/24)

SECTION 1014 GEOSYNTHETICS:

1014-1 General Requirements: of the Standard Specifications is revised to read:

Certificates of Analysis, conforming to the requirements of Subsection 106.05 of the specifications, shall be submitted.

Geosynthetic materials, excluding biaxial geogrid, must be on the DataMine list for geotextiles and geosynthetics on the AASHTO Product Evaluation & Audit Solutions (formerly NTPEP) website. The product line evaluation report from AASHTO Product Evaluation & Audit Solutions (formerly NTPEP) shall be provided to the Engineer prior to use on the project.

Fibers, yarns, and filaments used in the manufacture of geotextile fabric, and the threads used in joining by sewing, shall consist of long-chain synthetic polymers, composed at least 95 percent, by weight, of polyolefins or polyesters. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

Geosynthetic materials shall be furnished in protective covers capable of protecting the materials from harmful environmental conditions such as ultraviolet rays, abrasion, extreme heat, and water. Storage of the materials shall be in a manner that prevents damage, contamination, or deterioration.

Geotextile fabric shall be resistant to chemical attack, rot, and mildew, and shall have no tears or defects which will adversely alter its physical properties.

All numeric values in the following tables, except for apparent opening size (AOS), represent minimum average roll values (MARV) in the weaker principal direction. Numeric values for (AOS) represent maximum average roll values.

Woven slit film geosynthetics will not be allowed for use in Subsections 1014-5, 1014-6, 1014-7, and 1014-9 of the specifications.

(1015EPOX, 02/16/23)

SECTION 1015 EPOXY MATERIALS: the title and text of the Standard Specifications is revised to read:

SECTION 1015 EPOXY RESIN ADHESIVES:

1015-1 General Requirements:

Certificates of Compliance, conforming to the requirements of Subsection 106.05 of the specifications, shall be submitted to the Engineer by the contractor for any epoxy resin adhesives used on a specific project. Only those epoxy resin adhesives shown on the Department's Approved Products List (APL), or equal, will be allowed for use. Approved products may only be used in accordance with the limitations stated in the manufacturer's instructions, the APL, and the International Code Council Evaluation Service (ICC-ES) evaluation report for the product, if applicable. Copies of the most current version of the APL are available on the internet from the ADOT Research Center, through its Product Evaluation Program.

Epoxy resin adhesives shall be a two-component system that meets the requirements of ASTM C881, shall be furnished in the type, grade, and class specified, and shall meet all the requirements specified herein. For pre-packaged cartridge kits, the epoxy resin adhesive shall meet the requirements of ASTM C881 when mixed according to the manufacturer's instructions, utilizing the manufacturer's mixing nozzle. When a grade or class is not specified, an appropriate grade and class shall be selected for the particular application and approved by the Engineer. Epoxy resin adhesives for patching external concrete shall be gray in color.

All epoxy resin adhesives shall be resistant to the action of weathering, moisture, acids, alkalis, and other environmental factors.

The contractor shall submit product literature and Safety Data Sheets (SDS). The literature shall identify the recommended product use or applications for which it is intended, and the directions for use.

1015-1.01 Packaging, Labeling, and Storing:

Each component of epoxy resin adhesive shall be packaged in containers of size proportional to the amount of that component in the mix so that one container of each component is used in mixing one batch of epoxy resin adhesive.

The containers shall be of such design that all of the contents may be readily removed, and shall be well sealed to prevent leakage. The containers and labeling shall meet U.S. Department of Transportation Hazardous Material Shipping Regulations, and the containers shall be of a material, or lined with a material, of such character as to resist any action or breakdown by the components.

Each container shall be clearly labeled with the product type and identification code, component designation (A or B), manufacturer's name, date of manufacture, batch or lot

number, all directions for use, and such warnings or precautions concerning the contents as may be required by State or Federal Laws and Regulations.

Epoxy resin adhesives shall be stored in accordance with the manufacturer's recommendations at all times. Attention is directed to the characteristic of some epoxy resin components to crystallize or thicken excessively prior to use when stored at temperatures below 35 degrees F. Any material which shows evidence of crystallization or a permanent increase in viscosity or settling of pigments which cannot be readily dispersed with a paddle shall not be used.

1015-1.02 Directions for Use:

Use of epoxy resin adhesives shall be in accordance with the manufacturer's recommendations unless otherwise specified by the Engineer. Use of epoxy resin adhesives shall be allowed for only those uses as shown on the ADOT Approved Products List.

At the time of mixing, the two components of the epoxy resin adhesive shall be at a temperature between 60 and 85 degrees F, unless otherwise specified or approved by the Engineer. Any heating of the epoxy resin components shall be done by application of indirect heat.

Immediately prior to mixing, each component shall be thoroughly mixed with a paddle, unless otherwise specified. Separate paddles shall be used to stir each component.

Immediately prior to use, the components of the epoxy resin adhesive shall be mixed together in the specified ratios according to the manufacturer's recommendations. When mixed, all epoxy resin adhesive shall have a uniform color without streaks. No solvent shall be added to any epoxy resin adhesive.

Surfaces on which the epoxy resin adhesive is to be placed shall be free of rust, paint, grease, asphalt and loose or otherwise deleterious materials. The surface shall be dry unless otherwise allowed according to the manufacturer's recommendations for use. Any overlay or inserted material which is to be bonded to the underlying surface shall be placed before thickening of the epoxy resin adhesive has begun.

When epoxy resin adhesive is used as a binder to make mortar, the components of the epoxy resin adhesive shall be thoroughly mixed together before the sand or fine aggregate is added. The type, gradation, and proportion of sand or fine aggregate added and mixed with the epoxy resin adhesive to make mortar shall be as specified or recommended by the manufacturer. The sand or fine aggregate moisture content shall not be more than 0.5 percent as determined in accordance with AASHTO T 265. All surfaces against which mortar is to be placed shall be primed with a coat of the epoxy resin adhesive just prior to placing the mortar.

1015-2 Anchoring Adhesives - Steel to Concrete:

Epoxy resin adhesive anchoring systems shall be used for bonding anchors and rebar dowels into hardened concrete or masonry. Applications shall be limited to horizontal and down hole orientations. Epoxy resin adhesives shall not be used in any overhead vertical application, or permanently sustained purely axial tension application.

The anchoring adhesive shall consist of a two component epoxy resin adhesive formula that is packaged in a dual-cylinder cartridge that can automatically combine the constituents in the proper proportions. Manual proportioning of the components shall not be used for anchoring applications. The adhesive shall not be used beyond the expiration date shown on the packaging.

For horizontal applications where flow out of the anchoring hole is a problem, high viscosity or non-sag anchoring adhesives shall be used. Low and medium viscosity anchoring adhesives may be utilized in down holes which open upward. The product shall only be used for the application and limitations for which it was designed according to the manufacturer's product literature. Post-installed anchoring adhesives shall be installed in accordance with the manufacturer's printed installation instructions (MPII). Installation of adhesive anchors shall be performed by personnel trained to install adhesive anchors.

(A) Structural Applications:

Structural applications are defined as those requiring the anchoring adhesive system to develop a minimum tensile and shear strength resistance to an applied load. Post-installed anchoring adhesives shall have been tested in accordance with ICC-ES Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete (AC308), which incorporates the requirements found in ACI 355.4. A current ICC-ES evaluation report for the anchoring adhesive shall be submitted to the Engineer, who will review the conditions of use listed in the report before it is approved for use on a project. The conditions of use include limitations on base material temperature since higher temperatures affect adhesive bond tension and shear load strength. The anchoring adhesive shall only be used for the broad category (un-cracked concrete, cracked concrete, or masonry) for which it has been designated in the ICC-ES report.

Horizontal applications where a component of the applied load will be in sustained tension shall be installed by an individual who has a current ACI/CRSI Adhesive Anchor Installer Certification.

(B) Load Transfer Dowel and Tie-Bar Applications:

Applications for load transfer dowels and tie-bars are defined as those required to transfer load across joints in concrete slabs, walls and other concrete and masonry members. Epoxy resin adhesive shall meet the requirements of ASTM C881 Type IV. The anchors shall be installed, using the anchoring adhesive in the concrete or masonry member in strict accordance with the manufacturer's instructions. The anchoring adhesive shall only be used for the broad category (un-cracked concrete, cracked concrete, or masonry) for which it has been designated in the manufacturer's product literature.

1015-3 Concrete to Concrete Bonding Adhesives:

(A) General:

The grade of the epoxy resin adhesive system shall match the proposed use as identified in the product literature provided by the manufacturer. The product shall specifically be designed for this application according to the manufacturer's product literature. The pot life of the material shall be determined in accordance with AASHTO T 237, Part I.

(B) Hardened Concrete to Hardened Concrete

Epoxy resin base adhesive to be used for adhering or bonding hardened concrete to hardened concrete and other materials shall conform to the requirements of ASTM C881, Type I for non-load bearing applications and Type IV for load bearing applications.

(C) Hardened Concrete to Fresh Concrete

Epoxy resin base materials to be utilized for adhering or bonding freshly mixed concrete materials to hardened concrete, shall conform to the requirements of ASTM C881, Type II, for non-load bearing applications and Type V for load bearing applications.

1015-4 Epoxy Resin Adhesive for Mortar:

Epoxy resin adhesive to be used for binder in mortar, shall conform to the requirements of ASTM C881, Type I, for non-load bearing applications and Type IV for load bearing applications. The grade of the epoxy resin adhesive system shall match the proposed use as identified in the product literature provided by the manufacturer. The product shall specifically be designed for this application according to the manufacturer's product literature.

When epoxy resin adhesive is used as a binder to make mortar, the components of the epoxy resin adhesive shall be thoroughly mixed together before the sand or fine aggregate is added. The type, gradation, and proportion of sand or fine aggregate added and mixed with the epoxy resin adhesive to make mortar shall be as specified or recommended by the manufacturer. The sand or fine aggregate moisture content shall not be more than 0.5 percent as determined in accordance with AASHTO T 265. All surfaces against which mortar is to be placed shall be primed with a coat of the epoxy resin adhesive just prior to placing the mortar.

1015-5 Epoxy Resin Adhesive for Crack Repair:

Epoxy resin adhesive to be used for crack repair in concrete, shall be furnished as two components which shall be mixed together at or just before the point of injection.

The epoxy resin adhesive shall conform to the requirements of ASTM C881, Type I, for use in non-load bearing applications and Type IV for use in load bearing applications. The grade of the epoxy resin adhesive system shall normally be Grade 1, low viscosity. Grade 2, medium viscosity epoxy adhesive systems may be used in larger width cracks. The product shall specifically be designed for this application according to the manufacturer's product literature.

Immediately prior to injection, usually at or near the injection tip, the two components shall be brought together as part of the injection process. The injection equipment and process utilized shall be in accordance with the manufacturer's recommendations. No solvents shall be utilized to thin the material.

Appendix A

Section 33 32 16.01 Packaged Wastewater Grinder Pump Assemblies

PART 1 – GENERAL

1.01 SUMMARY

A. This section addresses supervision, labor, materials and equipment in the work for furnishing and installing packaged wastewater grinder pump assemblies.

B. General Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish, install, adjust, and test packaged wastewater grinder pump assemblies as shown on the Plans and as described in these Specifications.

C. All packaged wastewater grinder pump assemblies shall be provided by a single manufacturer.

D. Pump manufacturer scope of supply:
   1. The manufacturer shall furnish complete factory-built and tested packaged wastewater grinder pump station(s), each consisting of a) pump with motor, b) basin assembly, c) alarm device, d) unitized level control system, and e) all necessary appurtenances and extra materials as specified, to form a complete package system, inclusive of technical services. The waste handling capabilities of the grinder pump and station shall be tested and certified to NSF/ANSI 46.

E. Contractor scope of supply: Provide materials, equipment, appurtenances, and services not supplied as part of the system, including but not limited to:
   1. Unloading, storing, and protecting equipment at the site in accordance with supplier's recommendations (Add or remove as needed).

1.02 PRICE AND PAYMENT

A. The grinder lift station will be paid for at a lump sum price, including payment for furnishing all labor, material, tools, and equipment required for the installation of the lift station.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The referenced publications shall be the current effective edition.
   1. American Society for Testing Materials (ASTM)
   2. American Society for Testing and Materials International (ASTM)
   3. American National Standards Institute (ANSI)
   4. ISO 9001
   5. National Electrical Manufacturers Association (NEMA)
   6. National Sanitation Foundation – NSF/ANSI 46
   7. Occupational Safety and Health Administration
   8. Underwriters Laboratories

1.04 ALTERNATES - NOT USED

1.05 SUBMITTALS

A. General: If requested, the manufacturer will submit standard submittal data to the Engineer for review.

B. Action submittals:
    1. The manufacturer will supply the standard submittal, consisting of:
        a. Pump Catalog Data, including a certified performance curve and pump dimensional drawing, and a dimensional drawing of complete package.
        b. Materials of construction list
        c. Mounting accessory details
        d. Typical installation drawing
        e. Electrical schematics and diagrams, including control panel data and panel wiring schematic
        f. Accessory data
        g. Certified copies of test data from factory testing when specified - only after pumps have been ordered and manufactured.

C. Informational submittals:
    1. Descriptive information on material and equipment furnished
    2. Anchorage requirements
    3. Installation instructions
    4. Manufacturer's certificate of acceptance of installation and field testing
    5. List of manufacturer's recommended spare parts
    6. Installation & Operation Manual with parts list, pre-start-up checklist, start-up checklist, and proper winterization procedures
    7. Warranty documents
    8. Name and address of factory authorized service facility
D. Closeout submittals:
    1. Project record documents: Record actual locations of pumps and appurtenances on the contract drawing, reflecting all post-bid changes.
    2. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.
E. Shop Drawings and Manuals
    1. After receipt of notice to proceed, the manufacturer shall furnish the Engineer a minimum of six sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The Engineer shall promptly review this data, and return two copies to the manufacturer as approved, or approved as noted. Upon receipt of accepted shop drawings, the manufacturer shall proceed with order entry and fabrication of the equipment. Prior to completion of equipment delivery, the manufacturer shall supply four copies of Operation and Maintenance Manuals to the owner, and one copy of the same to the Engineer.

1.06 QUALITY ASSURANCE

A. Warranty
    1. The grinder pump manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, the panel for a period of 24 months after notice of owner's acceptance, but no greater than 27 months after receipt of shipment. Any manufacturing defects found during the warranty period will be

reported to the manufacturer by the owner and will be corrected by the manufacturer at no cost to the owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. All grinder pump units will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Field installation of the pump in tanks under 96 inches is not allowed. Field installation of the level sensor into the tank is not allowed. Grinder pump stations will be individually mounted on wooden pallets. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Qualifications

1. Pre-Approval of Manufacturer
   Any pump manufacturer not specified, but wishing to be pre-approved as an acceptable supplier shall submit a complete hydraulic analysis based on the design detailed in the drawings at least fifteen days prior to bid date.
2. All manufacturers must have been in the business of manufacturing complete grinder pump stations for a minimum of five years.
   a. The company shall submit detailed installation and user instructions for its product, submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts.
3. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems.
4. Manufacturer Representatives, Distributors, or Packagers will not be considered as manufacturers.
5. Manufacturer must demonstrate to the satisfaction of the Engineer that the proposed pumping equipment will meet system flows and heads required. In addition, pre-submittal must also demonstrate to the satisfaction of the Engineer that the equipment being proposed meets or exceeds all performance and safety requirements, materials of construction, and user benefits of the specified equipment.
6. Only pre-approved grinder pump station manufacturers will be considered. All bids utilizing manufacturers not pre-approved will be considered non-responsive.
7. Acceptable grinder pump station manufacturer(s) are the Environment One Corporation, or pre-approved equal.
8. The pumps shall be semi-positive displacement, 1 HP, 1725 RPM, 240V/60Hz, 1 Phase, grinder pumps.

9. CONTRACTOR will provide OWNER with location and description of manufacturer's Service Centers and spare parts stock.
10. Manufacturer shall be certified to ISO 9001 and shall provide a valid certificate upon request.
11. The manufacturer shall provide, upon request, a reference and contact list from ten of its largest contiguous grinder pump installations of the type of grinder pumps described within this specification.

2.02 PRODUCT DETAILS

A. Service Conditions:

The packaged pump system shall include a custom designed, integral, vertical rotor, motor driven, solids handling pump of the **progressing cavity type** with a single mechanical seal.

1. The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

B. System Component Requirements

1. Pump
    a. Double radial O-ring seals are required at all pump, motor, and control housing joints to minimize corrosion and create a protective barrier.
    b. Unit housings constructed of cast iron shall be fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied.
    c. Housings not constructed of cast iron shall be injection molded from thermoplastic composite materials specifically selected for excellent corrosion resistance, high impact strength and superior resistance to UV degradation.
    d. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel.
    e. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance.
        1. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.
    f. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable.
    g. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance.
    h. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective

grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.

i. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
    1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
    2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.
    3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
    4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
j. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.
k. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2. Motor
    a. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F insulation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds.
    b. The motor shall be press-fit into the casting for better heat transfer and longer winding life.
    c. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor.
    d. The motor protector shall be specifically investigated and listed by Underwriters Laboratories Inc. for the application.
        1. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.
    e. The wet portion of the motor armature must be 300 Series stainless steel.

1. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

f. Pump operation during instances of potentially damaging high current or low voltage conditions shall be inhibited by an in-pump electrical monitoring system that has been investigated and listed by Underwriters Laboratories Inc. for the application.

g. Motor start shall be controlled by a DC driven electromechanical relay integrated within the control compartment of the pump. Electrical monitoring shall ensure the relay operates reliably.
    1. AC Mechanical contactors for motor start are susceptible to damage from short cycling and will not be accepted.

3. Basin Assembly Components
    a. Tank and Integral Accessway

        i. The tank shall be a Wetwell/Drywell design made of high density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250” thick (minimum). All seams created during tank construction are to be thermally welded and factory tested for leak tightness.
        ii. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.
        iii. The tank base shall be designed in a manner that does not require a concrete anti-flotation collar.
        iv. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe.
        v. The tank capacities shall be as shown on the contract drawings.
        vi. The Drywell accessway shall be an integral extension of the Wetwell assembly and shall include a lockable cover assembly providing low profile mounting and watertight capability. The accessway design and construction shall enable field adjustment of the station height in increments of 3" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
        vii. All discharge piping shall be constructed of 304 stainless steel. The discharge shall terminate outside the accessway bulkhead with a stainless steel, 1-1/4” Female NPT fitting.
        viii. The discharge piping shall include stainless steel ball valve rated for 235 psi WOG; PVC ball valves or brass ball/gate will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
        ix. The accessway shall include a single NEMA 6P Electrical Quick Disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight.
        x. The EQD will be supplied with 32’, 25’ of useable Electrical Supply Cable (ESC) outside the station, to connect to the alarm panel. The ESC shall be installed in the basin by the manufacturer.

1. Field assembly of the ESC into the basin is not acceptable because of potential workmanship issues.

xi. The EQD shall require no tools for connecting, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque.
   1. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts.
   2. A junction box shall not be permitted in the accessway due to the large number of potential leak points.

xii. The EQD shall be so designed to be conducive to field wiring as required. The accessway shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank.

b. Valves

i. Anti-siphon valve

1. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the stainless steel discharge piping
2. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.
3. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.
4. The valve body shall be injection-molded from a thermoplastic composite resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped.
5. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

ii. Flapper style check valve

1. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping.
2. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow.
3. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.
4. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure.
5. The valve body shall be an injection molded part made of a thermoplastic composite resin.
6. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

iii. Stainless Steel Curb Stop/ Check Valve Assembly (Uni-lateral)

1. The curb stop shall be pressure-tight in both directions. The ball valve actuator shall include position stop features at the fully opened and closed positions.
2. The curb stop/check valve assembly shall be designed to withstand a working pressure of 235 psi.
3. The stainless steel check valve shall be integral with the curb stop valve.
4. The check valve will provide a full-ported 1-1/4" passageway and shall introduce minimal friction loss at maximum rated flow.
5. The flapper hinge design shall provide a maximum degree of freedom and ensure seating at low back pressure.
6. Thermoplastic Composite Fittings
    a. All plastic fitting components are to be in compliance with applicable ASTM standards.
7. All pipe connections shall be made using compression fitting connections including a Buna-N O-ring for sealing to the outside diameter of the pipe.
8. A split-collet locking device shall be integrated into all pipe connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.
9. Curb Boxes
    a. Curb boxes shall be constructed of ABS, conforming to ASTM-D 1788. Lid top casting shall be cast iron, conforming to ASTM A-48 Class 25, providing magnetic detectability, and be painted black. All components shall be inherently corrosion-resistant to ensure durability in the ground. Curb boxes shall provide height adjustment downward (shorter) from their nominal height.
10. Factory Test – The stainless steel, combination curb stop/check valve component shall be 100 percent hydrostatically tested to 150 psi in the factory.

c. High Density Polyethylene Pipe (Supplied by others):
    i. Pipe shall have a working pressure of 160 psi minimum and shall be classified SDR per ASTM D 3035.
    ii. Pipe Dimensions – The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by the SPECIFYING ENGINEER. SDR 7, 9 and 11 fittings are available from the manufacturer.
d. Core Unit
    i. The grinder pump station shall have a cartridge type, easily removable core assembly consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring.
    ii. The core unit shall be installed in the basin by the manufacturer.
    iii. Field assembly of the pump and controls into the basin is not acceptable because of potential workmanship issues and increased installation time.
        1. In some cases, stations taller than 96" may be shipped on their side without the cores assembled in the basin for freight purposes but this is the only exception.
    iv. The core unit shall seal to the tank deck with a stainless steel latch assembly. The latch assembly must be actuated utilizing a single quick release mechanism requiring no more than a half turn of a wrench.

v. The watertight integrity of each core unit shall be established by a 100 percent factory test at a minimum of 5 PSIG.

e. Alarm Device
   i. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting.
   ii. The NEMA 4X enclosure shall be manufactured of thermoplastic composite to ensure corrosion resistance.
      1. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.
      2. The enclosure shall not exceed 10.5" W x 14" H x 7" D, or 12.5" W x 16" H x 7.5" D if certain options are included.
   iii. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp, single-pole circuit breaker for the alarm circuit.
      1. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit.
      2. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.
   iv. The alarm panel shall include the following features:
      1. external audible and visual alarm
      2. push-to-run switch; push-to-silence switch
      3. redundant pump start; and high level alarm capability
   v. The alarm sequence is to be as follows when the pump and alarm breakers are on:
      1. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.
      2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
      3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.
   vi. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H.
   vii. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.
   viii. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet.
   ix. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).
   x. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

f. Level controls
   i. All necessary motor starting controls shall be located in the core unit.
      1. Locating the motor starting controls in a separate enclosure is not acceptable.

ii. The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls.
iii. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. The level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc.
iv. The level sensing housing must be constructed from a high-impact thermoplastic composite.
    1. The use of PVC for the level sensing housing is not acceptable.
v. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch.
vi. The air column shall be molded from a thermoplastic composite suitable for use in wastewater and with excellent impact resistance.
vii. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings.
viii. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit.
ix. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
x. All fasteners throughout the assembly shall be 300 Series stainless steel.
xi. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.
    1. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch.
    2. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue.
xii. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes.
    1. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation.
xiii. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

g. Serviceability
    i. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary.

ii. The level sensor assembly must be easily removed from the pump assembly for service or replacement.
iii. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.
iv. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged.
v. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly.
vi. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

l. Spare Parts

1. One spare grinder pump core, complete with all operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

2.04 ACCESSORIES (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Install in accordance with manufacturer's printed instructions (and state/municipal, and other governing standards).
   1. The pump shall be capable of operating continuously in a vertical submerged condition.
   2. Contractor shall complete all piping and supports, make all electrical power and control connections, and install all safety devices and instrumentation prior to equipment start-up.
   3. All anchor bolts, nuts, washers, and sleeves shall be 300 series stainless steel furnished by the contractor and shall be of ample size and strength for the purpose intended.

B. Earth excavation and backfill are also to be done as a part of the work under this section, including any necessary sheeting and bracing.
   1. The Contractor shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.
   2. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Engineer.
   3. Remove packing material. User instructions MUST be given to the Owner. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.
   4. Installation shall be accomplished so that 1 inch to 4 inches of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow adequate clearance for field connections, backfill installation and compaction.

5. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
6. A concrete anti-flotation collar, as detailed on and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump tank or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes. All Model DH071 tanks have been designed such that a concrete anti-flotation collar is not required. Other D-Series Models may require an anti-flotation collar.
7. The Contactor will provide and install a 4-foot piece of 4-inch SCH 40 PVC pipe with water tight cap, to stub-out the inlet for the property owners' installation contractor, as depicted on the contract drawings.
8. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the Contractor. An alarm device is required on every installation, there shall be NO EXCEPTIONS. It will be the responsibility of the Contractor and the Engineer to coordinate with the individual property owner(s) to determine the optimum location for the Alarm Panel.
9. The Contractor shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with 32 feet, 25 feet of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

C. Backfill Requirements:
1. Proper backfill is essential to the long-term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions. The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321.
2. Class 1, angular crushed stone offers an added benefit in that it doesn't need to be compacted. Class II, naturally rounded stone, may require more compactive effort, or tamping, to achieve the proper density. If the native soil condition consists of clean compactible soil, with less than 12 percent fines, free of ice, rocks, roots and organic material, it may be an acceptable backfill. Such soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of between 85 percent and 90 percent. Non-compactible clays and silts are *not* suitable backfill for this or any underground structure such as inlet or discharge lines. If you are unsure of the consistency of the native soil, it is recommended that a geotechnical evaluation of the material is obtained before specifying backfill.
3. Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing grinder pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped more than 4 feet from the discharge to the bottom of the hole to avoid separation of the constituent materials.
4. Improper backfilling may result in damaged stations. The grinder pump station shall be installed at a minimum depth from grade to the top of the 1 1/4" discharge line, to assure maximum frost protection. The finish grade line shall be 1" to 4" below the bottom of the lid, and final grade shall slope away from the grinder pump station.
5. All restoration will be the responsibility of the CONTRACTOR. Per unit costs for this item shall be included in the CONTRACTOR'S bid price for the individual grinder pump stations. The properties shall be restored to their original condition in all respects,

including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the ENGINEER.

D. Construction Practices – Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be in accordance with the pipe manufacturer's recommendations. The pipe should be handled in such a manner that it is not damaged by being dragged over sharp objects or cut by chokers or lifting equipment.
    1. Segments of pipe having cuts or gouges in excess of 10 percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt-fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt-fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.

    2. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long, fused sections. Care should be exercised to avoid cutting or gouging the pipe.

E. Pipe Installation – Assemble the compression fittings according to the fitting manufacturer's recommendations.
    1. The trench and trench bottom should be constructed in accordance with ASTM D 2321. Embedment materials should be Class I, Class II or Class III materials as defined in ASTM D 2321. The use of Class IV and/or Class V materials for embedment is not recommended and should be allowed only with the approval of the SPECIFYING ENGINEER. Bedding of the pipe should be performed in accordance with ASTM D 2321. Compaction should be as specified in ASTM D 2321. Deviations from the specified compaction shall be approved by the SPECIFYING ENGINEER.
    2. Haunching and initial backfill should be as specified in ASTM D 2321 using Class I, Class II or Class III materials. Materials used and compaction shall be as specified by the SPECIFYING ENGINEER. In cases where a compaction of 85 percent Standard Proctor Density is not attainable, the SPECIFYING ENGINEER may wish to increase the SDR of the pipe to provide adequate stiffness. ASTM D 2321 sections titled "Minimum Cover for Load Application," "Use of Compaction Equipment" and "Removal of Trench Protection" should apply unless directed otherwise by the SPECIFYING ENGINEER.

3.04 QUALITY CONTROL

A. The manufacturing facility where the pumps and complete packages are manufactured shall be audited in accordance with ISO 9001 certification requirements.

B. Factory Test
   1. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum).
   2. Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls.
   3. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps is not acceptable.
   4. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve.
   5. Additional validation tests include:
      a. integral level control performance
      b. continuity to ground
      c. acoustic tests of the rotating components.
   6. The engineer reserves the right to inspect such testing procedures with representatives of the owner, at the grinder pump manufacturer's facility.
   7. All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

C. Manufacturer's Representative
   1. Provide manufacturer's representative. The representative shall inspect the equipment, carry out the equipment start-up procedures, and provide training to the operators in how to effectively operate and maintain the equipment. The manufacturer's representative may be an employee of the manufacturer's distributor.
   2. Prior to Operational Testing, the CONTRACTOR shall have the manufacturer's representative perform the following:
      a. Megger test the stator and power cables
      b. Check proper rotation
      c. Check power supply voltage
      d. Measure motor operating load and no-load current
      e. Check level control operation and sequence
   3. During Final Acceptance Testing, the manufacturer's service representative shall review recommended operation and maintenance procedures with the OWNER'S personnel.
   4. The manufacturer's representative shall be present for a period of not less than one (1) day to complete the following:
      a. Inspect completed installation
      b. Observe equipment testing
      c. Observe equipment start-up
      d. Instruct operational personnel on equipment operation and maintenance.

D. Field Tests:

   Upon completion of the inspection performed by the Manufacturer's Representative, the pumping system shall be field tested as specified herein. The CONTRACTOR shall be responsible for supplying all equipment and materials necessary to perform testing,

including but not limited to, a portable generator and power cable (if temporary power is required), sufficient volume of water for each basin to trigger high water alarm, a portable generator or power source and ability to open all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

The Manufacturer's Representative and the CONTRACTOR shall perform the following test on each station:

a. Make certain the discharge shut-off valve in the station is fully open.
b. Turn ON the alarm power circuit and verify the alarm is functioning properly.
c. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
d. Consult the Manufacturer's Service Manual for detailed start-up procedures.

E. Inspections

1. Upon completion of the installation and on-site testing, and before acceptance by the OWNER, the pump package MANUFACTURER or the authorized pump package manufacturer's REPRESENTATIVE shall submit a written statement that the pump installation has been inspected and is completed in accordance with the manufacturer's recommendations.

F. OSHA Confined Space

1. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146, permit-required confined spaces).
2. "Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."

G. Safety

1. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc. to be safe and appropriate for the intended use.
    a. UL listing of components of the station, or third-party testing to UL standard are not acceptable.
2. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International.
    a. Third-party testing to NSF standard is not acceptable.

3.05 ADJUSTING

A. Adjust parts for smooth, uniform operation.

3.06 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish (surface) or surrounding construction.

END OF SECTION

Appendix B

Steel Casing Specification (Adapted from Maricopa Association of Governments (MAG) Standard Specifications for Public Works Construction, Section 602)

Description:

The Contractor shall furnish all labor, material and equipment as required for the installation of steel casing by a) Trenchless operation; using horizontal earth auger boring, hand tunneling or pipe ramming, or b) Open Cut operation; using trenching, placement and backfill for the protection of underground utilities.

Materials:

Butt Welded Steel Casing Fabrication:

Steel casing shall conform to ASTM A283 Grade C, ASTM A252 Gr. 2, ASTM A53, ASTM A139, (American Petroleum Institute "API" Specification) API 5L Gr B, API 5L X42 or API 5L X52. Welding shall use matching filler metal requirements as listed in AWS D1.1 Table 3.1. Shop and field joints shall be welded in accordance with AWS D1.1/D1.1M. Welding shall be performed by AWS D1.1 qualified personnel. Casing shall have a specified minimum yield strength, SMYS, of at least 35,000 psi.

- Steel Casing Wall Thickness: The minimum wall thickness for steel casing for a 8" pipe shall be 0.322".

Steel Casing Diameter for Open Cut Installations:

The steel casing for pressurized carrier pipes shall be the size indicated on the plans.

Dewatering:

Any water encountered during the operation shall be disposed of by the Contractor in a manner that will not damage public or private property or create a nuisance or health problem. The cost of furnishing pumps, pipes and equipment for dewatering shall be considered incidental to the work and no additional payment shall be made.

Carrier Pipe Placement:

No segment of carrier pipe shall be deflected, either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling.

If adjustment of the position of a length of pipe is required after it has been laid, it shall be removed and rejoined as for a new pipe. The Contractor shall be responsible to obtain the required line and grade for the carrier pipe, the carrier pipe shall not contact or rest on the casing.

The carrier pipe shall be placed using casing spacers, wood skids or steel pipes for rails. Casing spacers shall be installed 3 per joint minimum with 8-foot maximum spacing. The annular space between the casing and carrier line shall be left empty

unless otherwise directed. When the annular space is to be filled, 3/8 inch pea gravel shall be used.

Bulkheads consisting of brick and mortar or concrete shall be constructed on the ends of the casing; bulkheads shall be a minimum of 8-inches thick. Alternative casing end closures may be substituted for brick and mortar or concrete bulkheads if approved by the Engineer.

Appendix C

Arizona Department of Water Resources (ADWR) Well Abandonment Handbook

SECURING ARIZONA'S WATER FUTURE

ADWR

ARIZONA DEPARTMENT OF WATER RESOURCES

WELL ABANDONMENT HANDBOOK

SEPTEMBER 2008

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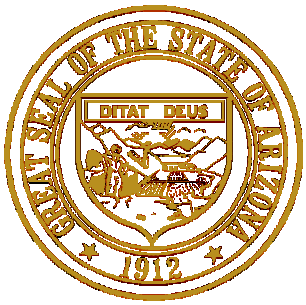

WELL ABANDONMENT HANDBOOK

September 2008

Janet Napolitano, Governor
State of Arizona

Herbert R. Guenther, Director
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September 25, 2008

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SUBSTANTIVE POLICY STATEMENT WELL ABANDONMENT HANDBOOK

I. BACKGROUND

The Arizona Department of Water Resources ("Department") is required by Arizona Revised Statute (A.R.S.) § 45-594(A) to adopt rules establishing construction standards for wells, including the abandonment of existing wells. The Department adopted such rules effective March 5, 1984, and amended the rules effective June 18, 1990. The well abandonment rule is set forth in Arizona Administrative Code ("A.A.C.") R12-15-816.

Pursuant to A.A.C. R12-15-816(G), the Department's well abandonment rule requires that the abandonment of a well be accomplished "through filling or sealing the well so as to prevent the well, including the annular space outside the casing, from being a channel allowing the vertical movement of water." Although the rule specifies the materials that must be used to fill or seal the well if it penetrates a single or multiple aquifer, the rule does not specify the materials that should be used if the well does not penetrate an aquifer or if groundwater or vadose zone contamination exists at or near the well site. Additionally, the rule does not prescribe a method for emplacing fill or seal materials in a well to ensure that water does not move vertically through the well after abandonment.

The Director has determined that the Department should provide additional written guidance to the public on well abandonment. The purpose of the written guidance is not to change any of the requirements in the Department's well abandonment rule or to impose any additional requirements. Instead the written guidance is intended to assist well owners and well drillers in complying with A.A.C. R12-15-816(G) by informing them of fill materials and emplacement methods the Department considers to be adequate to seal a well in a manner that will prevent the well from being a channel allowing the vertical movement of water under various aquifer and vadose zone conditions. By following the written guidance, a person will be assured of complying with A.A.C. R12-15-816(G).

II. WELL ABANDONMENT THAT CONFORMS WITH THE APPLICABLE PROCEDURES IN THE ATTACHED WELL ABANDONMENT HANDBOOK WILL BE DEEMED TO BE IN COMPLIANCE WITH A.A.C. R12-15-816(G)

To assist well owners and well drillers in complying with A.A.C. R12-15-816, the Director issues the attached Well Abandonment Handbook as a substantive policy statement. The Handbook sets forth procedures for abandoning a well under most aquifer and vadose zone conditions, including special conditions not addressed in the Department's well abandonment rule. A person who abandons a well in conformance with the applicable procedures outlined in the Handbook will be deemed to be in compliance with A.A.C. R12-15-816(G).

III. EFFECTIVE DATE

This substantive policy statement rescinds and replaces the previous substantive policy statement dated September 20, 2001, and shall become effective immediately. The Director may modify or revoke this policy at any time.

Dated this 3rd day of October, 2008.

Herbert R. Guenther
Director
Arizona Department of Water Resources

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I. Introduction

The Arizona Department of Water Resources ("ADWR") regulates the abandonment of wells in Arizona. ADWR adopted a rule setting forth requirements for well abandonment in 1984 and amended the rule in 1990. The amended rule is published in the Arizona Administrative Code ("A.A.C.") as Rule R12-15-816. A copy of the rule is attached to this Handbook as Appendix A.

ADWR's well abandonment rule requires that well abandonment be accomplished "through filling or sealing the well so as to prevent the well, including the annular space outside the casing, from being a channel allowing the vertical movement of water." A.A.C. R12-15-816(G). The rule prescribes the fill materials that must be used in certain aquifer conditions. A.A.C. R12-15-816(H). The rule also requires the filing of a pre-abandonment notice with ADWR (unless the well is a new well being abandoned in the course of drilling the well) and the filing of post-abandonment reports. A.A.C. R12-15-816(B), (E) and (F).

The purpose of this Handbook is to provide a step-by-step guide to the abandonment of a well in a manner that complies with ADWR's well abandonment rule. The Handbook describes the abandonment process from the filing of a Notice of Intention to Abandon with ADWR prior to commencing abandonment, to the filing of post-abandonment reports by the well owner and well driller. Most importantly, the Handbook describes procedures that may be used to adequately abandon a well, including fill materials and emplacement methods.

A standard abandonment method is described that may be used for any well, regardless of the aquifer and vadose zone conditions applicable to the well. Five alternative abandonment methods are also described for five different vadose zone and aquifer conditions. In most cases, the alternative abandonment method will be less expensive than the standard method. However, a well owner may need to demonstrate to ADWR that the well to be abandoned falls within the condition to which the alternative method applies before that method may be used. For that reason, the abandonment process may take longer if an alternative abandonment method is requested.

The well abandonment methods described in this Handbook are presented in much greater detail than in ADWR's well abandonment rule. However, the Handbook is not intended to change any of the requirements in the rule or to impose any additional requirements. The purpose of including the abandonment methods in the Handbook is to assist well owners and well drillers in complying with A.A.C. R12-15-816(G) by informing them of fill materials and emplacement methods ADWR considers to be adequate to seal a well in a manner that will prevent the well from being a channel allowing the vertical movement of water. A person who abandons a well in accordance with the applicable well abandonment method described in this Handbook will be assured of complying with A.A.C. R12-15-816(G).

The next section presents an overview of the abandonment process. Section III describes surface seal requirements for the upper 20 feet of all wells and special requirements for debris-filled or obstructed wells. Section IV describes the standard abandonment method and the five alternative methods. Appendix B contains definitions of terms used in this Handbook and Appendix C contains questions and answers regarding this Handbook.

II. Overview of the Well Abandonment Process

Legal authorization from the ADWR is required to abandon most types of wells in the State of Arizona. The types of wells for which abandonment authority from ADWR is required are described in the question and answer section of this Handbook (Appendix C).

The process that must be followed to obtain well abandonment authority starts with the filing of a notice of intention to abandon a well (NOIA) (see Figure 1). NOIA forms may be obtained from the ADWR Groundwater Management Support Section office in Phoenix, or at local ADWR offices located in Prescott, Casa Grande, Tucson and Nogales. The NOIA form must be signed and filed by the well owner. However, the licensed well driller or a consultant may assist the well owner in filling out and filing the NOIA.

Information that must be submitted in the NOIA form includes the following:

- A well construction diagram showing all existing well construction features and the proposed abandonment specifications.
- A description of the type and condition of the casing. Although this information may not be completely known prior to abandonment, this description should be a "best estimate" of the conditions.
- A description of the proposed method of abandonment. The casing removal techniques (such as pulling by hydraulic jacks, overdrilling, etc.), or casing non-removal techniques (such as casing perforations, brushing, sonar jetting, etc.) must be described. If the casing is to be perforated, the perforation method, size, and intervals to be perforated must be described.
- A description of the method of emplacing the sealing or fill materials (such as "tremie pumped" or "pressure grouting", etc.).
- The specific type and estimated amount of grout material to be used, and the ratios of water, cement, and/or other grout materials.

If the well owner or well driller has any questions during the abandonment planning stages prior to submittal of the NOIA, it is recommended that they contact the ADWR Hydrology Division. ADWR will gladly work with the well owner or well driller to answer any questions and conduct a preliminary review of the proposed abandonment plan. ADWR may be contacted at:

602-771-8500
(Phoenix metro area)

1-800-352-8488
(outside metro Phoenix)

After the NOIA is filed, ADWR performs a completeness review of the notice (See Figure 1). The completeness review entails the examination of the NOIA to determine if all required information has been properly submitted. After the ADWR determines that the NOIA is complete, a substantive review is performed to determine whether the proposed abandonment methods and materials meet the requirements of the ADWR well abandonment rule (See Figure 1). If the standard method of abandonment described on page 5 of this Handbook is selected, which may be used for any well regardless of the aquifer and vadose zone conditions applicable to the well, the NOIA will be approved without further review.

If an alternative abandonment method is selected, the NOIA will receive additional substantive review to determine whether the

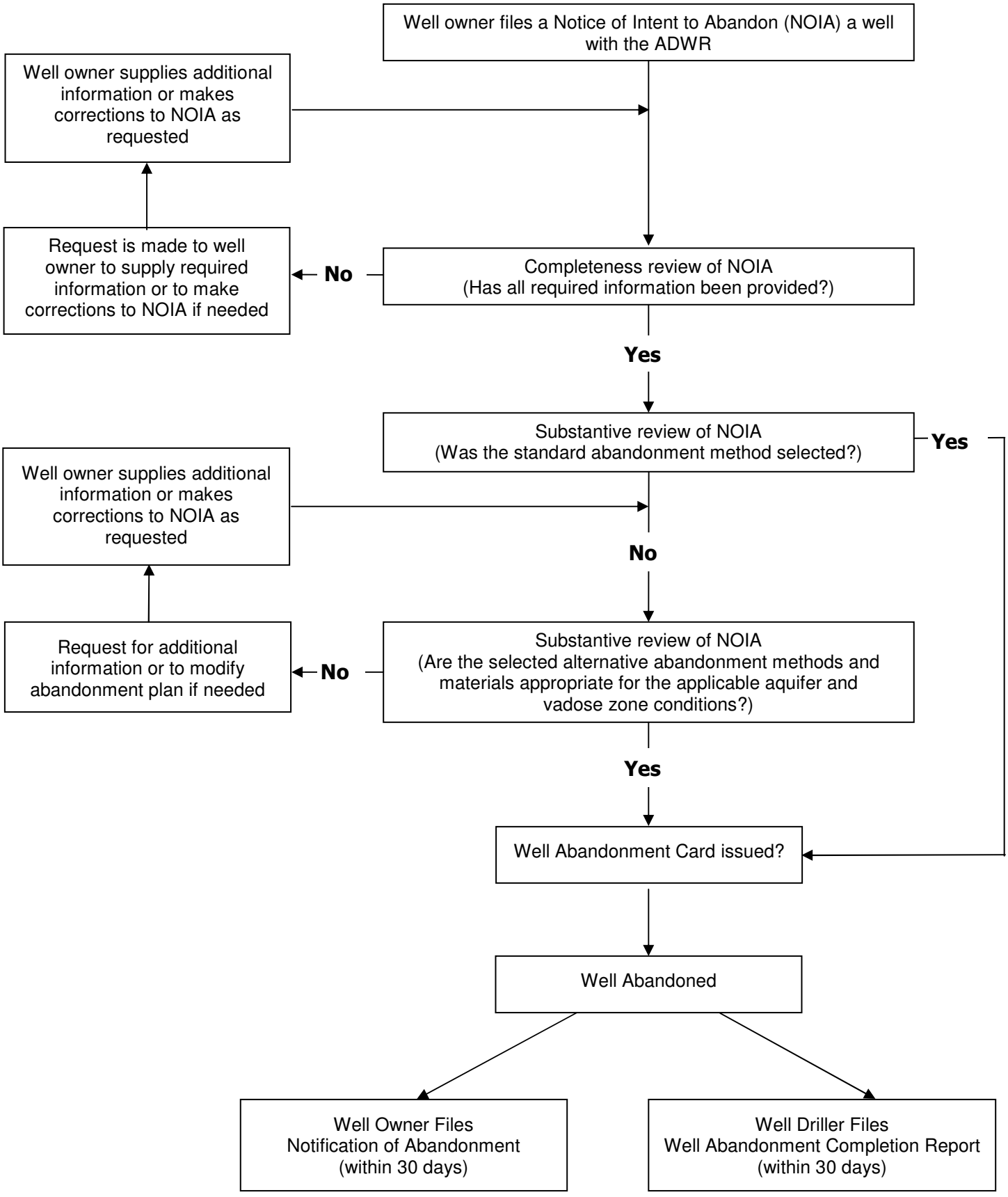
well falls within the condition to which the alternative method applies and whether appropriate fill materials were chosen. During the review process ADWR may contact the well owner to request additional information or discuss modifications to the proposed abandonment plan, if necessary.

Once the proposed well abandonment methods and materials meet the requirements of the abandonment rule, a well abandonment authorization card is mailed to the designated well driller and well abandonment operations may begin (See Figure 1).

Within 30 days after a well is abandoned, the well owner is required to file a Well Owner's Notification of Abandonment; and the well drilling contractor is required to file a Well Abandonment Completion Report with ADWR which describes the actual methods and materials used to abandon the well (See Figure 1). Information that must be submitted in the Well Abandonment Completion Report includes the following:

- The specific type and amount of grout and/or fill materials used as well as the mixing ratio of water, cement and/or other grout materials used.
- A description of the type and condition of the casing.
- A description of the actual method of abandonment. The casing removal techniques (such as pulling by hydraulic jacks, overdrilling, etc.), or casing non-removal techniques (such as casing perforations, brushing, sonar jetting, etc.) must be described. If the casing was perforated, the perforation method, size, and intervals must be described.
- A description of the method of emplacing the sealing or fill materials (such as "tremie pumped" or "pressure grouting", etc.).
- The latitude, longitude and well elevation of the abandoned well, and the method used to determine these data. Latitude and longitude coordinates determined from readily available Global Positioning System (GPS) equipment are preferred because of the high level of accuracy and comparative ease of measurement. If GPS equipment is used to determine these coordinates, the general grade of equipment should be specified (for example: survey grade or hand-held). Latitude, longitude and well elevation coordinates may also be obtained from conventional surveying methods or through estimation from a topographic map.

Figure 1
Well Abandonment Process



III. Surface Seal Requirements Applicable to the Upper 20 Feet of All Wells to be Abandoned and Special Requirements for Debris-Filled or Obstructed Wells

In addition to the well sealing and abandonment methods and materials that are discussed in the following section, ADWR's well abandonment rule requires a cement grout surface seal (plug) to be installed in the upper 20 feet of any well that is abandoned. Special requirements may also be necessary if casing obstructions and/or debris hamper the abandonment of a well. These requirements are described below:

A. Surface Seal Requirements

Surface Casing Removal Option

If the casing is removed from the top 20 feet of the well, a cement grout plug must be set extending from two feet below the land surface to a minimum of twenty feet below the land surface, and the well must be backfilled above the top of the cement grout plug to the original land surface.

Surface Casing Non-Removal Option

If the casing is not removed from the top 20 feet of the well, a cement grout plug must be set extending from the top of the casing to a minimum of twenty feet below the land surface, and the annular space outside the casing must be filled with cement from the land surface to a minimum of twenty feet below the land surface.

B. Special Requirements for Debris Filled or Obstructed Wells

In situations where casing obstructions and/or debris hamper well abandonment, the problems should be indicated on the NOIA form. In most instances a reasonable attempt to clear debris and obstructions from the well will be required. However, site-specific conditions will determine the actual method of abandonment.

IV. Abandonment Methods

A. Standard Abandonment Method

The ADWR standard abandonment method meets the requirements of ADWR's well abandonment rule under any given combination of aquifer and vadose zone conditions. The standard abandonment method may be followed to obtain expedited processing of an NOIA and issuance of a well abandonment authority.

Under the standard abandonment method, the entire length of well casing must be removed or the entire length of the casing must be reperforated (from 20 feet above the highest historic water level to the total depth of the well) with a minimum of two cuts per foot. If it is determined that the disturbance of the casing and/or gravel packed zones would negatively influence the sealing of the well, then an appropriate alternative abandonment method must be used (see Figure 2 for examples).

The well must be completely filled with neat cement, cement-bentonite grout or, except where free-product contamination is present, high-solids bentonite grout (granular or powder mixtures) with a minimum of 25% solids by weight. Materials or mixtures must be emplaced under sufficient pressure to fill all voids, including all annular space(s), and displace water from the well. A tremie pipe must be used to emplace the grout from the bottom up. The end of the tremie pipe must remain in close proximity to the rising grout surface, as the grout is pumped into the well.

In order to receive expedited processing, the NOIA should be filled out completely, and the "Standard method" should be selected in the proposed well abandonment method section of the NOIA form. The specific type

and estimated volume of grout material should be specified on the NOIA form. Any discrepancies between the estimated volume of grout to be used, and the actual amount of grout that was used for abandonment should be reported and explained on the Well Abandonment Completion Report.

B. Alternative Abandonment Methods

There are five alternatives to the standard abandonment method described above. Each alternative method is designed for a different vadose zone or aquifer condition, and only one alternative method is appropriate for a specific well. The conditions described at the beginning of each alternative and the depictions in Figure 2 should be carefully reviewed to determine the appropriate alternative method if the standard abandonment method is not selected. If an alternative method is selected, the method must be identified by number in the NOIA and the well owner may be required to submit information demonstrating that the applicable vadose zone or aquifer conditions exist for the well.

Alternative 1 – *Applies to wells that do not penetrate aquifers, including wells that have gone dry, and no vadose zone contamination issues exist.*

If the well does not penetrate an aquifer or has gone dry, and vadose zone contamination issues do not exist, the well must be filled with one or more of the following materials or mixtures: clean fine sand, cement grout (including neat cement grout, cement-bentonite grout and sand-cement grout), concrete grout, sand-bentonite grout, high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, high-solids bentonite chips or high-solids bentonite pellets. See Table 1 for mixing ratios. High-solids bentonite chips and high-solids bentonite pellets must be hydrated to manufacturer's specifications. The materials or mixtures are recommended to exceed the casing volume by approximately 30 percent.

In the course of drilling a new well, the well may be abandoned using drill cuttings from the well being drilled if the well does not penetrate an aquifer, and no vadose zone contamination issues exist.

Alternative 2 – *Applies to wells that do not penetrate aquifers, including wells that have gone dry, and vadose zone contamination issues exist.*

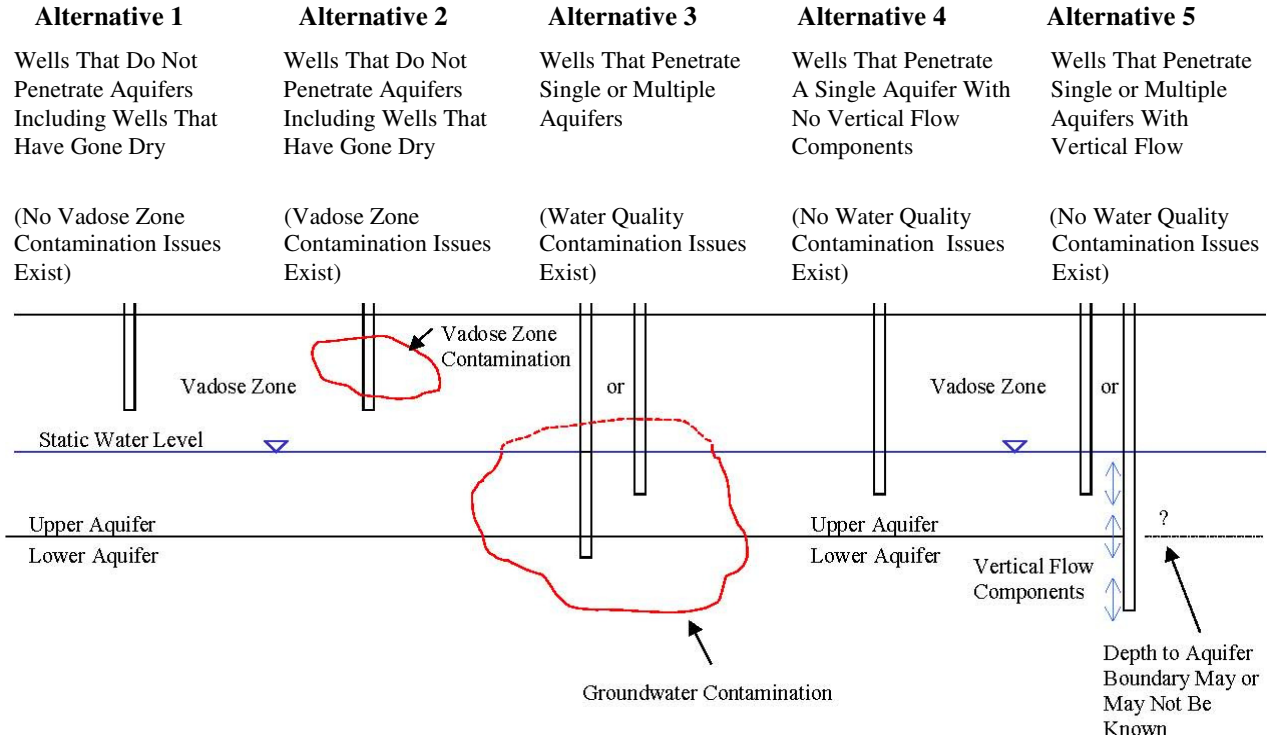
If the well does not penetrate an aquifer or has gone dry, and vadose zone contamination issues exist, but there is no free-product contamination, the well must be filled with one or more of the following materials or mixtures: cement grout (including neat cement grout, cement-bentonite grout and sand-cement grout), concrete grout, sand-bentonite grout, high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, high-solids bentonite chips or high-solids bentonite pellets. See Table 1 for mixing ratios. High-solids bentonite chips and high-solids bentonite pellets must be hydrated to manufacturer's specifications. The materials or mixtures are recommended to exceed the casing volume by approximately 30 percent.

If free-product contamination issues exist, the entire well must be sealed with neat cement grout.

Alternative 3 – *Applies to wells that penetrate single or multiple aquifers, and water quality contamination issues exist.*

If the well penetrates a single or multiple aquifer system and water quality contamination issues exist, then site-specific conditions will determine the appropriate seal material and emplacement method. The seal material must be no more permeable than the formation being sealed. A target

Figure 2
Alternative Abandonment Methods Applicable to Five Commonly Occurring Vadose Zone and Aquifer Conditions



hydraulic conductivity of 10^{-7} cm/s may be used for sealant materials. The types of acceptable materials or mixtures are: cement grout (including neat cement grout and cement bentonite grout), high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, high-solids bentonite chips or high-solids bentonite pellets. See Table 1 for mixing ratios. A minimum of 15% bentonite solids will be acceptable in most cases. However, a higher minimum of bentonite solids may be required in areas of high water quality contamination. Acid resistant cement (see definitions) may be required in certain areas where corrosive (low pH) groundwater conditions are encountered. The materials or mixtures are recommended to exceed the casing volume by approximately 30 percent.

If there is no free-product contamination at the well site, the vadose zone portion of the well may be sealed with the same material that is used to seal the well below the water level. High-solids bentonite chips and high-solids bentonite pellets must be hydrated to manufacturer's specifications if used in the vadose zone. If free-product contamination issues exist, the vadose zone portion of the well must be sealed with neat cement grout.

Materials or mixtures must be emplaced under sufficient pressure to fill all voids, including all annular space(s), and displace water from the well. A tremie pipe must be used to emplace the grout from the bottom up. The end of the tremie pipe shall remain in close proximity to the rising grout surface as the grout is pumped into the well.

Except as provided below for recently constructed monitor wells, if the casing is not removed, either the entire length of the casing must be reperforated (from 20 feet

above the highest historic water level to the total depth of the well), or the condition of the casing perforations must be determined by running a video log that must be submitted to the ADWR for review. If a video log demonstrates that the existing perforations are sufficiently open for grout to enter the annular space outside the casing, no additional perforations or casing treatments will be required. If the video log demonstrates that the existing perforations are not sufficiently open for grout to enter the annular space outside the casing, additional perforations and/or casing treatments such as mechanical brushing, scraping or sonic cleaning will be required, unless it is determined that disturbance of the casing and/or gravel packed zones would negatively influence the sealing of the well. Casing perforation and/or casing cleaning requirements for wells with water quality contamination issues will be made by ADWR on a case-by-case basis.

Wells requiring additional perforations must be perforated a minimum of two cuts per foot and sealed by pressure grouting. The intervals to be perforated must be determined based on site-specific information. However, if no vadose zone contamination issues exist, the perforations need only extend 20 feet above the static water level in the well.

Video logging and/or casing re-perforation may not be required in the case of the abandonment of recently constructed monitor wells. However, that determination must be made by ADWR on a case-by-case basis.

Alternative 4 – *Applies to wells that penetrate a single aquifer only without vertical flow components, and no water quality contamination issues exist.*

If the well penetrates an aquifer and hydrogeologic and stratigraphic information is available for the well at an acceptable level of confidence to determine that no aquifer boundaries and no vertical flow components exist within the length of the well, and if water quality contamination issues do not exist, the well must be filled with one or more of the following materials or mixtures: cement grout (including neat cement grout, cement-bentonite grout and sand-cement grout), concrete, high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, high-solids bentonite chips, high-solids bentonite pellets, and sand-bentonite grout. See Table 1 for mixing ratios.

In the course of drilling a new well, the well may be abandoned using drill cuttings from the well being drilled if the well does not penetrate an aquifer, and no vadose zone contamination issues exist.

The vadose zone portion of these types of wells may be filled with any of the mixtures or materials described above or allowed in Alternative 1. High-solids bentonite chips and high-solids bentonite pellets must be hydrated to manufacturer's specifications if used in the vadose zone. The materials or mixtures are recommended to exceed the casing volume by approximately 30 percent.

Materials or mixtures must be emplaced under sufficient pressure to fill all voids, including all annular space(s), and displace water from the well. A tremie pipe must be used to emplace the grout from the bottom up. The end of the tremie pipe shall remain in close proximity to the rising grout surface as the grout is pumped into the well.

Alternative 4 (Variance Option)

A variance option is available to abandon wells that are 8 inches or greater in diameter and that fall under Alternative 4 aquifer conditions. Alternative 4 (Variance Option) allows the use of clean fine sand to fill the well.

Please note that anyone wishing to use this alternative abandonment method must first apply to ADWR for a variance from the well abandonment rule.

Alternative 5 – *Applies to wells that penetrate single or multiple aquifers with vertical flow components, and no water quality contamination issues exist.*

If the well penetrates a single or multiple aquifer system with vertical flow components, and if water quality contamination issues do not exist, the well must be sealed to prevent the vertical migration of fluids with cement grout (including neat cement grout, cement-bentonite grout and sand-cement grout), high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, high-solids bentonite chips or high-solids bentonite pellets of sufficient volume, density, and viscosity to prevent fluid communication between aquifers. See Table 1 for mixing ratios.

The vadose zone portion of this type of well may be filled with any of the mixtures or materials described above or allowed in Alternative 1. High-solids bentonite chips and high-solids bentonite pellets must be hydrated to manufacturer's specifications if used in the vadose zone. The materials or mixtures are recommended to exceed the casing volume by approximately 30 percent.

Materials or mixtures must be emplaced under sufficient pressure to fill all voids, including all annular space(s), and displace water from the well. A tremie pipe must be used to emplace the grout from the bottom up. The end of the tremie pipe shall remain in close proximity to the rising grout surface as the grout is pumped into the well.

If the casing is not removed, it is recommended, but not required, that the condition of the casing perforations be determined by running a video log. If the video log demonstrates that the existing perforations are sufficiently open for grout to enter the annular space between the casing and the well bore, no additional perforations or casing treatments are necessary. If the video log demonstrates that the existing perforations are not sufficiently open for grout to enter the annular space outside the casing, additional perforations and/or casing treatments such as mechanical brushing, scraping or sonic cleaning are recommended, unless it is determined that disturbance of the casing and/or gravel packed zones would negatively influence the sealing of the well. A well requiring additional perforations should be perforated a minimum of two cuts per foot and sealed by pressure grouting.

Alternative 5 (Variance Option 1)

Alternative 5 (Variance Option 1) is available to abandon wells that are 8 inches or greater in diameter and that fall under Alternative 5 aquifer conditions. Alternative 5 (Variance option 1) allows the use of alternating layers of 50 feet of clean, fine sand and 10 feet of one of the approved Alternative 5 materials or mixtures mentioned above.

Please note that anyone wishing to use this alternative abandonment method must first apply to ADWR for a variance from ADWR's well abandonment rule.

Alternative 5 (Variance Option 2)

Alternative 5 (Variance Option 2) is available to abandon wells that are 8 inches or greater in diameter and that fall under Alternative 5 aquifer conditions. Alternative 5 (Variance Option 2) allows the installation of seals at aquifer boundaries if boundaries exist and if hydrogeologic and stratigraphic information is available for the well at an acceptable level of confidence to determine the depth(s) of aquifer boundaries. Aquifer boundary seals must be composed of one of the approved Alternative 5 materials or mixtures mentioned above.

Aquifer boundary seals must extend at least 50 feet above and 50 feet below aquifer boundaries to provide a reasonable level of confidence that the boundaries will be sealed. The intervals of the well above and below the seals must be filled with clean, fine sand or one of the approved Alternative 5 materials or mixtures mentioned above.

Please note that anyone wishing to use this alternative abandonment method must first apply to ADWR for a variance from ADWR's well abandonment rule.

Table 1
Acceptable Well Abandonment Materials and Mixtures

Category	Specific Material	Mixing Ratio		Permeability (cm/sec)	Applicable Abandonment Methods	Special Considerations
		Solids	Water			
Cement, Sand, Concrete & Bentonite Mixtures [1]	Neat Cement **or** Neat Cement Grout	One 94 pound sack of cement	Not more than six (6) gallons water	10^{-5} To 10^{-7}	Standard Method and Alts. 1-5	Must be pumped with tremie pipe. Not for use in low pH environments.
	Concrete **or** Concrete Grout	Cement, sand and aggregate with no less than seven (7) 94 lb. sacks of cement per cubic yard of concrete	Not more than seven (7) gallons water per sack of cement	—	Alts. 1,2,4,5	Cannot be used under Alternative 2 if free-product contamination issues exist.
	Sand-Cement Grout	One part cement and no more than one part sand by volume	Not more than six (6) gallons water	$2x10^{-5}$ to $5x10^{-8}$	Alts. 1,2,4,5	Cannot be used under Alternative 2 if free-product contamination issues exist.
	Cement-Bentonite Grout	One sack of cement (94 lb.) & 3-5 lbs. bentonite	Not more than six and one-half (6.5) gallons water	10^{-5} to 10^{-11}	Standard Method and Alts. 1-5	Cannot be used under Alternative 2 if free-product contamination issues exist. Also cannot be used in vadose zone portion of an Alternative 3 well if free-product contamination issues exist.
	Sand-Bentonite Grout	Equal parts sand and bentonite by volume	Slightly more than one (1) gallon water per pound of sand	—	Alts. 1,2,4	May be difficult to pump; the sand may be dumped into place while the bentonite slurry is pumped via tremie pipe. Cannot be used under Alternative 2 if free-product contamination issues exist.
	Acid Resistant Cement (Pozzolanic Cement)	One sack of cement (94 lb.) and seventy-four (74) lbs. pozzolans (fly-ash, perlites, etc.) 2% to 6% of bentonite by weight is needed if perlites are used	Not more than ten (10) gallons of water per sack of cement	—	See special considerations	Typically used in areas where low pH groundwater is encountered. If perlites are used bentonite is needed to keep perlites from floating. Chemical admixtures and plastizers may be used to reduce viscosity.
Well Cuttings	Clean cuttings from the well being drilled and abandoned	NA	NA	—	Alts. 1,4	Only permissible for wells that do not penetrate aquifers or wells that only penetrate a single aquifer with no vertical flow components. No vadose zone and no water quality contamination issues may exist.
Forms of Bentonite [1,2]	High-Solids Bentonite Grout (powder or granular mixture) with a minimum 15% solids by weight Minimum grout density = 9.2 lbs./gallon	Fifty (50) lbs. dry bentonite powder (powder mixture) **or** One hundred fifty (150) lbs. granular bentonite & 1 qt. Polymer (granular mixture)	Thirty–four (34) gallons (powder mixture) **or** One hundred (100) gallons (granular mixture)	10^{-7} to 10^{-8}	Alts. 1-5	A minimum of 15% solids bentonite will be acceptable in most cases. However, a higher minimum of bentonite solids may be required in areas of high water quality contamination. Cannot be used under Alternative 2 if free-product contamination issues exist. Also cannot be used in vadose zone portion of an Alternative 3 well if free-product contamination issues exist. Granular mixtures generally require the addition of polymers.
	High-Solids Bentonite Grout (powder or granular mixture) with a minimum 25% solids by weight Minimum grout density = 10.0 lbs./gallon	Fifty (50) lbs. dry bentonite powder (powder mixture) **or** One hundred fifty (150) lbs. granular bentonite & 1 qt. Polymer (granular mixture)	Eighteen (18) gallons (powder mixture) **or** Fifty-four (54) gallons (granular mixture)	10^{-8} to 10^{-9}	Standard Method	Cannot be used if free-product contamination issues exist. Granular mixtures generally require the addition of polymers.
	High-Solids Bentonite Chips and Pellets	NA	NA	—	Alts. 1-5	Rate of pour should not exceed 50 lbs. / 5 minutes. Must be hydrated to manufacturer's specifications if used in vadose zone. Cannot be used under Alternative 2 if free-product contamination issues exist. Also cannot be used in vadose zone portion of an Alternative 3 well if free-product contamination issues exist.

Notes: 1) Additives will be considered on a case by case basis (i.e., fly ash, CaCl, etc.).
2) Manufacturer's specifications should be followed to achieve a minimum 15% and 25% solids mixtures–mixing ratios listed in this table are approximate.

References

1. Alsay-Pippin Corporation, 1980, Handbook of Industrial Drilling Procedures and Techniques, 40 pp.

2. American Water Works Association, 1998, AWWA Standard for Water Wells, ANSI/AWWA A100-97, 73 pp.

3. Arizona Department of Water Resources, 2001, Statutes and Rules Governing Minimum Well Construction Standards and the Licensing of Well Drillers, 32 pp.

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APPENDIX A – A.A.C. R12-15-816, The ADWR Well Abandonment Rule

R12-15-816. Abandonment

A. Well abandonment shall be performed only by a licensed well drilling contractor or single well licensee.

B. Except as provided in subsection (F) of this Section, the owner of a well shall file a notice of intent to abandon the well prior to abandonment, on a form prescribed and furnished by the Director, which shall include:

1. The name and mailing address of the person filing the notice.

2. The legal description of the land upon which the proposed well to be abandoned is located and the name and mailing address of the owner of the land.

3. The legal description of the location of the well on the land.

4. The depth, diameter and type of casing of the well.

5. The well registration number.

6. The materials and methods to be used to abandon the well.

7. When abandonment is to begin.

8. The name and well drilling license of the well drilling contractor or single well licensee who is to abandon the well.

9. The reason for abandonment.

10. Such other information as the Director may require.

C. The Director shall, upon receipt of a proper notice of intent to abandon, mail a well abandonment authorization card to the designated well drilling contractor or single well licensee.

D. Except as described in subsection (F) of this section, a well drilling contractor or a single well licensee may commence abandoning a well only if the driller has possession of an abandonment card at the well site, issued by the Director in the name of the driller, authorizing the abandonment of that specific well or wells in that specific location.

E. Within 30 days after a well is abandoned pursuant to this Section, the well drilling contractor or single well licensee shall file with the Director a Well Abandonment Completion Report on a form prescribed and furnished by the Director which shall include the date the abandonment of the well was completed and such other information as the Director may require.

F. In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card. If the well is abandoned pursuant to this subsection without first filing a notice of intent to abandon and without an abandonment card, the well drilling contractor or single well licensee shall provide the following information in the Well Abandonment Completion Report:

1. The legal description of the land upon which the well was abandoned and the name and the mailing address of the owner of the land.

2. The legal description of the location of the well on the land.

3. The depth, diameter and type of casing prior to abandonment.

4. The well registration number.

5. The materials and methods used to abandon the well.

6. The name and well drilling license number of the well drilling contractor or single well licensee who abandoned the well.

7. The date of completion of the abandonment of the well.

8. The reason for abandonment.

9. Such other information as the Director may require.

G. The abandonment of a well shall be accomplished through filing or sealing the well so as to prevent the well, including the annular space outside the casing, from being a channel allowing the vertical movement of water.

H. A well not penetrating an aquifer shall include a surface seal which shall be accomplished as follows:

1. If the casing is removed from the top 20 feet of the well, a cement grout plug shall be set extending from two feet below the land surface to a minimum of twenty feet below the land surface, and the well shall be backfilled above the top of the cement grout plug to the original land surface.

2. If the casing is not removed from the top ten feet of the well, a cement grout plug shall be set extending from the top of the casing to a minimum of twenty feet below the land surface, and the annular space outside the casing shall be filled with cement from the land surface to a minimum of twenty feet below the land surface.

I. In addition to the surface seal required in subsection (H):

1. A well penetrating a single aquifer system shall be filled with cement grout, concrete, bentonite drilling muds, clean sand with bentonite, or cuttings from the well.

2. A well penetrating a single or multiple aquifer system with vertical flow components shall be sealed with cement grout or a column of bentonite drilling mud of sufficient volume, density, and viscosity to prevent fluid communication between aquifers.

J. Materials containing organic or toxic matter shall not be used in the abandonment of a well.

K. The owner or operator of the well shall notify the Director in writing no later than 30 days after abandonment has been completed. The notification shall include the well owner's name, the location of the well, and the method of abandonment.

APPENDIX B – Definitions

For the purposes of this Handbook, the following terms have the following meanings:

Acid Resistant Cement (also known as Pozzolanic cement) (generic mixture): means a cement mixture that has improved resistance to corrosive fluids. Acid resistant cement is developed by adding silicious materials, pozzolans, to Portland cement. Pozzolans from both natural materials of volcanic origin such as perlites (volcanic ashes), heat treated clays, shales, tuffs, opaline cherts and diatomaceous earth, and artificial materials consisting of by-products from glass factories, furnace slag, and fly ash may be used. A common mixing ratio is 74 pounds of pozzolans per 94 pound sack of cement and not more than ten (10) gallons of water per sack of cement. If perlites are used, 2 to 6 percent of bentonite by weight is needed to keep the perlite from floating. Acid resistant cement is typically recommended for well abandonment material in areas where low pH groundwater is encountered (such as near some mine sites).

Aggregate (generic mixture): means sand or gravel with particle size up to ¼ inch.

Annular Space: "means the space between the outer well casing and the borehole wall. An annular space also means the space between an inner well casing and an outer well casing." **A.A.C. R12-15-801(1)**

Aquifer: "means an underground formation capable of yielding or transmitting usable quantities of water." **A.A.C. R12-15-801(2)**

Aquifer Boundary: means a vertical change in aquifer properties indicated by a difference in hydraulic conductivity between aquifer layers that is at least greater than two orders of magnitude (100 times greater).

Bentonite "means a colloidal clay composed mainly of sodium montmorillonite, a hydrated aluminum silicate." **A.A.C. R12-15-801(5)**

Cement Grout or Grout: "means cement mixed with no more than 50 percent sand by volume, and containing no more than six gallons of water per 94 pound sack of cement." **A.A.C. R12-15-801(15)**

Cement grout is sometimes referred to as "sand-cement grout", when sand is in the mixture.

Grout is often used as a synonym for slurry which is a generic term that means a thin mixture of liquid, commonly water, and any of several finely divided substances such as cement or clay particles.

Cement-Bentonite Grout (generic mixture): means a mixture of cement, bentonite and water at a ratio of 6.5 gallons of water per each 94 pound sack of cement with not more than 3 to 5 pounds of bentonite per sack of cement.

Concrete or Concrete Grout (generic mixture): means a mixture of cement, sand, coarse aggregate and water, with not less than seven (7) 94 pound sacks of cement per cubic yard of mixture and not more than seven (7) gallons of water per sack of cement.

Exploration Well: "means a well drilled in search of geophysical, mineralogical, or geotechnical data". **A.A.C. R12-15-801(13)**

Free-Product Contamination: means any known hazardous substance that is essentially immiscible (non-soluble) in water. Some typical examples of free-product contamination are gasoline and carbon tetrachloride.

Hazardous Substance: has the same meaning prescribed by A.R.S. § 49-201.

High-Solids Bentonite Grout (granular or powder mixture) with a minimum of 15% solids by weight: means a mixture of granular bentonite or powder bentonite that yields a grout that has a minimum 15% bentonite solids by weight.

High-solids bentonite grout with a minimum of 15% solids by weight can be prepared from a mixture of granular bentonite (nominal 8 to 20-mesh particle size), water and polymer at a ratio of one hundred-fifty (150) pounds of granular bentonite and one hundred (100) gallons of water premixed with one (1) quart of polymer.

High-solids bentonite grout with a minimum of 15% solids by weight can also be prepared from a mixture of bentonite powder (nominal 200-mesh particle size) and water at a ratio of fifty (50) pounds of dry bentonite powder and thirty-four (34) gallons of water.

High-Solids Bentonite Grout (granular or powder mixture) with a minimum of 25% solids by weight: means a mixture of granular bentonite or powder bentonite that yields a grout that has a minimum 25% bentonite solids by weight.

High-solids bentonite grout with a minimum of 25% solids by weight can be prepared from a mixture of granular bentonite (nominal 8 to 20-mesh particle size), water and polymer at a ratio of one hundred-fifty (150) pounds of granular bentonite and fifty-four (54) gallons of water premixed with one (1) quart of polymer.

High-solids bentonite grout with a minimum of 25% solids by weight can also be prepared from a mixture of bentonite powder (nominal 200-mesh particle size) and water at a ratio of fifty (50) pounds of dry bentonite powder and eighteen (18) gallons of water.

High-Solids Bentonite Chips: means chips of coarse bentonite ranging in size from 0.25 to 0.75 inch.

High-Solids Bentonite Pellets: means pellets of fine compressed bentonite (200-mesh) ranging in size from 0.25 to 0.50 inch.

Neat Cement or Neat Cement Grout (generic mixture): means a mixture of one (1) 94 pound sack of cement with not more than six (6) gallons of clean water.

Pressure Grouting "means a process by which a grout is confined within the borehole or casing of a well by the use of retaining plugs, packers, or a displacing fluid by which sufficient pressure is applied to drive the grout into and within the annular space or interval to be grouted." **A.A.C. R12-15-801(23)**

Sand-Bentonite Grout (generic mixture): means a mixture of equal parts sand and bentonite by volume with slightly more than one (1) gallon of water per pound of sand.

Sand-Cement Grout (generic mixture): means a mixture of one 94 pound sack of Portland cement, sand and water in the proportion of not more than one (1) part by volume of sand to one (1) part of cement with not more than six (6) gallons of water per 94 pound sack of cement.

Sealing: means the conscious effort to construct a positive permanent barrier within a well that restricts or prohibits the vertical movement of groundwater and/or any other fluids or materials.

Vadose Zone Well "means a well constructed in the interval between the land surface and the top of the static water level. **A.A.C. R12-15-801(26)**

Vadose Zone Contamination Issue: means any hazardous substance that is found in the vadose zone at or in the vicinity of the well at concentrations that exceed established state or federal standards.

Water Quality Contamination Issue: means any known hazardous substance that is found in groundwater at or in the vicinity of the well at concentrations that exceed established state or federal standards.

Well: means any man-made opening in the earth through which water may be withdrawn or obtained from beneath the surface of the earth including: 1) all water wells, monitor wells and piezometer wells; 2) geothermal wells for which the rules of the Arizona Oil and Gas Commission do not require the reinjection of all water associated with the geothermal resource to the producing strata; and 3) all exploration wells and grounding or cathodic protection holes, except those that are less than 100 feet in depth and do not encounter groundwater.

The question and answer section of this Handbook contains additional information concerning the types of wells that are subject to ADWR's well abandonment rule.

Well Abandonment "means the modification of the structure of a well by filling or sealing the borehole so that water may not be withdrawn or obtained from the well." **A.A.C. R12-15-801(28)**

APPENDIX C – Questions and Answers about the Abandonment Handbook

Why was it necessary to provide a separate well abandonment Handbook when there is an existing well abandonment rule?

ADWR has become aware of some misunderstanding among well owners and well drillers concerning the requirements of the well abandonment rule, A.C.C. R12-15-816. This Handbook is intended to provide guidance to well owners and well drillers on what is required by the rule.

In addition, this Handbook describes the procedures and materials that should be used to abandon wells not detailed in the rule. The well abandonment rule requires a person abandoning a well to fill or seal the well in order to prevent the well, including the annular space outside the casing, from being a channel allowing the vertical movement of water. Any well owner or well driller who abandons a well in compliance with this Handbook will be deemed to be in compliance with this requirement.

Q. ***What types of wells are subject to ADWR's well abandonment rule?***

A. The well abandonment rule applies to man-made openings in the earth through which water may be withdrawn or obtained from beneath the surface of the earth, including all water wells, monitor wells and piezometer wells.

The well abandonment rule also applies to geothermal wells for which the rules and regulations of the Arizona Oil and Gas Commission do not require the reinjection of all waters associated with the geothermal resource to the producing strata, as well as exploration wells and grounding or cathodic protection holes greater than 100 feet in depth (regardless of whether they intercept groundwater).

Q. ***What types of openings in the earth are not subject to ADWR's well abandonment rule?***

A. The well abandonment rule does not apply to:

1. man-made openings in the earth not commonly considered to be wells, such as construction and mining blast holes, underground mines and mine shafts, open pit mines, tunnels, septic tank systems, caissons, basements, and natural gas storage cavities;

2. an injection well or vadose zone well that is subject to regulation by the Arizona Department of Environmental Quality (ADEQ), provided that ADEQ has issued a letter or other document asserting explicit regulatory authority over the well;

3. oil, gas, and helium wells drilled pursuant to the provisions of Title 27, Arizona Revised Statutes (wells regulated by the Arizona Oil and Gas Commission); and

4. boreholes in the earth less than 100 feet in depth which are made for purposes other than withdrawing or encountering groundwater (such as exploration wells and grounding or cathodic protection holes less than 100 feet in depth), except that if groundwater is encountered in the drilling of the borehole, the well abandonment rule will apply.

Although the well abandonment rule does not apply to these types of wells and boreholes, it is nevertheless recommended that unused wells or

boreholes that are not regulated under ADWR's well abandonment rule be abandoned in a manner that will protect the aquifer.

Q. ***What is the benefit of abandoning an unused well, as opposed to capping the well (which is also allowed under ADWR's rules)?***

A. Proper well abandonment is favored over well capping for both environmental and safety reasons.

Unused and unabandoned wells constitute actual or potential environmental hazards because they can serve as vertical conduits for hazardous substances to cross-contaminate aquifers. For example, during the last several decades, serious and costly vertical cross-contamination of a multiple aquifer system has occurred through unabandoned conduit wells at the Indian Bend Wash Superfund site in Scottsdale, Arizona. Owners of unused, unabandoned wells should also realize that they may be held legally responsible for secondary contamination if it is demonstrated that their well served as a conduit for vertical cross-contamination of an aquifer system.

Public safety issues also favor well abandonment over well capping. Capped wells are often tampered with, and once the well cap is removed there is a real danger for humans or animals to fall into the well, or for the well to be used for the illegal disposal of hazardous materials.

Q. ***Why is it <u>generally required</u> to run a video log to determine the condition of the casing perforations in areas where water quality contamination exists if the casing is not ripped?***

A. Because significant conduit flow can occur through the annular space outside the casing, it is essential to seal this pathway to prevent potential vertical cross-contamination. Therefore, when water quality contamination issues exist, unless the well casing is removed or the casing is re-perforated over its entire length from 20 feet above the highest historic water level to the total depth of the well, the well owner must run a video log to determine whether the grout material can flow through the casing perforations and seal the annular space outside the casing.

Video logging and/or casing re-perforation may not be required in the case of the abandonment of recently constructed monitor wells. However, that determination must be made on a case-by-case basis.

In areas where water quality contamination issues do not exist, if the casing is not ripped, a video log is <u>recommended</u>, although not required, to determine perforation conditions. It is important to make sure that the well and the annular space outside the casing are properly abandoned even when there are no current water quality contamination issues. This is because the water could become contaminated in the future.

It should also be pointed out that additional benefits can be derived from running a video log. Those benefits may include: the determination of the structural integrity of the well casing, the presence of casing anomalies and obstructions, the presence of perched or cascading water, etc. This information can be very important in developing an effective abandonment design.

Q. ***Under what circumstances is it permissible to use drill cuttings to abandon a well?***

A. In the course of drilling a new well, the well may be abandoned using drill cuttings from the well being drilled only if the well does not penetrate an aquifer or the well penetrates a single aquifer only, with no vertical flow components. Drill cuttings may only be used to abandon the well from which they were originally removed. Drill cuttings may not be used to abandon wells or boreholes that have water quality and/or vadose zone contamination issues.

Q. ***How can it be determined whether vertical flow components exist in an aquifer or aquifer system?***

A. The determination of vertical flow conditions in an aquifer can be a challenging task. However, vertical flow conditions can be assessed by evaluating water level data collected in piezometers or monitor wells that are completed at different depths within an aquifer or aquifer system at the same location. Vertical fluid movement can also be evaluated in non-pumping wells using various geophysical logging techniques such as flowmeter logging, spinner logging or tracer logging. The observation of cascading water or water seeping into a non-pumping well below static level is a clear indication of vertical flow conditions within the well.

Because unit-specific water level data are typically unavailable, and geophysical logging may be impractical or too costly, it is best to assume that most aquifers or aquifer systems have some component of vertical flow, and well abandonment methods and materials should be chosen accordingly.

Q. ***What should I do if I have further questions concerning a well abandonment project?***

A. Contact ADWR Hydrology Division at:

602-771-8500
(Phoenix metro area)

1-800-352-8488
(outside metro Phoenix)

HYDROLOGY
DIVISION
HYDROLOGY
DIVISION
ADWR
ARIZONA DEPARTMENT
OF WATER RESOURCES

SECURING ARIZONA'S WATER FUTURE

ADWR
ARIZONA DEPARTMENT OF WATER RESOURCES

3550 N CENTRAL AVENUE, SUITE 200
PHOENIX, ARIZONA
85012-2105

PHONE: 602-771-8500
1-800-352-8488

FAX: 602-771-8691

WEBSITE: http://www.azwater.gov

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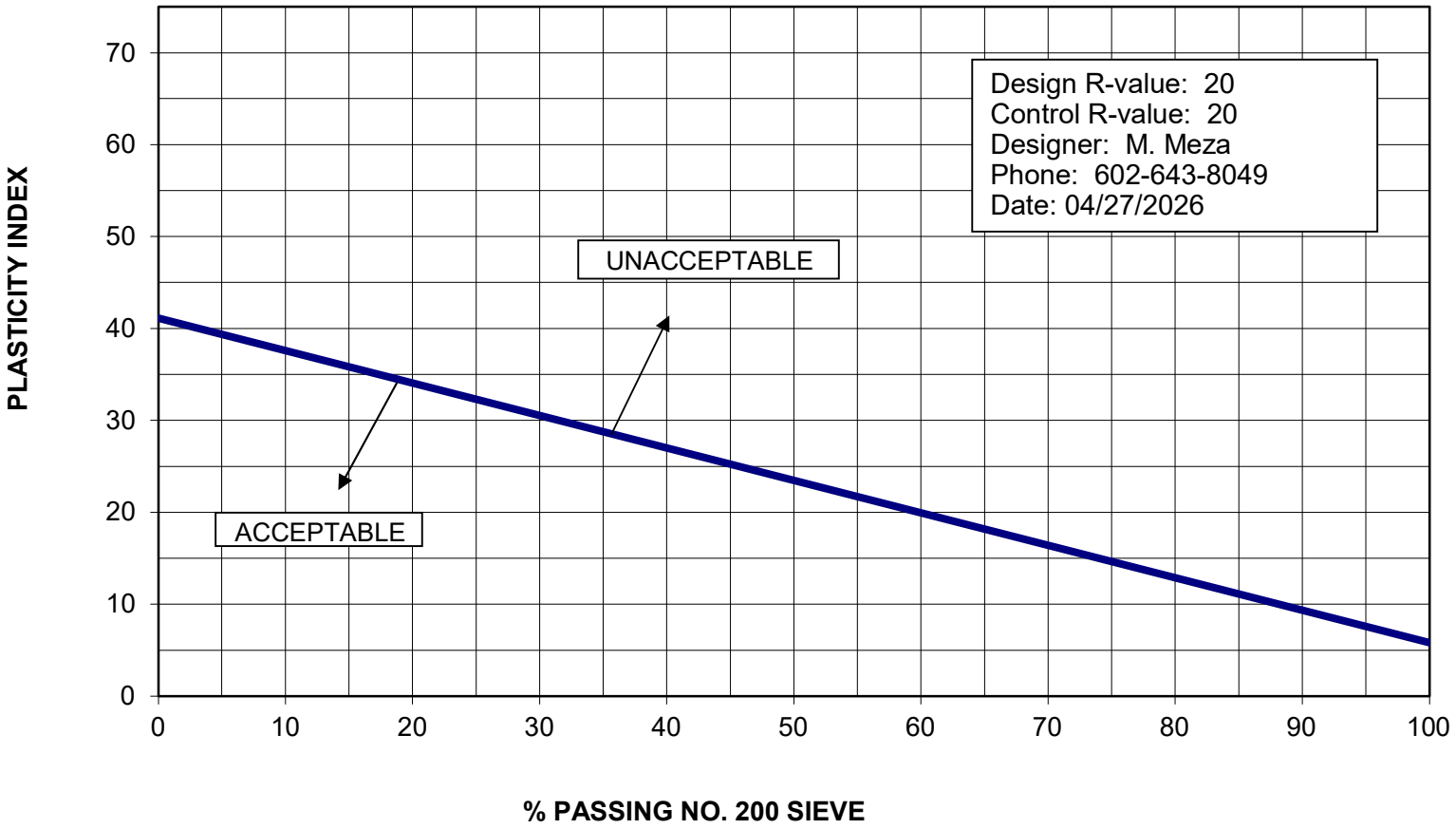
Appendix D

Subgrade Acceptance Chart

FIGURE 2 - SUBGRADE ACCEPTANCE CHART

San Simon POE Site Improvements

ADOT PROJECT No. 010 CH 383 F0728 01D



Appendix E

Slump Loss Test of Portland Cement Concrete

Slump Loss Test of Portland Cement Concrete:

This method shall be used to determine the slump loss of freshly mixed Portland Cement Concrete over a period of time. The purpose of this test procedure is to ensure that the concrete will maintain the minimum required slump throughout the anticipated concrete hauling and placement period.

The slump loss test results shall be submitted as part of the installation plan described in subsection 609-1.03 and performed prior to the mix design being submitted to the Engineer for approval.

The Slump Loss Test of Portland Cement Concrete shall be performed by a certified technician meeting the requirements of the ACI Concrete Field Testing Technician Grade I or equivalent and shall be per the following procedure and guidelines:

(A) The test shall be performed on a sample of mixed concrete that complies with the proposed concrete mix design submitted for the drilled shaft foundations.

(B) A test batch of the proposed concrete mix design submitted for the drilled shaft foundations shall be prepared at a temperature consistent with ambient and concrete temperatures anticipated during actual concrete placement.

(C) The test batch shall be a minimum of three cubic yards.

(D) After the test batch has been mixed per the mix design requirements, a minimum of one cubic foot of the concrete shall be sampled in accordance with the requirements of ASTM C172.

(E) An initial test shall be performed for slump (per ASTM C143) and ambient and concrete temperatures (per ASTM C1064). Air content shall be tested per ASTM C231 or ASTM C173, if required by the proposed concrete mix design.

To simulate in-place plastic concrete, the certified technician shall:

(1) Discharge approximately one cubic yard of the test batched concrete in a hole, form or suitable container having approximate dimensions of three feet by three feet by three feet deep. The dimensions of the hole form or suitable container used may be adjusted based on project requirements.

(2) Line the hole, form or suitable container with plastic to prevent moisture loss. Cover the top of the hole, form or suitable container with plastic to prevent rapid evaporation.

(3) Isolate the concrete from vibration for the duration of the test.

(4) Obtain at least one cubic foot of concrete from the test simulated in-place concrete every hour and perform testing until the slump has reached the specified minimum slump requirements per section 609-2.01(D).

(5) Re-cover the simulated in-place concrete with plastic after each slump test.

The contractor shall submit to the Engineer the following in tabular and graphical form, and shall include these results in the installation plan described in Subsection 609-1.03:

(a) The Elapsed Time

(b) Slump from simulated in-place sample

(c) Air Temperature

(d) Concrete Temperature

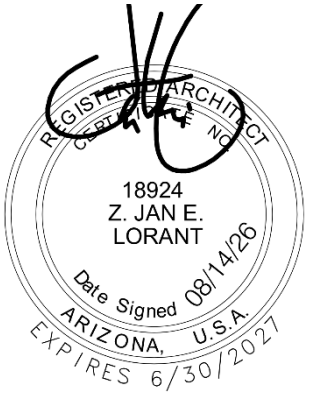
(e) Percent Air (if air entrained)

The graphical form shall depict time versus each of the tests performed. The contractor shall also submit the type (hole, form or suitable container) and its respective dimensions used for the simulated in place testing.

The Engineer may require additional testing after review of the results.

Appendix F

Section 920 – Architectural Specifications



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CSI NUMBER 01 14 00

WORK RESTRICTIONS

PART 1 - GENERAL

1.01 SCHEDULE, COORDINATION & ACCESSIBILITY

A. Contractor shall schedule and coordinate Work that is determined to be disruptive to adjacent facilities with the Owner to mitigate disruptions.
   1. All electrical connections and testing shall be conducted on weekends, holidays, or other hours compatible with the Owner's operations.

B. All utility work shall proceed without disruption to the existing facilities. If the following systems are to be impacted by the Work, advance notice and approval is required by the Owner:
   1. HVAC systems.
   2. Electrical systems.
   3. Telecommunications systems, including fiberoptics and telephone systems.
   4. Fire systems.
   5. Plumbing systems.
   6. Irrigation systems.
   7. Accessibility.
   8. Traffic control.

C. Public and Owner access to the existing Administrative and other buildings is required at all times. Temporary closures may be permitted with coordination and sufficient advance preparation with the Owner.

D. All temporary roadway, building, and sidewalk closures shall be coordinated with the Owner.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 01 26 13

REQUESTS FOR INFORMATION (AFTER BIDDING)

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Administrative requirements for Requests for Information after bidding.

1.02 DEFINITIONS

A. Request For Information (RFI):
   1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, a field condition discovered, or regarding an error, conflict, or omission in the Contract Documents. Herein after referred to as an RFI.
   2. Examples of items that might need clarification include ambiguous or conflicting information, missing dimensions or details, unclear material or product references, coordination questions between disciplines, and field conditions that differ from the Contract Documents.
   3. A properly prepared RFI shall include a detailed statement that indicates the specific Drawing(s), Specification(s), Submittal(s), or condition(s) in need of clarification.
   4. Drawings shall be identified by drawing number and location on the Drawing sheet.
   5. Specifications shall be identified by CSI number, paragraph, and page number.

B. Improper RFI:
   1. An RFI that is not properly prepared (e.g. does not have acceptable references to Contract Documents or does not suggest solutions).
   2. Handwritten (i.e. instead of typed or electronically submitted).
   3. An Improper RFI will be processed by the Architect after it is corrected and properly submitted. The Architect will notify the Contractor when an RFI is deemed an Improper RFI, and the opportunity to correct it will be given. The processing time for an Improper RFI shall restart when it is correctly submitted.

C. Frivolous RFI:
   1. An RFI that requests information that is clearly shown in the Contract Documents.
   2. A Frivolous RFI may be returned unanswered or voided. The Architect will notify the Contractor when an RFI is deemed a Frivolous RFI.

D. Confirming RFI:
   1. An RFI that documents a verbal directive and its resolution, whether initiated by the Architect, Contractor or Owner.
   2. Contractor shall clearly label each “Confirming RFI” as such on the RFI.

1.03 CONTRACTOR’S REQUESTS FOR INFORMATION

A. RFIs shall be submitted on a form or in an electronic format acceptable to the Architect and Owner.
   1. Forms shall be completely filled-in and shall be fully legible after photocopying, transmission, or scanning to pdf or other format required.
   2. RFIs shall be submitted in numerical order with no breaks in the consecutive numbering.
   3. Attachments to RFIs shall bear the RFI number on each page and shall be consecutively numbered in chronological order.

4. RFIs may be submitted by email or via an electronic project management system approved by the Architect and the Owner.

B. RFIs shall be originated by the Contractor.
   1. RFIs from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by the Contractor prior to submittal to the Architect.
   2. RFI's from subcontractors or material suppliers sent directly to the Owner's Representative, the Architect, or the Architect's consultants will not be accepted and will be returned as Improper RFIs.

C. When the Contractor is unable to determine from the Contract Documents, the material, process, or system to be installed, the Architect shall be requested to make a clarification of the indeterminate item.
   1. Wherever possible, such clarification shall be requested at the next appropriate project meeting, with the response entered into the meeting minutes. When clarification at the meeting is not possible, either because of the urgency of the need or the complexity of the item, Contractor shall prepare and submit an RFI to the Architect.

D. Contractor shall endeavor to keep the number of RFIs to a minimum. If in the opinion of the Architect, and validated by the Owner, the process becomes unwieldy due to the number and frequency of RFIs submitted, the Architect may require the Contractor to abandon the RFI process and submit future requests for information as either submittals, substitutions or requests for change.

E. Contractor shall carefully study the Contract Documents to ensure that the requested information is not available therein. RFIs which request information available in the Contract Documents will be deemed either "improper" or "frivolous" as defined above.

F. In cases where RFIs are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically, and similar items, the Contractor shall fully lay out a suggested solution using drawings or sketches drawn to scale and submit them with the RFI. RFIs which fail to include a suggested solution will be returned as Improper RFIs.

G. RFIs shall not be used for the following purposes:
   1. To request approval of submittals.
   2. To request approval of substitutions.
   3. To request changes which are known to entail additional cost or credit. A Change Order Request form shall be used for that purpose.

H. In the event the Contractor believes that a clarification by the Architect results in additional cost or time, Contractor shall not proceed with the work indicated by the RFI until a Change Order, or Construction Change Directive, is applicable to project is prepared and approved. RFI's shall not automatically justify a cost increase in the work or a change in the project schedule.

I. Contractor shall prepare and maintain a log of all RFIs. At any time requested by the Architect or Owner, Contractor shall furnish the log for review. Contractor shall show outstanding or unanswered RFIs at each project meeting.

J. Contractor shall allow a period of up to seven (7) working business days for review and response to each RFI by the Architect. When review is required by one or more consultants, the review and response period shall be ten (10) working business days.
   1. The Architect will endeavor to respond in a timely fashion to RFIs.
   2. Each RFI shall state a requested date and/or time for response. However, the requested date and/or time for a response is not a guarantee that the RFI will be answered by that date and/or time if the Architect determines the date and/or time is too expeditious.

1.04 ARCHITECT'S RESPONSE TO REQUESTS FOR INFORMATION

A. The Architect will respond to RFIs in one of the following formats:
   1. For properly prepared and confirming RFIs:
      a. Response directly on the RFI form.
      b. Electronic response in the approved electronic RFI format.

c. In an Architect's Supplemental Instructions (ASI).
d. In a Proposal Request (PR) / Request For Proposal (RFP).
e. Another format deemed appropriate by the Architect.

2. For Improper or Frivolous RFIs:
   a. Notation or stamp on the returned RFI stating "Not Reviewed".
   b. Notification to the Contractor of RFI processing fees.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Preconstruction Conference.
B. Progress Meetings.
C. Preinstallation and Coordination Meetings.

1.02 RELATED CSI NUMBERS

A. CSI Number 01 50 00 – TEMPORARY FACILTIES AND CONTROLS.

1.03 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference to discuss the Project, prior to Work commencing, will be held at a time and location designated by the Architect or Owner.
   1. Contractor, and representatives of major Subcontractors, shall meet with the Owner and Architect. The purpose of this conference is to discuss the Project in detail, including the Scheduling of Work, Work restrictions, and questions.
   2. All agreements, changes, or acknowledgements at the Conference are subject to written confirmation; oral approvals are non-binding.
   3. Meeting minutes will be taken by the Architect and distributed to all attendees within 48 hours of the Conference.

1.04 PROGRESS MEETINGS

A. Progress meetings will be held at the Project site, or another location approved by the Architect and Owner, at the day, time and interval designated and approved by the Architect or Owner. Meetings will typically be no more frequent than once per week.
   1. Contractor, and representatives of major Subcontractors when deemed necessary by the Architect or Owner, will attend the progress meetings. Contractor is responsible for notifying Subcontractors of their required attendance.
   2. These meetings will address progress of the Work and issues or questions that may have developed since the previous meeting. Discussion topics include:
      a. Construction site safety & security.
      b. Public relations.
      c. Special inspections and material testing.
      d. Construction schedule(s).
      e. Work in progress.
      f. Upcoming Work.
      g. Field observations and reports.
      h. Submittals, shop drawings, and mock-ups.
      i. Requests for Information (RFI's).
      j. Architect's Supplement Instructions (ASI's)
      k. Proposal Requests (PR's).
      l. Potential Change Orders and Change Orders.
      m. Pay applications.
      n. Other action items.

3. All agreements, changes, or acknowledgements at the meetings are subject to written confirmation; oral approvals are non-binding.
4. Meeting minutes shall be taken by the Contractor and distributed to all attendees within 48 hours of the meetings.

1.05 PREINSTALLATION AND COORDINATON MEETINGS

A. Preinstallation and coordination meetings, as deemed necessary by the Architect or the Owner, will be at the day, time and interval designated and approved by the Architect or Owner.
   1. These meetings will be held at the Project site, or another location approved by the Architect or Owner.
   2. Contractor, and representatives of Subcontractors when deemed necessary by the Architect or Owner, will attend the meetings. Contractor is responsible for notifying Subcontractors of their required attendance.
   3. All agreements, changes, or acknowledgements at the meetings are subject to written confirmation; oral approvals are non-binding.
   4. Meeting minutes shall be taken by the Contractor and distributed to all attendees within 48 hours of the meetings.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Temporary fences, enclosures, and barriers.
B. Temporary pumping facilities.
C. Temporary field offices and storage enclosures.
D. Temporary Heating, Ventilating, and Air Conditioning (HVAC).
E. Temporary toilet and handwashing facilities.
F. Temporary utilities.
G. Temporary fire protection.
H. Temporary scaffolds.
I. Staging areas.
J. Temporary signage.
K. Traffic control.
L. Noise, debris, and dust control.
M. Security and monitoring.
N. Tree, plant, and hardscape protection.

1.02 RELATED CSI NUMBERS

A. CSI Number 01 14 00 – Work Restrictions.

1.03 REFERENCES

A. Applicable Occupational Safety and Health Administration (OSHA) rules, regulations, and standards.
B. Applicable Centers for Disease Control and Prevention (CDC) rules, regulations, and standards.
C. Applicable State, County, and Local government rules, regulations, and standards.
D. Requirements of the Authority Having Jurisdiction (AHJ).

1.04 GENERAL REQUIREMENTS

A. Contractor is responsible for all labor, material, equipment and services necessary to furnish, erect, and maintain temporary facilities and controls, and perform temporary work required in the performance of the Contract.
B. Maintenance and Removal: Maintain temporary facilities and controls in a clean, proper, safe operating, and sanitary condition for the duration of the Contract. Upon completion of the Contract, remove all temporary facilities and controls from the project site.
C. Contractor personnel and all construction personnel shall not use any utilities, toilets, handwashing facilities, offices, or any other resource in existing Owner facilities, except with written permission of the Owner.
D. Employ all measures necessary to meet the requirements for workplace safety with regard to health emergencies as prescribed by the CDC and OSHA. Provide a worksite-specific safety plan that is administered by the Contractor’s designated Safety Supervisor and approved by the Owner.

1.05 PREVENTATIVE AND SAFETY MEASURES

A. Contractor is responsible for safety of the job site and general public as governed by applicable Federal, State, County and local rules, regulations, and standards. Contractor shall provide a “competent person” as required for implementing and monitoring all safety precautions and programs related to the performance of the Work.
B. Provide regular PPE for workers engaged in various tasks, including but not limited to:
    1. Fall protection.
    2. Hard hats.
    3. Hearing protection.
    4. Gloves – the type of glove shall be appropriate for the task.
    5. Eye protection.
    6. Face masks – the type of mask appropriate for the task.
    7. Cleaners and sanitizer products.

1.06 TEMPORARY FENCES, ENCLOSURES, AND BARRIERS

A. Provide and maintain all fences, barricades, lights, shoring, trench and hole covers, and other protective structures or devices necessary for the safety and protection of workmen, the public, equipment, and property as required by State, County, or local laws, regulations, and ordinances, including any requirements by the Authority Having Jurisdiction (AHJ).
B. Provide 6-foot high woven wire temporary fencing around the entire construction area, with optional wind fabric if requested by the Owner. Contractor shall gain approval of the fencing and its precise location with the Owner prior to installation. Fencing shall be erected and secured in a manner to withstand the forces to which it may be subjected. Locate gates for access to the areas as required. Close and lock all fencing gates after normal working hours. A duplicate set of keys to all fencing gate locks shall be furnished by the Contractor to the Owner.

1.07 TEMPORARY PUMPING FACILITIES

A. Provide and maintain pumping facilities, including power, for keeping the site, excavations, and structure free from accumulations of water at all times, whether from underground seepage, rainfall, drainage or broken lines.

1.08 TEMPORARY FIELD OFFICES AND STORAGE ENCLOSURES

A. Provide suitable temporary field office facilities complete with telephone and furnishings, required for the Contractor’s daily administration of the Work. Location of temporary offices to be approved by Owner prior to installation. Office space shall be kept clean by the Contractor.
B. Contractor shall provide all storage enclosures required for his operations.
C. Contractor shall furnish and install temporary enclosures, doors and transparent plastic windows as required to protect building(s) from damage due to vandalism or weather.

1.09 TEMPORARY HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

A. If permanent equipment is to be used for temporary HVAC, prior to operation, verify that installation is approved for operation, equipment is lubricated, and filters are in place.
    1. If air handlers are used during construction, filtration media with efficiency reporting value as designated in the Contract Documents must be used at each return air grill. Verify with Mechanical Engineer through Architect prior to implementation.
    2. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in the Specifications.

C. Ventilate enclosed areas to assist curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.10 TEMPORARY TOILET AND HANDWASHING FACILITIES

A. Contractor shall provide and pay for temporary toilet and handwashing facilities for use by all workmen and enforce their use by all personnel.
B. Provide facilities complying with State, County, and local sanitary laws, along with OSHA and CDC regulations.
C. Maintain facilities in a clean, sanitary condition.
D. Provide adequate supplies of toilet paper, hand soap, hand sanitizer, and paper towels.

1.11 TEMPORARY UTILITIES

A. All equipment and devices used at Temporary Utilities shall comply with all applicable State, County, and Local codes and ordinances.
B. Electric power as required for the Contractor's use shall be provided and paid for by the Contractor.
C. Fuel for power and/or heating required for the Contractor's use, shall be provided by and paid for by the Contractor.
D. The Contractor shall provide an extended warranty or guarantee period on any permanent systems which are used during the construction period, such warranty to commence on date of Substantial Completion at the Contractor's expense.
E. The Contractor shall pay for all water used and any applicable sewer service charges.
F. The Contractor shall make all arrangements for an adequate supply of clean water for construction purposes.
G. The Contractor shall supply and pay for adequate cool, pure drinking water with individual drinking cups or sanitary bubbler fountain for the use of all construction personnel and visitors on the project. The quality of the drinking water shall meet the standards for public water supplies.
H. Existing utilities may be connected to or utilized with the approval of the Owner.

1.12 TEMPORARY FIRE PROTECTION

A. Provide adequate fire extinguishers on site and within the premises of the building(s) during the course of construction. Type and sizes recommended by the NFPA and required by State, County, and local rules, regulations, codes, ordinances, and standards.to control fires resulting from the particular work being performed. Instruct employees in their use. Place extinguishers in the immediate vicinity of the work being performed, ready for instant use. In the use of especially hazardous types of equipment, such an acetylene torches, welding equipment, tar pots, kettles, and other similar devices, no work shall be commenced, or equipment used unless fire extinguishers of approved type and capacity are placed in the working area available for immediate use by the workmen using the above-mentioned equipment.
B. Provide at least one (1) operational standpipe to each level during construction as required by State, County, and local rules, regulations, codes, ordinances, and standards.

1.13 ACCESSIBILITY OF VALVES & CONTROLS

A. Equipment that must be operated or maintained, such as valves, traps, controls, unions, motors, or similar, shall be placed in an accessible location.

1.14 TEMPORARY SCAFFOLDS

A. The work under each CSI Number of these Specifications shall include providing, installing, and maintaining all scaffolds, staging, trestles, and planking necessary for the work under each CSI Number, in strict conformity with applicable Federal, State, County, and local rules, regulations, standards, codes, and ordinances. The maintenance of same is not to interfere with or obstruct the work of other trades. Additionally, the work under each CSI Number of these Specifications shall include providing all forms of protection necessary to preserve the work of other trades free from damage. These provisions shall be considered as though repeated under each separate CSI Number of these Specifications.

1.15 STAGING AREAS

A. Contractor shall be responsible for meeting and conferring with the Owner to determine the areas and limits of all staging areas.
B. After the staging areas have been determined, Contractor shall prepare and submit to the Owner a detailed drawing of the fenced areas, including all traffic control devices if required.
C. Contractor may use the site to temporarily store construction materials and park trailers, construction equipment and employee vehicles. Contractor shall not store petroleum products, hazardous or toxic substances, flammable materials, or use the area for storage of disabled/wrecked vehicles, or use the area for vehicle maintenance.
D. The Contractor shall be responsible for security of the contractor parking areas.

1.16 TEMPORARY SIGNAGE

A. Contractor and subcontractor signage, except for those specifically required by Regulatory Agencies and/or safety measures, is prohibited unless approved by the Owner prior to installation.
B. Contractor shall provide and install a Project Information Sign prior to starting construction to inform the public about the project. Coordinate with Architect and Owner on design of the sign. The Sign shall include the names of all entities participating in the project. The sign shall be installed at a location approved by the Owner. Contractor shall maintain the sign as necessary and update the information when requested by the Owner. Updates to the sign will be at the cost of the Owner.
C. Provide comprehensive safety signage as required by Federal, State, County, and Local rules, regulations, codes, ordinances, and standards.

1.17 TRAFFIC CONTROL

A. Contractor shall be responsible to provide all barricades, signs, lights, off-duty police officers, fences, security instruments, flagmen, and all other traffic control devices and personnel necessary to properly mark and control the construction area for the safe and efficient movement of traffic. Contractor shall be responsible for maintaining all traffic control devices during construction and shall be responsible for the removal of all traffic control devices upon completion of the work, once accepted by the Architect and Owner.
B. All traffic controls measures shall conform to the latest editions of Section 401 of the MAG Uniform Standard Specifications for Public Works Construction, City of Phoenix Traffic Barricade Manual and standards (if applicable), and the Manual of Uniform Traffic Control Devices.
C. Whenever construction operation creates a condition hazardous to the public in the opinion of the Contractor or the Owner, the Contractor shall furnish such flagmen and guards as necessary to provide adequate warning to the public of any dangerous conditions.
D. Safety devices, flagmen and guards, while on duty, shall conform to the applicable Local, County and State requirements. The Contractor shall be responsible to immediately inform the Owner of hazardous conditions.

1.18 NOISE, DEBRIS, AND DUST CONTROL

A. Contractor shall develop and implement a Dust Control Plan as required by State, County, and Local rules, regulations, standards, codes, and ordinances. Contractor shall obtain appropriate permits and comply with all regulatory requirements.
B. All subcontractors engaged in dust-generating operations (land clearing, maintenance, land clean-up, earthmoving, weed abatement, excavations, construction, demolitions, bulk material handling, storage/transporting operations, and other similar activities) at a site that is subject to a dust control permit must register with the Authority Having Jurisdiction (AHJ) and pay any applicable fees.
C. Exercise all possible care to control excessive noise during construction.
D. All debris shall be removed from all pipes, pipe chases or other such remote and hidden spaces prior to closing of said spaces.

1.19 TREE, PLANT, AND HARDSCAPE PROTECTION

A. Existing or newly planted vegetation, shrubs, trees, sidewalks, paving, and hardscape, if present on the site, shall be protected against damage of any kind during the duration of construction, unless directly affected by the Work of this Contract. No diesel or gasoline engine shall be left running under trees. No vehicle shall be allowed to pass over the feeder root system within the drip line unless approved by the Owner. Work, storage, and traffic areas shall be restricted to those areas immediately adjacent to the construction site as outlined in the Contract Documents. Damage of any kind caused by the Work of this contract shall be made good before final acceptance of the Project. Contractor shall provide water and protection barricades as required to maintain all trees, plants, shrubs, and existing site improvements designated to remain.

1.20 ACCESS TO PROJECT SITE

A. Authorized representatives of the State, County, City, and Owner shall have ready access to the project at all times after checking in with the Contractor and attending safety orientation as required by the Contractor.

1.21 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification CSI Numbers.
B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.
C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Protect finished floors, stairs, elevators, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting them with durable sheet materials.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
F. Prohibit traffic from landscaped areas.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Cutting, fitting, and patching, including attendant excavation and backfill required to complete the Work, and for the following:
   1. Making several parts fit together properly.
   2. Uncovering portions of Work to provide for installation of ill-timed Work.
   3. Removing and replacing defective and non-conforming Work.
   4. Removing samples of installed Work required for testing, as directed by Architect.
   5. Providing routine penetrations of non-structural surfaces for installation of piping electrical conduit, and similar items.

1.02 RELATED CSI NUMBERS

A. CSI Number 00 14 00 – Work Restrictions.

1.03 SUBMITTALS

A. Written requests: In advance of executing any cutting, patching, or alterations, Contractor shall submit written request to Architect requesting consent to proceed when it affects the following:
   1. Work of Owner or other trades.
   2. Structural value or integrity of any element of the Project.
   3. Integrity or effectiveness of weather-exposed or moisture-resistant elements of systems.
   4. Efficiency, operational life, maintenance, or safety of operational elements.
   5. Visual qualities of sight-exposed elements.

B. Written requests shall include the following:
   1. Identification of Project.
   2. Description of affected Work.
   3. Necessity for cutting alteration or excavation.
   4. Effect on Work of Owner or other trades, or structural, or weatherproof integrity of Project.
   5. Description of proposed Work.
   6. Alternatives to cutting and patching
   7. Cost proposal, when applicable.
   8. Written permission of trades whose Work will be affected.
   9. Day and time Work will be uncovered and when the Work will be performed, in order to provide notice for observation when necessary.

1.04 PAYMENT FOR COSTS

A. Costs caused by ill-timed or defective work or work not conforming to the Contract Documents, including costs for additional services of the Architect and Engineer(s) shall be paid for by the Contractor. The Contractor will be billed for additional services at the current hourly rate charged by the Architect and Engineer(s). The Architect and Engineer(s) will charge the Owner and such costs will be deducted from monies still due to the Contractor.

B. Payment of work done on written instructions of the Architect, other than for defective or nonconforming work, will be paid by the Owner on approval of a written Change Order.

Contractor shall provide written cost proposal prior to proceeding with cutting and patching instructed by Architect for other than defective of nonconforming work. All work shall be approved by the Architect and Owner prior to commencement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials for replacement of Work removed in compliance with the Contract Documents for the type of Work and with the Drawings and Specifications for each specific product involved.

PART 3 - EXECUTION

3.01 EXAMINATION & INSPECTION

A. Inspect existing conditions of Work, including elements subject to movement or damage during cutting and patching, and excavating and backfilling. After uncovering Work, inspect conditions affecting installation of new products and verify procedures with Architect.
B. Report unsatisfactory or questionable conditions in writing to Architect. Do not proceed with Work until further instructions are received.

3.02 PREPARATION

A. Provide shoring, bracing, and supports as necessary to maintain structural integrity of the Work. Design of shoring, bracing and supports shall be performed by an Engineer registered in the state in which the project is located.
B. Provide devices and methods to protect other portions of Work from damage, including elements which may be exposed by cutting and patching Work. Maintain excavations free from water.

3.03 INSTALLATION

A. Performance:
   1. Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
   2. Execute cutting and demolition by methods which prevent damage to other Work to provide proper surfaces to receive installation of repairs and new Work.
   3. Execute excavating and backfilling by methods which prevent damage to other Work and settlement as specified in the Earthwork Specification.
B. Employ original installer or fabricator to perform cutting and patching for:
   1. Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants and waterproofing.
   2. Sight-exposed finished surfaces.
C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes as shown on Drawings and as specified.
D. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Conform to fire code requirements for penetrations and maintain integrity of fire walls and ceilings.
E. Restore Work which has been cut or removed. Install new products to provide completed Work in accordance with requirements of Contract Documents and as required to match surrounding areas and surfaces.
F. Refinish entire surfaces as necessary to provide an even, matching finish as follows:
   1. Painted Walls or Ceilings: To nearest intersection with another finish or corner.

2. Where applied finishes occur (i.e.: wallcovering, tile, wood paneling): To nearest intersection of finish without damage to adjacent material. Where match of pattern, grain, texture, or similar finish cannot be made, refinish area to intersection with other finish or internal corner.
3. Manufactured or shop fabricated materials: Replace entire affected surface or entire component.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by cutting and patching activities according to each surface's specifications.
B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner. Leave Work in clean, operable condition.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 03 05 14

FLY ASH

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Fly ash admixture for incorporation into concrete mixes for Cast-in Place Concrete, Masonry Mortar and Grout, and Concrete Unit Masonry.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 30 00 – Cast-in-Place Concrete.

1.03 REFERENCES

A. American Concrete Institute (ACI) PRC-211.1 – Selecting Proportions for Normal-Density and High-Density Concrete – Guide.
B. American Concrete Institute (ACI) PRC-232.1 – Report on the Use of Raw or Processed Natural Pozzolans in Concrete.
C. American Concrete Institute (ACI) PRC-232.2 – Report on the Use of Fly Ash in Concrete.
D. ASTM C311 – Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
E. ASTM C618 – Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

1.04 SUBMITTALS

A. Contractor shall list use of fly ash in each concrete mix submittal.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coal Fly Ash and Raw or Calcined Natural Pozzolan.
    1. Sampled and tested in accordance with the current edition of ASTM C311.
    2. Conform to the requirements of the current edition of ASTM C618 as follows:
        a. Meet the requirements of ASTM C618, Table 1 Chemical Requirements and Table 1A Supplementary Optional Chemical Requirements.
        b. Meet the requirements of ASTM C618, Table 2 Physical Requirements and Table 2A Supplementary Optional Physical Requirements in the following areas:
            i. Effectiveness in Controlling Alkali-Silica Reaction.
            ii. Effectiveness in Contributing to Sulfate Resistance, Procedure A.
            iii. Uniformity Requirements when air-entraining concrete is specified.
        c. Air-entrained concrete is not recommended in locations at elevations below 3000 ft. above sea level.
    3. Source Quality Control:
        a. Fly ash shall come from sources with an established quality control program to demonstrate that the fly ash consistently conforms to ASTM C618 specification and uniformity requirements. The quality history shall include a minimum of 40 test results representing a minimum of the previous 6 months of production of fly ash.

b. Per the current edition of ACI PRC-232.2, the fly ash quality history shall be available that demonstrates at least monthly ASTM C618 certification results from a Cement and Concrete Reference Laboratory (CCRL) accredited laboratory. A minimum of 20 reports representing at least 6 months of fly ash production is required.

2.02 MIXES

A. Provide fly ash admixture for incorporation into concrete mixes as specified in the Cast-in-Place Concrete, Masonry Mortar and Grout, and Concrete Unit Masonry specifications.
B. Proportioning:
   1. Per ACI PRC-232.2, the most effective method for proper proportioning of concrete for a specific application is by use of a trial batch and testing program per ACI PRC-211.1. When necessary, a series of mixtures shall be prepared and tested to determine the proper proportions for the specific project requirements.
   2. Fly ash shall not be proportioned at less than percentage specified above under the paragraph “Recycled Content”.
   3. Fly ash shall not exceed recommended proportions indicated for various applications on the General Structural Notes (GSN’s) of the Contract Documents.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Formwork for the following cast-in-place concrete Work:
   1. Footings.
   2. Foundation Walls.
   3. Slabs-on-grade.
   4. Stem walls.
   5. Stairs.
   6. Concrete toppings.
   7. Site concrete elements.
   8. Other cast-in-place concrete Work shown on the Drawings.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 05 14 – Fly Ash.
B. CSI Number 03 20 00 – Concrete Reinforcing.
C. CSI Number 03 30 00 – Cast-In-Place Concrete.

1.03 REFERENCES

A. American Concrete Institute (ACI) 117 – Specification for Tolerances for Concrete Construction and Materials.
B. American Concrete Institute (ACI) 301 – Specifications for Structural Concrete.
C. American Concrete Institute (ACI) 303R – Guide to Cast-in-Place Architectural Concrete Practice.
D. American Concrete Institute (ACI) CODE 318 – Building Code for Structural Concrete.
E. American Concrete Institute (ACI) 347.3 – Guide to Formed Concrete Surfaces.
F. American Plywood Association (APA) Product Standard PS 1 – Structural Plywood.
G. American Society for Testing and Materials (ASTM) C1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
H. American Society for Testing and Materials (ASTM) E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
I. American Society for Testing and Materials (ASTM) E548 – Standard Guide for General Criteria Used for Evaluating Laboratory Competence.

1.04 SUBMITTALS

A. Product Data: For each type of material or product to be used.
B. Material Certificates: Signed by the Manufacturers for each of the following:
   1. Form materials.
   2. Form-release agents.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
B. Testing Agency Qualifications: An independent agency, acceptable to the Authorities Having Jurisdiction (AHJ), qualified according to ASTM C1077 and ASTM E329 for testing indicated, and as documented according to ASTM E548.
C. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish(es), texture(s), tolerances, and standards of workmanship.
    1. Build panel(s) in the size and location shown on the Drawing or as directed by the Architect.
    2. If mockup is not acceptable to the Architect, rebuild mockup until acceptable results are achieved.
    3. Approved mockup panel(s) may become part of the completed Work if undisturbed at time of Substantial Completion.
    4. Mockups to be constructed by the same foreman and crew using the same equipment that will be used to perform the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, number, and manufacturer.
B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions.
C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from manufacturers offering products meeting the requirements of this specification CSI Number.

2.02 MATERIALS

A. Form-Facing Materials.
    1. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
        a. Plywood, metal, or other Architect-approved panel materials.
        b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1 and as follows:
            i. High-density overlay, Class 1 or better.
            ii. Medium-density overlay, Class 1 or better.
            iii. Structural 1, B-B or better; mill oiled, and edge sealed.
            iv. B-B (Concrete Form), Class 1 or better; mill oiled, and edge sealed.
    2. Rough-formed Finished Concrete: Plywood, lumber, metal, or another Architect-approved material. Provide lumber dressed on at least two edges and one side for tight fit.
    3. Soil Retainers: Material to be rigid and non-degradable.
    4. Chamfer Strips: Wood, metal, PVC, or rubber strips, ½ inch by ½ inch minimum, or as shown on Drawings.
    5. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
    6. Form-Release Agent: Commercially formulate form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
        a. Formulate form-release agent with rust inhibitor for steel form-facing materials.

i. **Basis of Design Product: FormShield PURE or FormShield WB, Euclid Chemical Co., www.EuclidChemical.com.**
ii. As approved by Architect and in compliance with substitution requirements.

7. Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   a. Furnish units that will leave no corrodible metal close than 1 inch to the plane of exposed concrete surface.
   b. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   c. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

PART 3 - EXECUTION

3.01 INSTALLATION - FORMWORK

A. Work shall conform to ACI 301 and ACI 303R, except as modified by the requirements of the Contract Documents.
B. Design, erect, shore, brace, and maintain formwork, to support vertical loads, lateral loads, static loads, dynamic loads, and construction loads that might be applied, until structure can support such loads.
C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.
E. Construct forms tight enough to prevent loss of concrete mortar.
F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.
G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
I. Chamfer exterior corners and edges of permanently exposed concrete.
J. Form opening, chases, offset, recesses, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
K. Fastening devices for other Work:
   1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other Work.
   2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.
   3. Verify usage of dovetail slots with Architect.
   4. Where concrete surfaces are veneered with masonry, install masonry anchor slots.
      a. In concrete forms set vertically 2’-0” on center.
      b. Install two continuous slots per face at each column face wider than 1’-4”.
   5. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.

L. Install sleeves in concrete piers, columns, beams, or joists only upon approval of the Architect.
M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
N. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.03 FIELD QUALITY CONTROL

A. Testing and Inspecting required: Special inspections and independent testing agency to perform field tests and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
B. Inspect formwork prior to concrete placement to verify resulting element width, depth and length correspond to those indicated on formwork installation drawings and Contract Documents.
C. Where special formed surface finish requirements are required, verify forming materials comply with requirements.
D. Adequacy of formwork, shoring, and reshoring to support vertical and lateral loads during construction is the sole responsibility of the Contractor.

3.04 CLEANING

A. During the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number includes:
   1. Reinforcing bars for cast-in-place concrete.
   2. Smooth bar dowels and diamond dowels and dowel baskets for concrete slab joints.
   3. Deformed bar anchors and headed shear connectors.
   4. Couplers for reinforcing bars.
   5. Welded wire fabric
   6. Ties and supports for reinforcement.

B. Related CSI Numbers:
   1. CSI Number 03 10 00 – Concrete Forming and Accessories.
   2. CSI Number 03 30 00 – Cast-in-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 117 – Specification for Tolerances for Concrete Construction and Materials.
   2. ACI 301- Specification for Structural Concrete.
   3. ACI 315 – Standards on Details and Detailing of Concrete Reinforcement.
   4. ACI 318 – Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM).

C. American Welding Society (AWS):
   1. AWS D1.1 – Structural Welding Code – Steel.
   2. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI)
   1. Manual of Standard Practice.
   2. Placing reinforcing Bars.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Submit in accordance with ACI 315, “Standards on Details and Detailing of Concrete Reinforcement”

1. Provide necessary plan, elevation and section detail placing drawings that illustrate fabrication, bending, and placement of reinforcement.
2. Include bar sizes, lengths, material, and grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and aps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Welding Certificates – signed by contractor certifying that welders comply with requirements of Article 1.04 “Quality Assurance”.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator utilizing experienced detailers who have successfully completed CRSI’s Reinforcing Bar Detailer Program.

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Welding: Qualify procedures and personnel according to AWS D1.4, “Structural Welding Code – Reinforcing Steel.”

1.05 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars: STM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Deformed Bar Anchors (DBA): Standard fluxed ASTM A 496 deformed bards prepared for stud welding.
1. Available Manufacturers:
    a. Erico Fastening.
    b. Nelson Stud Welding.

D. Headed Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
1. Available Manufacturers:
    a. Erico Fastening.
    b. Nelson Stud Welding.

2.02 JOINT DOWELS

A. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burr. Provide dowel ends that are sawn with round ends, not sheared with crimped ends.

B. Smooth Dowel Support Baskets:
   1. Available Manufacturers:
      a. American Highway Technology

C. Smooth Dowel Coating: Grease or bituminous coating.

D. Diamond Plate Dowels: Saw cut from ASTM A 36 hot rolled plate.
   1. Available Products:
      a. Diamond Dowel™ by PNA, Inc.

E. Smooth Plate Dowels and Baskets:
   1. Approved Manufacturers:
      a. PNA, Inc.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bare supports from steel wire, or plastic according to CRSI's "Manual of Standard Practice," and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.

B. Supports for Slabs-On-Grade with Steel Reinforcement: use supports with sand plates or horizontal runners.
   1. Dayton Richmond: Aztec E-Z Chair – PEZ with E-Z Chair Sand Plate PSP.
   2. General Technologies, Inc.: Composite Chairs on Sand Plates

2.04 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" and accepted shop drawings.

B. Do not re-bend or straighten steel reinforcement except where specifically accepted.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement. Adjust reinforcing to avoid sleeves, block outs and other voids in concrete.

B. Underfloor Vapor Retarders: When chairing reinforcement on top of underfloor vapor retarders, use only supports with integral sand plates.
   1. Do no cut or puncture vapor retarder.
   2. Repair damage and reseal cuts or punctures in vapor retarder before placing concrete.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bards according to AWS D1.4, where indicated.

E. Provide bar supports in sufficient number and heavy enough to carry steel they support. Place no bar more than 2 inches beyond last leg of continuous bar support. Do not use bar supports to support runways for concrete buggies, or similar loads.
      1. Maximum support bar spacing shall not exceed 48 inches.
      2. maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.

F. Bar supports on ground may be concrete block for slab depth of 7 inches or less and if positioned in staggered pattern. Provide bar chairs with sand feet where slab thickness exceeds 7 inches.

G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

H. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.

I. For walls reinforced on both faces, provide spreader bars and chairs to surfaces of forms on each side at spacings not to exceed 8 feet in either direction. For walls with singles layer of reinforcing, provide chairs each side at spacing not to exceed 8 feet in either direction.

J. Install welded wire reinforcement in longest practicable lengths. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

K. Center smooth dowel bars on joints, position dowels at center of slab depth and align perpendicular to face of joints both vertically and horizontally. Within 30 minutes before placement of adjacent concrete along doweled joints, apply dowel coating on free ends of dowels.

3.02 PROTECTION AND REPAIR

A. Install additional bar supports at locations where reinforcement position is not maintained due to collapsed chairs or construction activity from time of original placement.

3.03 FIELD QUALITY CONTROL

A. Assign individual to monitor reinforcement position during concrete placement and reposition bars that are displaced due to construction activity.

B. Testing and Inspecting: Engage a qualified special inspector and material testing agency to perform field quality control inspections and testing in accordance with Division 01 Section "Structural Tests and Inspections" and as required by structural engineer.

C. Submit reports of inspections and material testing as soon as practical after they are made.

D. Inspect reinforcement in all cast-in-place concrete footings, foundation frost walls, basement walls, and columns, excluding slabs on grade, footings without transverse reinforcement, and topping slabs.

E. Inspect reinforcement in all cast-in-place concrete retaining walls and elevated structural slabs.

F. Verify reinforcing bar grade.

G. Verify reinforcing bars are free of dirt, excessive rust, and damage.

H. Verify reinforcing bars are adequately tied, chaired, and supported to prevent displacement during concrete placement.

I. Verify proper clear distances between bars and to surfaces of concrete.

J. Verify reinforcing bar size and placement.

K. Verify bar laps for proper length and stagger and bar bends for minimum diameter, slope, and length.

L. Verify mechanical splices are place in accordance with Contract Documents and reviewed shop drawings.

M. Verify installation of anchor rods, embedded plates and angles are placed in accordance with the Contract Documents.

N. Correct work that does not comply with specified requirements prior to scheduling concrete placement.

O. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes: Cast-in-place concrete including, but not limited to, the following:
   1. Footings
   2. Foundation walls and piers
   3. Concrete Seat Walls
   4. Slabs-on-grade
   5. Pool Decking
   6. Concrete Toppings
   7. Miscellaneous concrete items
   8. Placement of embedded items provided by other trades.
   9. Other items as indicated on Drawings.

B. Related CSI Numbers:
   1. CSI Number 03 05 14 – Fly Ash.
   2. CSI Number 03 10 00 – Concrete Formwork.
   3. CSI Number 03 20 00 – Concrete Reinforcement.
   4. CSI Number 05 10 00 – Structural Metal Framing.
   5. CSI Number 05 50 00 – Metal Fabrications.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Interior slabs on grade scheduled to receive applied floor finishes (carpet tile, ceramic, or porcelain tile, etc.) shall be tested as specified herein under Field quality Control Relative Humidity and PH test requirements.

1.03 REFERENCES

A. American Association of State Highway and Transportation Organization (AASHTO): M 182 Burlap Cloth made from Jute of Kenaf.

B. American Concrete Institute (ACI):
   1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 214 – Recommended Practice for Evaluation of Strength Test Results of Concrete.
   3. ACI 301 – Specifications for Structural Concrete for Buildings
   4. ACI 302 – Guide for Concrete Floor and Slab Construction.
   5. ACI 303R-12 – Architectural Concrete.
   6. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   7. ACI 305 – Hot Weather Concrete.

8. ACI 308/308.1 – Standard Practice for Curing Concrete.
9. ACI 309 – Guide for Consolidation of Concrete.
10. ACI 318 – Building Code Requirements for Structural Concrete.
11. ACI 347.3R-13 – Guide to Formed Concrete Surfaces.

C. American Institute of Steel Construction (AISC): code of Standard Practice for Buildings and Bridges.

D. American National Standards Institute (ANSI): NSF Standard 61.

E. American Society for Testing and Materials (ASTM).

F. Council of American Structural Engineers (CASE): Guideline for Special Structural Inspection and Testing.

G. International Building Code (IBC).

H. National Ready Mixed Concrete Association (NRMCA): Certification of Ready Mixed Concrete Production Facilities.

I. Portland Cement Association (PCA).

1.04 SUBMITTALS

A. Concrete Mix Designs: Submit mix design for each class of concrete to the Architect for review. Review of mix designs by Architect and/or Engineer shall in no way relieve the Contractor of responsibility for the performance of the concrete. Each mix design submittal shall contain the following:
   1. Mix Number (corresponding to mix ticket on trucks delivered to site).
   2. Application for which concrete is designed (i.e. – footings, slabs, etc.).
   3. Applicable mix performance criteria including:
      a. Final Design strength at 28 days.
      b. Unit Weight.
      c. Air Content.
      d. Slump (with water only and after addition for WRA and/or HRWRA).
   4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
      a. Cementitious materials.
      b. Aggregate source, geological type, size, and shape.
         1) Include total gradation for combined course and fine aggregates for mixed specified to contain Well Graded Aggregate.
         2) Include calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
      c. Water.
         1) Indicate amount of mixing water to be withheld for later addition at Project site.
      d. Water cementitious materials ration w.cm.
      e. Admixtures.
   5. Submit alternate design mixture when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments

B. Product Data: For each type of product indicated:
   1. Form-release agents.
   2. Concrete Admixtures.

3. Curing Materials.
4. Joint Fillers.
5. Floor and Slab Treatments.
6. Bonding Agents.
7. Adhesives.
8. Repair Materials.

C. Proposed construction joint and saw-cut connection joint locations for slabs-on-grade.

D. Provide Mock-Up Section for Architect Review:
   1. Exposed concrete stem walls.
      a. Chamfered top edge
      b. Vertical Joints.

E. Informational Submittals:
   1. Manufacturer's Instructions for each type of product indicated:
      a. Curing and Sealing Compounds.
      b. Joint Fillers.
      c. Floor and Slab Treatments.
      d. Bonding Agents.
      e. Adhesives.
      f. Repair Materials.

F. Construction Test Reports:
   1. Concrete Tests: See Structural Specifications.
   2. Floor tolerance measurement.
   3. Relative Humidity and pH Tests: For slabs where flooring materials are installed.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain materials from same source throughout Work.

D. Contractor shall assign a qualified staff member for perform quality control on their own work in the field on a daily basis, for each day work is performed. The contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.

E. Pre-Installation Conference:

1. Contractor shall conduct a meeting at Project site to review proposed mix designs and discuss required methods and procedures to achieve required concrete construction..
2. Contractor shall distribute meeting agenda to all attendees a minimum of 7 days prior to the scheduled meeting date.
3. Attendees: Responsible representatives of every party who is concerned with the concrete work to attend the conference.
4. Meeting minutes will be taken by the Contractor for distribution to all attendees within 5 days of meeting. Distribute minutes also to Owner, Architect, and Structural Engineer.
5. Minutes shall include statement by concrete subcontractor indicating proposed mix design, placement, finishing and curing procedures can produce the concrete quality required by these specifications.

F. Static Coefficient of Friction: Sealed concrete floors shall have a tested coefficient of friction of 0.71 minimum dry, 0.6 minimum wet for level surfaces and treads of stairs and 0.8 minimum wet or dry for ramp surfaces when tested in accordance with ASTM D2047/UL410.

1.06 PROJECT CONDITIONS

A. Rain protection: Do not place concrete during rain unless adequate protection has been provided.

B. Cold weather protection: Comply with ACI-306R

C. Hot weather protection: Comply with ACI-305R and 305.1-06.

D. Source Limitations: Obtain materials from same source throughout Work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Joint Filler, Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type I or Type II, alkali content not to exceed 0.6 percent. Use one brand and type of cement throughout Project unless otherwise specified.

B. Aggregate – Structural Concrete: Clean, coarse aggregate and gravel, free from foreign matter, conforming to ASTM C33. Aggregate shall be graded from coarse to fine in accordance with ASTM C33, Size 67.

C. Admixtures:
1. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures. Provide one of the following:
   a. AEA-92 and AIR 40, Euclid Chemical Co. www.euclidchemical.com
   b. Sika AER, Sika Corp. www.sikaconstruction.com
   c. Master Builders MB-VR or MB-AE, BASR Admixtures www.basf-admixtures.com
2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more thatn 0.05 percent chloride ions. Provide one of the following:

a. Eucon NW or Eucon WR 91, Euclid Chemical Co.
b. Master Builders Pozzolith 322N, BASF Admixtures.
c. Plastocrete 160, Sika Chemical Corp.

3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494. Type F or Type G and containing not more that 0.05 percent chloride ions. Provide one of the following:
   a. Eucon 37/Eucon 1037, or Plastol Series, Euclid Chemical Co.
   b. Daracem 100 or ADVA Flow, W.R. Grace & Co.
   c. Mater Builders Rheobuild 1000 or Glenium 3030, BASF Admixtures.
4. High-Range, Water-Reducing, and Retarding (Superplasticizer): ASTM C494, Type G. Provide one of the following:
   a. Eucon 537, Euclid Chemical Co.
   b. Daracem 100, W.R. Grace & Co.
   c. Master Builders Rheobuild 916, BASF Admixtures.
5. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Provide one of the following:
   a. Accelguard 80, 90, or NCA, Euclid Chamical Co.
6. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and contain not more than 0.05 percent chloride ions. Provide one of the following:
   a. Eucon NR or Eucon Retarder 100, Euclid Chemical Co.
   b. Master Builders Pozzolith Retarder, BASF Admixtures.
   c. Plastiment, Sika Chemical Co.
7. Fly ash admixture: In accordance with Section 03 05 05 and General Structural Notes on Structural Drawings.
8. Use se-retarding admixtures during hot weather only when approved by Architect.
9. Prohibited Admixtures: Calcium Chloride, thiocyanates or admixtures containing more thank 0.05 percent chloride ions are not permitted.

2.02 ACCESSORIES

A. Bonding Agents and Repair Products:
   1. Interior Only (PVA): L&M Construction Chemicals EVERWELD www.lmcc.com; EucoWeld, Euclid Chemical Company www.euclidchemical.com; US Spec Bondcoat PVA www.usspec.com; or Larsens' Weld Crete www.larsenproducts.com
   2. Interior Only for Bonding Existing Concrete to Fresh Concrete (Epoxy): Sikadur 32, Hi-Mod, Sika www.sikausa.com; Euco 452 Series, Euclid Chemical Company www.euclidchemical.com; Maxi-Bond 2500, US Spec www.usspec.com; or Rezi Weld, W.R. Meadows www.wrmeadows.com
   3. Exterior and Interior Bonding Admixture (acrylic latex): SBR Latex or Flexcon Euclid Chemical Company www.euclidchemical.com; Intralok, W.R. Meadows www.wrmeadows.com; Acylcoat, US Spec www.usspec.com; or Dayton Bond J40, Dayton Superior www.daytonsuperior.com
   4. Polymer Repair Compounds: Polymer and microsilica modified cementitious based compounds.
      a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      b. Horizontal Locations:
         1) Sikatop 121 or 122, Sika Chemical www.sikausa.com

2) Thin Top Supreme, Concrete Top Supreme, Euclid Chemical Company www.euclidchemical.com
3) TP Mortar, US Spec www.usspec.com

5. Underlayment Topping: Free-flowing, self-leveling, pumpable cementitious base compound.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Ardex K-15, Ardex Inc.
      2) Flo-Top or Super Flo-Top, Euclid Chemical Co.
      3) Self-Leveling Underlayment, US Spec
      4) Underlayment 110, BASF
6. Repair Topping: Latex modified, sandless cementitious mortar topping with bond strength meeting or exceeding requirements of ASTM C1059.
   a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      1) Thin Top Supreme, Euclid Chemical Company
      2) TP Mortar, US Spec
      3) As approved by Architect.

B. Non-Shrink Grout:
   1. Premixed or prepackaged, non-metallic, non-gaseous, blood free compound; non-shrink when tested in accordance with ASTM C 1107, Grade B at a fluid (flow cone) consistency of 20 to 30 seconds.
   2. Attain minimum compressive strength of 7,00 psi in 28 days at above fluid consistency.
   3. Fluid grouts: Remain workable, flow through flow cone after 20 minutes with slight agitations, in temperatures from 40 to 70 degrees F.
      a. Acceptable Products: Subject to compliance requirements, provide one of the following:
         1) Suregrip High Performance, Dayton Superior, www.daytonsuperior.com
         2) Sikagrout 212, Sika www.sikausa.com
         3) Master Builders (Masterflow 713) www.masterbuilders.com
         4) W.R. Meadows No. 588 Grout www.wrmeadows.com
         5) L&M Construction Chemicals (DURAGROUT) www.lmcc.com
         6) US Spec “GP Grout” www.usspec.com
         7) Euclid N-S Grout www.euclidchemical.com
   4. High Flow Fluid Grouts: High flow grout shall achieve 95 percent contact when placed under an 18 inch x 36 inch base plate, remain workable, and flow through cone after 60 minutes in temperature from 70 to 90 degrees F.
      a. Acceptable Products: Subject to compliance with requirements, provide one of the following:
         1) Hilti HIT-RE 500-SD www.hilti.com

C. Epoxy Anchoring Adhesive: 2-component, high modulus, 100 percent solids epoxy gel adhesive complying with ASTM C881.
   1. Acceptable Products: Subject to compliance with requirements, provide one of the following:
      a. Hilti HIT-RE 500-V3 www.hilti.com
      b. Simpson Strong-Tie Co. Set-XP www.simpsonanchors.com

D. Formed Construction Joint: Standard design plastikey, tongue and groove key joint, 3-1/2 inch vertical dimension for 4 inch slabs. For use only in slabs not exposed to vehicular traffic.

E. Preformed Expansion Joint filler: ASTM D1751.

F. Liquid Curing and Sealing Compound:
   1. Verify that specified curing compound is compatible with the floor finish material(s) and adhesives(s) that will be applied to floor surface prior to delivery of curing compound to jobsite. If it is determined that the curing compound is not compatible with the floor finish material(s) and adhesives(s) that will be applied to floor surface, Contractor shall immediately notify Architect.
   2. Dissipating Hydrcarbon Resin Curing Compound: ASTM C309 VOC compliant, 350 g/l, for use on slabs receiving subsequent applied finishes and where noted on Drawings. Subject to compliance with requirements, provide one of the following:
      a. Kurez DR VOX or Kurez W VOX, Euclid Chemical Company www.euclidchemical.com
      b. Maxcure Resin Clear HS, US Spec www.usspec.com
   3. Clear Curing and Sealing Compound (Voc Compliant, 350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m² when applied at 300 sq. ft./gal/ Manufacturer's certification is required. Subject to project requirements provide one of the following products:
      a. Chemrex Kure 1315, BASF Construction Chemicals www.chemrex.com
      b. Lumiseal WB, L&M Construction Chemicals www.lmcc.com
      c. Radiance UV-25, US Spec www.usspec.com
      d. Super Diamond Clear VOX, Euclid Chemical Company www.euclidchemical.com
      e. VOCCOMP-30, W.R. Meadows www.wrmeadows.com

G. Sealer: VOC compliant, acrylic copolymer type.
   1. Interior: ASTM C1315, Class A. Subject to requirements, provide one of the following:
      a. VOCOMP-30, W.R. Meadows.
      b. Euclid Super Aqua Cure VOX, Euclid Chemical Company.
      c. Dress & Seal WB#30, L&M Construction Chemicals.
      d. J-19, Dayton Superior
   2. Liquid Densifier-Sealer for Ground and Polished Concrete: As specified in Section 03 35 43.

H. Leveling Agent: Sonneborn Sonoflow, Euclid Flo-top, Ardex K-15, L&M Construction Chemicals Levelex, US Spec "Self-Leveling Underlayment, or Dayton-Superior Levelayer 1 are acceptable products.

I. Liquid Sealer Densifier: High Performance, deeply penetrating concrete densifier; odorless, colorless, VOC compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum solids content of 20 percent of which 50 percent is siliconate.
   1. Subject to project requirements provide one of the following products:
      a. Ashford Formula, Curecrete Chemical Company, Inc. www.ashfordformula.com
      b. Diamond Hard, Euclid Chemical Company www.euclidchemical.com
      c. SealHard, L&M Construction Chemicals www.lmcc.com
      d. Liquihard, W.R. Meadows www.wrmeadows.com
      e. J-17 Surehard, Dayton-Superior www.daytonsuperior.com
      f. Industraseal, US Spec www.usspec.com
   2. Liquid Densifier-Sealer for Ground and Polished Concrete: As specified in Section 03 35 43.

J. Vapor Barrier: As specified in Section 03 05 08.

K. Concrete Accessories: Gateway Engineering Company, Dayton-Superior Corporation, or Burke Concrete Accessories.

L. Evaporation Retarder:
   1. Type: Monomolecular film, compatible with subsequent coatings and floor finishes.
   2. Acceptable Manufacturer and Products: L&M Construction Chemicals (E-Con), Master Builders (Confilm), Sika (Sika Film), W.R. Meadows (Evapre), US Spec (Monofilm ER), or Dayton Superior (Surefilm J-74).

2.03 MISCELLANEOUS ACCESSORIES

A. Cast in Stair Nosings: Wooster Supergrit® BF Extruded Aluminum for Heavy Traffic.
   1. Nose Height: 1/4 inch.
   2. Include Hold Anchor.
   3. Surface Design: Multi-Strip Grit.

B. Skate Guards for Pre-cast Benches: See Section 03 45 00 and Architectural Drawings.

2.04 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, Portland Cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to ¼ inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.05 MIXES

A. Design of Mixes: All mix designs shall be prepared in accordance with ACI 318-05, “building Code Requirements for Structural Concrete”, Section 5.3, “Proportioning on the Basis of Field Experience or Trial Mixtures.”

B. Selection of proportions for normal weight concrete: ACI 301.

C. Mix and deliver ready-mixed concrete in accordance with requirements of ASTM C94, Option A.
   1. Not more than 90 minutes shall elapse from time water is introduced into the concrete mixture until completion of placement.
   2. Do not add water to mix that has stiffened to increase its workability.
   3. At no time shall concrete mix exceed a bulb thermometer reading of 90 degrees F. or over.
   4. Use ice or other method as reviewed by Architect/Engineer, to keep concrete below 90 degrees F. Temperature.

D. All concrete must contain the specified water-reducing admixture or the specified high-range water-reducing admixture (superplasticizer). All thin concrete slabs, less than 8 inches in thickness placed at air temperatures below 50 degrees F shall contain the specified non-

corrosive, non-chloride accelerator. All concrete slabs placed at air temperatures above 90 degrees F may require the use of a water reducing retarding admixtures.

E. All concrete required to be air entrained shall contain an approved air entraining admixture. All pumped concrete, concrete for industrial slabs, synthetic fiber concrete, architectural concrete, self-consolidating concrete, concrete required to be watertight or concrete with a water/cement ration of 0.50 (4000 psi at 28 days or more).

F. Water/cement ration for concrete used for interior slab on grade construction: 0.40 to 0.45.

G. Air Entraining Admixture: All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 4.5 to 7.5 percent in accordance with ACI 212.3R. All interior slabs subject to vehicular abrasion, shall have a maximum air content of 3 percent.

H. Compressive strength (28 day): As shown on Structural Drawings.

I. Slump, for consolidation by vibration: As shown on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to placing concrete:
   1. Clean equipment involved.
   2. Remove debris and foreign material from the forms.
   3. Remove concrete laitance from reinforcing steel.
   4. We wood forms and masonry units in contact with concrete.

B. No wood will be permitted to remain permanently inside the forms.

C. Coordinate the necessary Trades as required to provide the sleeves, bolts, anchors, holes, etc., to be built in.

D. Place vapor retarder over subbase immediately prior to placing of floor slab.
   1. At locations indicated on Drawings, install vapor retarder in accordance with ASTM E1643-11 and manufacturer's printed instructions.
   2. Unroll vapor barrier/retarder with the longest dimension parallel with the direction of the pour.
   3. Lap vapor barrier/retarder over footings or seal to foundation walls.
   4. Vapor barrier/retarder shall be continuous over entire floor area and turned up a minimum of 2 inches at perimeter walls and penetrations and sealed with termination bar.
   5. Overlap joints 6 inches and seal with manufacturer's tape.
   6. Seal all penetrations (including pipes) per manufacturer's instructions.
   7. No penetration of the vapor barrier/retarder is allowed except for reinforcing steel, structural members and permanent utilities.
   8. Repair damaged areas by cutting patches of vapor barrier/retarder, overlapping damaged area 6 inches and taping all four sides with tape.
   9. Vapor barrier/retarder installation shall be approved by the vapor barrier manufacturer prior to concrete placement.

3.02 PLACING OF CONCRETE

A. Concrete Work shall be performed in accordance with ACI-301 except as amended by this Section.

B. Convey concrete from the mixer to place of final deposit by methods which will prevent segregation of aggregate or loss of material. Place concrete at such a rate that concrete is at all times plastic and to insure a practically continuous flow of concrete. Concrete not in place 1-1/2 hours after water has been added at batch plant may be rejected by Architect.

C. Place concrete as nearly as practicable in its final position to avoid segregation due to rehanding or flowing. Do not deposit concrete that has partially hardened or been retempered.

D. Do not place concrete during rain unless adequate protection has been provided.

E. Thoroughly compact concrete by suitable means during the placing, and work around the reinforcement and embedded items into the corners of the forms.
   1. Use vibrators to aid in the placement of the concrete, operated by experienced personnel.
   2. Keep at least one spare operating vibrator on the job at all times during the concrete operations.

F. Self-Consolidation concrete does not require vibration.

G. Set reinforcing dowels connecting new concrete construction to existing with epoxy anchoring adhesive as indicated on Structural Drawings.

3.03 CONSTRUCTION, EXPANSION, AND CONTRACTION JOINTS

A. Construction Joints: Provide as required to facilitate construction in accordance with Concrete Jointing Plan of Drawings and reviewed shop drawings.

B. Expansion and Contraction Joints: Place expansion and contraction joints where required to ensure that undesirable thermal and shrinkage cracking of slabs is minimized.
   1. See Drawings for locations of expansion and contraction joints in slabs-on-grade and in topping pours.
   2. If drawings do not indicate locations, verify with Architect prior to placement of slabs-on-grade and topping pours.
   3. Utilize early entry saw-cutting techniques using specialized equipment and procedures in accordance with the manufacturer of the saw-cutting equipment to saw-cut all joints in interior and exterior slabs within 2 hours of final finishing of the floor slabs while the concrete is still in its early green state.
      a. Acceptable Equipment: Soff-Cut International, Inc., Corona, CA 1-800-776-3328 www.soffcut.com
   4. At exterior slabs-on-grade provide a 1/2 inch wide expansion joint wherever slabs abut vertical construction elements whether indicated or not.

C. Additional reinforcing may be required at some construction, expansion/contraction and control joints, and shall be supplied and installed at no additional cost.

D. Reinforcing shall be continuous through construction joints of reinforced slabs, unless otherwise indicated on Drawings. Placement schedule shall be submitted for approval.

E. For slabs-on-grade, no concrete pour shall be longer than 100 feet of more than 4,000 square feet in area, unless early entry saw-cutting techniques are utilized for placement of joints in the

slab while the concrete is still in a green state and prior to the slab developing expansion/contraction cracking at random location. Provide shear keys as detailed.

F. Provide support of formed construction joint materials by means that does not puncture of otherwise damage under floor vapor retarder at interior floor slabs on grade.

3.04 FINIISHING VERTICAL (FORMED) SURFACES

A. Formed surface finishes (Confirm with Architect prior to finishing):
   1. Pits, tunnels, mechanical rooms and concealed surfaces: Remove fins, patch tie holes.
   2. Interior and exterior exposed surfaces: Remove fins, patch tie holes, stone joint marks, out-of-plane surfaces and other projections to produce uniform, smooth, dense concrete having the following formed finish Class and permitted abrupt or gradual irregularities as designated by ACI 347-04:
      a. Vertical and horizontal exterior exposed surfaces: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
      b. Other surfaces prominently exposed to public view: Class A Smooth Finish, 1/8 inch, except abrupt irregularities shall be removed.
      c. Concealed surfaces where covered by another finish: Class C, 1/2 inch, except abrupt irregularities shall be limited to 1/4 inch.

3.05 FINISHING HORIZONTAL SURFACES

A. Rake concrete into place, screed and compact with a light tamp, except do not tamp topping and slabs on grade. Screed with sawing motion and float surface to bring fines to the top.

B. Mix and apply evaporation retarder in accordance with manufacturer's printed instructions immediately after floating. In extreme drying conditions, apply additional material as needed. Apply lightly on hard to trowel floor areas.

C. Concrete Flatwork (Slab) Finishes:
   1. Interior Flatwork Concrete:
      a. Sealed, smooth steel trowel finish.
      b. Ground and polished concrete as specified in Section 03 35 43.
   2. Exterior Flatwork: As follows, unless otherwise indicated on Drawings:
      a. Natural color broom finish (Heavy, Medium or Light) concrete as schedule on Drawings.

D. When concrete has hardened sufficiently so that excess fines will not be brought to the surface, trowel slab with a steel trowel to a smooth surface free of pinholes and other imperfections. A mechanical trowel with rotating steel blades, approved by Architect, shall be used for this operation.

E. After the surface has hardened sufficiently to ring under a trowel, trowel again with a steel trowel to a hard, burnished surface free of blemishes.

F. Concrete slabs scheduled to receive ceramic or stone tile, concrete topping or similar finishes shall have a screeded finish but true and even to plane with no sharp projections or ridges.

G. Use a 1/8 inch radius edger on edges of exposed Work. Use a deep cutting, 1/8 inch radius scoring tool or sawcutting to provide scoring for control joints as indicated unless otherwise noted or directed.

H. At areas to receive floor covering, grind joints smooth between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.

3.06 SLABS

A. Saw cut or score contraction joint pattern indicated on Drawings. Use thick blade or scoring tool. Early entry saw shall be used immediately after final finishing and to a depth of 1-1/4 inches. A conventional saw or scoring tool shall cut 1/4 of the depth of slab thickness.

B. Slope to drains as indicated on Drawings, but not less than 1/4 inch per foot nominal across entire room or area to be drained.

3.07 REPAIR OF SURFACE DEFECTS

A. Modify or replace concrete not conforming to required lines, detail and elevations. Grind high spots and fill low areas as required to provide finished floor tolerances as required for application of finish floor materials.

B. Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects. Do not patch, repair or replace exposed architectural concrete except upon express direction of Architect.

C. After forms are removed, fill tie rod holes, correct honeycomb spots, remove fins and clean and finish damaged surfaces. Wipe off excess mortar and rub to match adjoining surfaces.

D. When excessive honeycombing is revealed, remove the defective material immediately after stripping forms to a depth of 3/4 to 1 inch. Cut edge of area perpendicular to surface to avoid feathered edges. Repair using the following method or submit method of repair and patching material to Architect and Structural Engineer for approval.
   1. Saturate with water for several inches beyond cutout and brush-in a grout consisting of equal parts Portland cement and sand. Follow immediately with the patching mortar. Leave the patch slightly higher than the surrounding surface. After an hour or two, finish flush with the adjoining surface. Wipe and rub patch to match adjoining surfaces. Keep patches moist for 7 days.
   2. Patching mortar shall consist of the same materials and proportions as the original concrete except that the coarse aggregate shall be omitted. When color match is required, adjust mixture to produce a finished color to match the adjoining concrete surfaces.

E. Cracks caused by expansion, shrinkage and the like that occur in natural color concrete up through final acceptance of building shall be carefully repaired by epoxy injection or other method approved by Architect.

3.08 CURING

A. Protect freshly deposited concrete from premature drying and maintain without drying at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.

B. Curing Methods: Cure concrete surfaces receiving finish materials, including, but not limited to; cementitious toppings, paint and flooring, using one of the following two methods immediately after finishing operations. Consideration shall be given to the construction schedule impact and the compatibility of finish materials with the concrete when selecting a method.
   1. Keep concrete continuously moist for at least 7 days using polyethylene film, liquid membrane forming curing compound, or other acceptable covering. Interior floor slabs on grade shall be continuously moist cured for a minimum of 7 days in accordance with ACI standards.
   2. Liquid curing compounds shall not be acceptable unless it has been demonstrated that curing compound can satisfactorily serve as a base for finish materials or removed, resulting in a satisfactory base for adhesion of finish materials.
   3. Where approved for use, apply liquid curing compound in accordance with the Manufacturer's printed instructions.
   4. Refer to Structural Drawings for other acceptable curing procedures.

C. Prevent rapid drying of the concrete at the end of the curing period.

D. During the curing period, protect

3.09 UNDERLAYMENT OR REPAIR TOPPING

A. Apply underlayment or repair topping to correct unsatisfactory floor surface due to undue settlement or failure to meet tolerance requirements.

B. Slab surface preparation and placing procedures shall be approved by the underlayment and/or repair topping manufacturer and Architect prior to start of installation.

C. Installation: Install underlayment and/or repair topping materials in accordance with manufacturer's published instructions and recommendations.

3.10 FLOOR SEALER

A. At areas indicated on Drawings, provide 2 coats of sealer

B. Surface must be clean, dry and free of loose dirt, oil, wax, curing and parting compounds and other foreign matter.

C. Apply each coat in accordance with Manufacturer's printed instructions.

3.11 LIQUID SEALER DENSIFIER

A. Provide one coat of sealer densifier at exposed concrete slabs.

B. Clean and prepare concrete floors to receive liquid sealer densifier in accordance with manufacturer's printed instructions.

C. Concrete slabs to receive liquid sealer densifier shall be properly cured in accordance with recommendations of the liquid sealer densifier manufacturer's recommendations.

D. Application shall be made in strict accordance with manufacturer's printed instructions and just prior to completion of construction.

1. Spray, squeegee or roll-on liquid sealer densifier to clean, dry concrete surface.
2. Scrub liquid into concrete surface with a mechanical scrubber.
3. Keep surface wet with sealer densifier during the application process.
4. When product thickens, but not more than 60 minutes after initial application, squeegee or vacuum surface to remove all excess liquid.

E. Apply each coat in strict accordance with manufacturer's instructions.

3.12 FIELD QUALITY CONTROL

A. Tests: Inspection and testing of concrete mix will be performed by a testing laboratory in accordance with Section 01 45 00.
1. Provide free access to Work and cooperate with appointed firm.
2. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
3. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
4. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; on before each day's pour of each type of air-entrained concrete.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 degree f (27 deg C) and above, and one test for each set of compressive-strength specimens.
6. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
7. Compressive-Strength Test: ASTM C 39; one set for each day's pour exceeding 5 cu. Yd. plus additional sets for each 50 cu. Yd. more than the first 25 cu. Yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
8. Take one additional test cylinder during cold weather concreting, and cure on job site under same conditions as concrete it represents.
9. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
10. Concrete which does not meet the compressive strength requirement at 28 days will be rejected and removed from the Project, and disposed of in a legal manner.

B. Relative Humidity and pH Testing:
1. Provide an independent testing agency certified by Test Apparatus Manufacturer.
   a. Tramex
   b. Deimhorst,
   c. Equal as approved by Architect.
2. Two weeks before installation of the ceramic tile, VCT, Vinyl, wood, carpet, epoxy flooring and/or other finish flooring systems over the interior concrete slabs, provide Relative Humidity and pH Testing to determine the level of water vapor transmission in the slab.
3. Conduct testing in accordance with ASTM F 2170-19a and ASTM F 710.
4. Conduct Relative Humidity tests after HVAC system has been in continuous use for 36 hours with a minimum ambient temperature of 72 degrees F. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature in NOT acceptable.
5. The number of tests to be placed is equal to 3 in the first 1,000 s.f. and 1 per each additional 1,000 s.f.

6. Document test results and provide copy to Architect with a marked up floor finish plan showing test results.
7. Provide a written clarification on status of HVAC system before and during the test and the length of time the ambient air temperature was maintained before the tests.

3.13 PROTECTION

A. Protect finished surfaces from stains or abrasions. Protect surfaces or edges by leaving forms in place or by providing temporary covers. Protect concrete from rain, flowing water or mechanical injury.

B. Protect floor slabs from the droppings of plaster, paint, dirt, and other marring by covering with polyethylene plastic sheet, or other acceptable floor protection covering, well lapped and sealed.

1. Where concrete slabs are scheduled to be the finished floor surface, or where slab is treated with a special concrete finish serving as the finished floor surface, provide a continuous covering of 1/2 inch particle board, joints tightly butted and cut to sizes tight to wall construction, over entire floor area over polyethylene plastic sheet, or other acceptable floor protection sheeting. Maintain covering (polyethylene and particleboard) in good condition until danger of damage is past.

3.14 CLEANING

A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 03 80 00

CONCRETE CUTTING AND CORE DRILLING

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Concrete cutting, including sawing of concrete slabs and walls.
B. Concrete core drilling of concrete slabs, walls, columns and other concrete structures.

1.02 RELATED CSI NUMBERS

A. CSI Number 01 73 29 – CUTTING AND PATCHING.
B. CSI Number 03 20 00 – CONCRETE REINFORCING.
C. CSI Number 03 30 00 – CAST-IN-PLACE CONCRETE.

1.03 REFERENCES

A. Concrete Sawing & Drilling Association (CSDA) Specifications:
   1. CSDA-C-101 – Core Drilling.
   2. CSDA-CS-109 – Chain Sawing.
   3. CSDA-DB-112 – Diamond Blade.
   4. CSDA-F-102 – Flat Sawing.
   5. CSDA-HS-108 – Hand Sawing.
   6. CSDA-W-104 – Track-Mounted Wall Sawing.
   7. CSDA-WS-106 – Wire Sawing.
B. Concrete Sawing & Drilling Association (CSDA) Standards:
   1. CSDA-BC-107 – Blade Application Code for Diamond Saw Blades.
   2. CSDA-BB-110 – Bolt Together Core Bits.
   3. CSDA-CT-111 – Continuous Tube Threads.
C. Concrete Sawing & Drilling Association (CSDA) Tolerances:
   1. CSDA-TL-001 – U.S. Tolerances and Limits for Construction Drilling and Sawing.
   2. Tolerances and Limits for Construction Drilling and Sawing.
   3. Basic Parameters for Concrete Drilling and Sawing Equipment.
D. International Association of Concrete Drillers and Sawers (IACDS) – The Standard, IACDS S-Tolerances-2 2017.
E. International Conference Council (ICC) – International Building Code (IBC)

1.04 SUBMITTALS

A. Coring procedures.
   1. Submit concrete coring procedures, which shall include the following:
      a. Proposed coring methods.
      b. Equipment to be used, including coring equipment and rebar scanning/locating equipment.
B. Remedial procedures when reinforcement is cut.
   1. Coring operations shall terminate immediately when reinforcement is cut. The Contractor shall submit to the Architect the procedure proposed to repair the cut reinforcement and to prevent further cutting of reinforcement.

C. Immediately after coring, the concrete cores shall be identified by the Contractor with a description of the core locations and submitted to the Architect. Record the As-Built conditions on the As-Built Contract Documents.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: A qualified Contractor utilizing experienced personnel who have successfully completed projects of similar size and scope as to this one with a minimum of five (5) years of experience.
B. The cutting and boring Contractor shall adhere to all applicable safety guidelines in accordance with Federal, State, and local ordinances, and as required by the Authorities Having Jurisdiction (AHJ).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Clean, potable water for sawing and core drilling operations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Contractor shall examine the areas of Work covered under this CSI Number and report detrimental conditions, in writing, to the Architect.
B. Before proceeding, verify that required inspections of conditions have been completed.

3.02 PREPARATION

A. Before cutting or coring, the Contractor shall determine the following, as applicable, utilizing concrete scanning or other Architect-approved methods as necessary.:
    1. Location of buried or embedded utilities.
    2. Location and size of steel rebar in the concrete slabs, walls, columns, or other concrete structures.
    3. Location of post-tensioning cable in the concrete slabs.
    4. Location of utility lines, conduits, and other items within the concrete.

3.03 PROTECTION

A. Existing Buildings and Facilities: Protect adjacent buildings, building entries, facilities, walkways, and other adjacent items during the Work of this CSI Number.
B. Temporary Protection: Erect temporary protection, such as walk paths, fences, railings, canopies, and covered passageways, where required by Authorities Having Jurisdiction (AHJ) and as indicated or shown on the Drawings.
C. Provide temporary barricades and other protections required to prevent injury to people and damage to adjacent buildings and facilities to remain.
D. Protect walls, windows, roofs, and other adjacent exterior and interior construction that are to remain and that are exposed to the Work of this CSI Number.
E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place until the Work is completed and accepted by the Owner.
F. Damages to utilities or other objects within the concrete slabs, walls, columns, or other structures are the responsibility of the Contractor, and shall be repaired or replaced at no additional cost to the Owner.

G. Prior to starting sawing or core drilling operations, protect against damage to the property caused by water traveling through the cracks in the concrete. Provide adequate protection against water and/or other damage caused by the drilling or sawing above, adjacent to or below the critical or occupied areas.

3.04 SAWING REQUIREMENTS

A. Comply with CSDA specifications, standards, tolerances, and best practices.
B. Comply with OSHA standards for equipment and operations.
C. Provide sawing equipment adequate in units and power to complete the sawing operations.
D. Provide reference points to properly chalk line proposed saw cuts.
E. Sawing Method: Sawing method shall consist of cutting a groove in concrete with a power-driven concrete saw to the designated depth and width.
F. Saw groove lines straight and to consistent depth.
G. Spray water-assisted equipment to control dust.

3.05 CORE DRILLING REQUIREMENTS

A. Comply with CSDA specifications, standards, tolerances, and best practices.
B. Comply with OSHA standards for equipment and operations.
C. Position holes in a manner to avoid rebar locations, while maintaining spacing as indicated on the Drawings.
D. Detect location of existing reinforcement using scanning methods and indicate on exposed concrete surface. Verify hole location using pilot holes prior to coring.
E. Explore hole locations with the smallest bit feasible. When existing reinforcing steel is encountered while drilling test holes, abandon hole and patch with non-shrink grout. Relocate new hole not less than 3 dowel diameters from rejected hole and repeat procedure. Do not cut existing reinforcement or slant drill to miss reinforcement.
F. Drill holes utilizing methods that will not shatter, damage, or spall the concrete adjacent to the holes. If shattering, damage, or spall are caused adjacent to the holes, it is the Contractor's responsibility to repair or patch those areas at no additional cost to the Owner.
G. Drill holes perpendicular to the surface to the required depth.
H. Drill holes over 1” in diameter with non-impact rotary tool with diamond core drills of the proper size to minimize spalling at the hole exit.
I. Clearance:
    1. Anchors:
        a. Comply with adhesive manufacturer’s guidelines.
        b. If hole sizes are not specified in the Contract Documents, drill holes ¼-inch larger than the diameter and ½-inch longer than the length of the anchor.
    2. Conduits and Pipes:
        a. Provide ½” clearance of the largest portion of the pipe or conduit passing through the hole to prevent dust or foreign matter from entering or leaving the area.
        b. If patching or packing is required around the pipe, provide a minimum of one-inch clearance be allowed to accommodate such patching or packing.
J. Vacuum or wash slurry and tailings generated from drilling operations. Do not permit water from drilling operations to contact interior finishes; to fall on public traffic; to flow across sidewalks, shoulders, or lanes occupied by public traffic; or to flow into gutter or other drainage facilities.
K. Provide equipment in drilling operations meeting all OSHA standards and specifications as to plugs, noise and fume pollution, wiring and maintenance.
L. If post-tensioning cable or stressing end caps are uncovered during the Work, cease Work in the immediate vicinity and contact Architect for further instructions. Concrete repairs involving or related to post tensioning cables shall be performed only under direction and supervision of the Structural Engineer.

3.06 TOLERANCES

A. Sawing: Deviation of sawcut lines shall not vary from correct position by more than 1/8 inch per ten (10) linear feet. Depth of groove shall not vary more than 1/8 inch per ten (10) linear feet.
B. Coring: Deviation in alignment of cored holes shall not be more than ½ inch per ten (10) feet of cored hole length with a maximum deviation of not more than three (3) inches.

3.07 CLEANING

A. Do not allow debris to accumulate. Remove demolished material from the site as work progresses.
B. Clean up all concrete and cement materials, equipment, and debris upon completion of each portion of the concrete work.
C. During the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 10 00

STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes: Structural steel framing including, but not limited to:
   1. Columns
   2. Beams
   3. Lintels
   4. Anchor Bolts
   5. Shelf Angles
   6. Bearing Plates
   7. Miscellaneous Structural steel items.

1.02 SUBMITTALS

A. Shop Drawings: Submit shop and erection Drawings clearly showing each piece required for fabrication and erection. Drawings shall include material grade, camber, holes and other pertinent data. Indicate welds by standard AWS symbols showing size, length, and type of each weld.

B. Test Reports: Submit reports for welded connection tests.

C. Submit anchor setting drawings clearly showing location of all anchor bolts and embedded plates to be anchored in concrete and masonry construction. Provide templates for anchor bolts.

D. Submit as required by Structural GSN and details.

1.03 QUALITY ASSURANCE

A. Welding:
   1. Performed by certified welders in compliance with AWS D.1 Structural Welding Code.
   2. Welders shall be duly qualified within the last 12 months in the position in which they are to weld and the qualifications and Specifications for workmanship shall comply with the AWS requirements "AWS Structural Welding Code - Steel."

B. Certifications:
   1. Prior to fabrication or shipment of material to the job site, furnish certification of the Manufacturer of the structural steel that material furnished meets or exceeds requirements of ASTM standards specified or noted on Drawings, for each type of material.
   2. Prior to site welding operation, submit welders' written certifications and qualifications.

C. Tolerances: All steel exposed to view shall be architectural steel, and tolerances as a minimum shall comply with section 10 of AISC code of standard practice. Steel beams and girders will be exposed, both interior and exterior.

1.04 DELIVERY, STORAGE AND HANDLING

A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.

B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Materials shall be new, of uniform quality, suitable and without defects affecting the strength or service of the structure.

B. Structural Steel: ASTM A572 or A992, except angles, channels and plates shall be ASTM A36 (Fy = 36ksi).

C. Steel Pipe Columns: ASTM A53 Grade B or ASTM A501 (Fy = 36,000 psi).

D. Steel Tube Columns: ASTM A500, Grade B.

E. Bolts:
1. Machine Bolts: ASTM A307, unless otherwise indicated.
2. High Strength Bolts: ASTM A325.

F. Welded Anchors and Shear Connectors: ICC approved, as manufactured by KSM or Nelson.

G. Welding Rods: AWS A5.0, E70 series, low hydrogen type.

H. Metal Primer: VOC compliant.
1. Interior Steel: Tnemec FD88-559 Gray www.tnemec.com.
2. Exterior Steel:
   a. Exposed to view: Compatible with high performance coating specified in CSI Number 09 96 00.
   b. Other Locations: Tnemec Tneme-Zinc 90-97 (organic)
3. Other, as approved by Design Professional.

2.02 FABRICATION

A. Workmanship and details of construction (except as otherwise indicated or specified) shall be in conformity with applicable articles of the latest AISC Manual, Parts 1 through 4; AISC Specifications; except Section A7 (Design Documents) and Chapter N (Plastic Design); and the applicable building codes. Sections 3.1, 3.4 and 4.2 of AISC code of Standard Practice are specifically excluded from this work.

1. Sections shall be of dimensions, weight and design as indicated, assembled complete at the shop, with base plates and other detailed materials attached.
2. Furnish 1/4 inch thick leveling plates at columns where base plates are shop fabricated to columns.
3. Make connections as indicated or detailed, on the Drawings and the reviewed shop and erection Drawings.
4. Exposed steel shall have smooth, clean surfaces with no identifying trade marks, names etc., exposed to view.
5. Leave in condition for finish painting.

B. Bolted connections shall be as detailed or shall conform to AISC standard bolted connections with maximum number of 3/4-inch diameter bolts. See Framed Beam Connections Tables II, III, or IV of AISC Manual of Steel Construction.

C. No slotted holes permitted at steel connections unless shown on Drawings or approved by Structural Engineer.

D. Where bolt holes in steel members are enlarged to more than 1/16 inch diameter oversize, provide 3/16 inch x 2-1/2 inch x 2-1/2 inch plate washers to steel members with 3/16 inch fillet weld all around.

E. Loose Steel Lintels: Provide loose structural steel shape lintels for openings and recesses in masonry walls and partitions, as shown. Weld adjoining members together to form a single unit. Provide not less than 4 inch bearing at each side of openings, unless otherwise shown.

F. Shelf Angles: Provide structural steel shelf angles of sizes shown for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise shown.

G. Loose Bearing Plates: Provide loose bearing plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

2.03 SHOP FABRICATION FOR USE OF HIGH STRENGTH BOLTS

A. Joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of loose mill scale, burrs, or any foreign material (including paint). Field paint these areas with the specific shop paint after erection and completion.

B. Joints using high strength bolts shall be inspected by a representative of an independent testing laboratory acceptable to the Owner's Representative.
1. Inspection shall be accomplished by the use of a properly calibrated torque wrench.
2. Calibration shall be by the procedure specified in the Specifications for structural joints using ASTM A325 or A490 bolts, under Section 9, inspections (pp. 6-276) Ninth Edition, AISC Manual of Steel Construction.
3. Check a minimum of 20 percent of the bolts in each connection.
4. If one or more of the bolts checked in any connection is below the minimum tension, check all of the bolts in that connection.
5. Bolts which cannot be properly tensioned will be rejected.

C. Check calibrated wrenches individually for accuracy at least once daily for actual conditions of application.

D. The Inspector shall check to insure that bolt threads are eliminated from the shear planes. Submit copies of the torque reading for each connection directly to the Architect in the form of a report, along with the minimum torque values required to reach the specified tensions and the calibration procedures.

E. The use of load indicator washers or twist-off spline type of fastener requires specific prior approval of the Architect.

2.04 SHOP WELDING

A. Make welds by the electric-arc process.

B. Grind exposed welds smooth.

C. Where weld size is not indicated, it shall develop full strength of member and connection.

2.05 PAINTING - SHOP COAT

A. Items of steel and iron Work indicated or specified to be encased in concrete shall not be painted.

B. Primer applied to members to receive spray fireproofing shall have been tested and certified as acceptable for application and shall be approved by fire proofing manufacturer.

C. Clean steel Work by wire brushing, or by other means selected by the fabricator, of loose mill scale, loose rust, accessible weld slag, or flux deposit, dirt and other matter. Remove oil and grease deposits by solvent. Solvents used shall be low toxic.

D. After cleaning, give steel Work one coat of metal primer.
1. Apply primer thoroughly and evenly to dry surfaces by brush, spray, roller coating, flow coating or dipping at the selection of the fabricator.

E. Apply primer at a rate of 350 sq. ft. per gallon to provide a wet film of 4.5 mils.

F. Paint erection marks on painted surfaces. Touch-up surfaces where welding, grinding of welds, joints, etc. are done in the field.

G. The paint shall be thoroughly dry before the members are handled or loaded.

2.06 SOURCE QUALITY CONTROL

A. Tests: Where a welded splice is fabricated in beams or columns other than those detailed, fabricator shall have splice connection tested using one of the following methods: magnetic particle, radiographic, or ultrasonic. Testing shall be conducted by an independent testing laboratory and a report submitted to the Architect. The costs of this testing shall be borne by the fabricator.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify anchor bolt locations, grouting and elevation of base and setting plates, and other material set by other Trades before commencing Work.
   2. Notify Architect of Work set by others which does not comply with specified tolerances. Do not erect material upon such Work until it has been satisfactorily corrected.
   3. Start of Work implies acceptance of Work of other Trades affecting structural frame erection.

3.02 ERECTION

A. Erect Work to the proper lines and levels, plumb and true, and in correct relation to other Work maintain this condition to completion.

B. Connections:
   1. Machine Bolting:
      a. Fair-up holes with pins to align holes before bolting.
      b. Ream unfair holes to obtain alignment or drill new holes.
      c. Enlargement of holes with drift pins or burning of new holes is not permitted.
      d. Draw bolts up tight after members are aligned and leveled, and set or deform threads to prevent loosening.
   2. Welding:
      a. Weld by shielding arc method per AWS standard code for arc and gas welding in building construction.
      b. Submit certification that welders have passed AWS code qualification tests.
      c. Refer to Shop Drawings for weld size and dimensions.
      d. Close joints exposed to weathering with continuous 1/8 inch weather welds.
      e. Grind smooth exposed welds, but grinding shall not reduce weld strength or required cross section.
      f. Protect finish material from damage due to welding.
      g. Remove unsatisfactory welds by chipping or arc air method.

   3. Connect members temporarily and align completely before making permanent connections.
      a. Temporary conditions shall consist of bolts in no less than 1/3 of the holes and in no case less than 3 bolts in any single connection.
      b. Surfaces in contact shall be thoroughly clean when assembled.
      c. Provide necessary temporary bracing and guying to align the structure properly for permanent connections, and safely resist erection, dead load and wind stress.
      d. Take particular care to have the Work plumb and level (maximum slope ratio tolerance 1 to 500 for interior members, 0 to 1000 for exterior members) before making permanent connections.
      e. Remove bracing and guys only after permanent alignment and assembly and structure is capable of completely sustaining design and temporary construction loads.

C. Exposed Steel:
   1. Verify the condition of exposed steel after erection.
   2. Exert particular care to provide a neat, accurate installation with members straight and true, corners and edges square, sharp and free from burrs and irregularities, adjacent members perfectly matched and no bolts or rivets exposed.
   3. Remove erection bolts and seats and plug weld and grind holes smooth.

D. Touch-up Painting:

1. Remove temporary guys, bracing and bracing clips, and grind flush remaining burrs, before painting. Remove welding slag, spatter, rust and burnt paint and wire brush clean welds before touch-up.
2. Touch-up Painting: Touch-up welds, abrasions, bolted connections, and other areas where shop prime paint has been removed or is damaged with specified prime paint or galvanizing repair paint.

3.03 CLEANING

A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises in a legal manner.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Increase S and I properties for simple or two span continuous to achieve equivalent load capacity. Minimum allowable diaphragm shear furnished, per ICC report, shall be 435 pounds per foot.
   2. Sections and properties shall meet AISC Specifications.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop and erection Drawings showing layout, material and fastening methods and each piece to be erected. Note deck welding pattern and physical properties of decking.

B. Report: Submit ICC report showing diaphragm shear test.

1.3 QUALITY ASSURANCE

A. Welding: Performed by certified welders in compliance with AWS D.1.3 requirements and procedures for manual shielded metal arc welding.

B. Certifications:
   1. Prior to fabrication or shipment of material to the job site, furnish certification of the manufacturer of the steel decking that material furnished meets or exceeds requirements of ASTM standards specified or noted on Drawings, for each type of material.
   2. Prior to site welding operation, submit welders' written certifications and qualifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle metal decking in manner which will prevent damage or deformation.

B. Stack decking stored at the site before erection on platforms or pallets, and suitably protect from the weather.

C. Exercise special care so as not to damage or overload the decking during the construction period.

D. Do not use metal decking for storage or as a working platform until the sheets have been welded in position.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved by Architect, subject to conformance with Specification requirements:
   1. Consolidated Systems, Inc. www.csisteel.com
   2. Metal Deck, Inc.
   3. United Steel Deck, Inc. www.njb-united.com/usd.htm
   4. Verco Manufacturing, Inc. www.vercodeck.com
   5. Vulcraft Division, Nucor Corp. www.vulcraft.com/sc
   6. Wheeling Corrugating Division www.wheelingcorrugating.com
   7. Approved equal subject to conformance with specifications and General Structural Notes.

2.2 MATERIALS – GENERAL

A. Recycled Content:
   1. Structural Steel: Minimum 75% post-consumer and 15% pre-consumer recycled content.
   2. Steel Decking: Minimum 75% post-consumer and 15% pre-consumer recycled content.
   3. Other Steel: Minimum 26% post-consumer and 7% pre-consumer recycled content.

2.3 2.03 RIBBED DECK

A. Steel Deck and Finish: General Requirements: In accordance with General Structural Notes on Structural Drawings.

2.4 2.04 ACCESSORIES

A. Provide ridge and valley plates, closures, can't strips, roof sump pans and other accessories where required or as shown on Drawings and of same material and finish as steel deck.

B. Furnish miscellaneous supporting members at openings and edges, as shown on Drawings and as required.

C. Galvanizing Repair Paint: High zinc-dust content paint complying with SSPC Paint 20 (94 percent minimum zinc dust content, dry film, by weight).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Erector shall examine subsurfaces to receive Work and report detrimental conditions, in writing, with a copy to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Before proceeding, verify that required inspections of existing conditions have been completed.

3.2 ERECTION - RIBBED DECK

A. Place deck sheets in accordance with approved erection layout Drawings and in accordance with requirements of General Structural Notes on Drawings.

B. Deck units shall be fabricated to span three or more support spacing, with end laps of at least two inches which shall occur over supports. Male joint of side laps shall engage female joint by at least 5/8 inch.

C. Openings shown on the erection layout Drawings shall be cut by the deck erector. Openings not shown on the erection diagram, such as those required for stacks, conduits, plumbing vents, etc. shall be cut and reinforced if necessary, by the Trade requiring the openings.

D. Attach deck to supporting members by fusion welding. Care shall be exercised by the welder in the selection of electrodes and amperage to provide positive welds and prevent high amperage blow holes. Welds shall be made from the top side of the deck with the welder following close behind the placement crew.

E. Ridge and valley plates, closures, can't strips, roof sump pans and other accessories shall be attached directly to the deck to provide a suitable surface for the application of insulation and/or roofing.

F. Welding washers are not necessary for ribbed deck of 22 gauge or heavier, or when the bottom rib width equals or exceeds 5/8 inch.

G. Where washers are required, weld deck to steel framing through 16-gauge welding washers with 1-inch x 3/8-inch puddle welds. Maximum weld spacing shall be as follows unless noted otherwise on the Structural Drawings:
   1. End and end laps: 6 inches o.c.
   2. Intermediate supports: 6 inches o.c.
   3. Edges, perimeter beams and angles parallel to deck flutes: 12 inches on center
   4. Opening edges: 6 inches on center

H. Weld sheets to each other with side seam welds at 12 inches on center.

3.3 FIELD QUALITY CONTROL

A. Tests: When required by the Architect, installation of metal decking and welding shall be subject to inspection by a qualified Testing Agency acceptable to Architect, the cost of which will be paid out of the Testing Allowance.

B. The Testing Agency shall:
   1. Test and inspect metal decking and workmanship to verify compliance with Contract Documents.
   2. Check material, equipment, procedures, welds, ability of welders.
   3. Furnish Architect with a verified report that completed Work conforms with Contract Documents.

3.4 CLEANING

A. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 41 00

STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes:
   1. Load-bearing metal stud systems for interior framing and load-bearing and non-load bearing exterior framing as shown on Drawings and as specified.
   2. Interior walls shall be non-load bearing studs (as specified in CSI Number 09 22 16) for walls going to ceiling and load bearing steel studs for walls going to structure.

1.02 SYSTEM DESCRIPTION

A. Provide metal stud framing, minimum 18 gauge in accordance with General Structural Notes and sizes in accordance with structural drawings shall be used for exterior wall construction and exterior/interior ceiling/soffit assemblies as indicated on Drawings. Exterior metal stud framed wall construction shall:
   1. Resist wind loading up to 30 lbs./sq. ft. (minimum).
   2. Be braced as required to accommodate a maximum deflection of L/360.

B. Design Requirements: Design structural members in accordance with AISI "Specification for the Design of Cold-formed Structural Steel."
   1. Maximum allowable deflection:
      a. Walls receiving gypsum wallboard finishes: L/240.
      b. Walls receiving plaster and brittle finishes, including EIFS and stucco:
      c. L/240.
      d. Walls receiving ceramic tile finishes: L/360.
   2. Design system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.03 SUBMITTALS

C. Product Data: Submit Manufacturer's Specifications, design data and installation instructions.

D. Shop Drawings: Submit Drawings showing layout, dimensions, and construction details.
   1. Shop drawings and calculation developed by General Contractor shall be used for exterior wall construction as indicated on Drawings.
   2. Submit Drawings showing layout, dimensions, and construction details. Provide calculations sealed by a Professional Engineer registered in the State of Arizona.

E. Certificates:
   1. Submit Mill Certification with shipment to verify chemical composition, yield strength, tensile strength, elongation, and coating thickness. Include listing of applicable ASTM standards specified in this CSI Number and comparison of ASTM requirements to actual materials provided to jobsite.
   2. Submit Manufacturer's certification that products furnished meet or exceed the specified design requirements.

1.04 QUALITY ASSURANCE

F. Welding: Performed by certified welders in compliance with AWS D1.3 Structural Welding Code Sheet Steel.

G. Regulatory Requirements: Manufacturers shall have current ICC or CABO evaluation report.

1.05 DELIVERY, STORAGE AND HANDLING

H. Exercise care during unloading, storage, and erection to avoid damage. Dumping on the ground is not permitted.

I. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Furnish products as manufactured by a manufacturing member of the Steel Stud Manufacturers Association (SSMA) www.ssma.com, subject to compliance with Specification requirements.

2.02 MATERIALS

B. General

C. Studs, Track, Bracing and Bridging: Conform to ASTM C955.
   1. ASTM A653, G60 hot-dip galvanized coating.
   2. Minimum structural properties: In accordance with General Structural Notes.

D. Track: Channel shaped; same width as studs, for tight fit; 16 gage solid web, galvanized or painted to match studs.

E. Bracing, Furring, Bridging: Formed galvanized sheet steel; channel shaped. Provide CRC - 1-1/2 inch x 16 gage bridging.

F. Plates, Gussets, Clips:
   1. Galvanized formed steel, thickness determined for conditions encountered, Manufacturer's standard shapes.

2. Connector devices (VertiClip, DriftClip and StiffClip) as manufactured by the STEEL Network, Inc. (TSN), Raleigh, NC (888) 474-4876 www.steelnetwork.com are acceptable.

G. Fasteners and Attachments:
1. Sheet metal: Self-drilling self-tapping screws, type appropriate for attachment detail requirements with penetration through joined materials not less than 3 exposed threads.
2. Anchorage devices to structural components: Power driven, or powder actuated, drilled expansion bolts, or screws, with sleeves.

H. Welding Electrodes: Comply with AWS standards and as indicated on General Structural Notes on Drawings.

2.03 FABRICATION

I. Fabricate assemblies of framed sections of sizes and profiles required, with framing members fitted, reinforced, and braced to suit design requirements.

J. Fasten metal studs by welding or screw-fastening as indicated. Do not fasten framing members by wire tying.

K. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 ERECTION

C. Install components in accordance with Manufacturer's instructions.

D. Align floor and ceiling tracks; locate to wall and partition layout. Secure in place with fasteners or welding at maximum 24 inches. Coordinate installation of sealant with floor and ceiling tracks.

E. Place studs at 16 inches o.c.; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method unless noted otherwise.

F. Construct corners using minimum three studs. Double stud at wall opening, door and window jambs.

G. Erect load bearing studs one piece full length. Splicing of studs is not permitted.

H. Erect load bearing studs, brace and reinforce to develop full strength to meet design requirements.

I. Extend stud framing to underside of floor or roof structure above.

J. Fasten metal studs by welding or screw-fastening as indicated. Do not fasten framing members by wire tying.

K. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

L. Install intermediate studs above and below openings to match wall stud spacing.

M. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.

N. Attach cross studs or furring channels to studs for attachment of fixtures anchored to walls.

O. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

P. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 FIELD QUALITY CONTROL

Q. Testing: At Owner's request, Contractor shall provide spot testing of actual properties of steel framing to verify compliance with specifications.

3.04 CLEANING

R. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes: Metal fabrications, including items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems in other CSI Numbers of these Specifications. Types of metal items include, but are not limited to, the following:
   1. Steel pipe and tube bollards
   2. Mechanical wall screen panels
   3. Miscellaneous framing and supports including, but not limited to the following:
      a. Supports for suspended ceiling suspended finishes, fixtures and other items as necessary, including flat screen monitors, equipment, fixtures and similar items.
      b. Applications where framing and supports are not specified in other CSI Numbers.
      c. Other items as indicated
   4. Miscellaneous steel trim.
   5. Other items as indicated or required.

B. Related Requirements:
   1. CSI Number 03 30 00 “Cast in Place Concrete for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturer’s written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, template, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
   1 Steel framing and supports for operable partitions
   2 Steel framing and supports for countertops
   3 Steel tube reinforcement for low partitions.
   4 Steel framing and supports for overhead doors and grilles.
   5 Steel framing and supports for mechanical and electrical equipment

6 Prefabricated building columns.
7 Shelf angles.
8 Metal ladders.
9 Miscellaneous steel trim.
10 Metal bollards
11 Abrasive metal thresholds.

B. Submit Drawings for the fabrication and erection of assemblies of items which are not completely shown by the Manufacturer's data sheets.

1.04 INFORMATIONAL SUBMITTAL

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES

1.05 QUALITY ASSURANCE

A. Standards: Comply with the following, except as otherwise shown and specified:
1. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
2. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
3. AWS "Structural Welding Code-Steel."
4. ASTM A6 "General Requirements for Rolled Steel Plates Shapes, Sheet Piping and Bars for Structural Use."
5. Aluminum:
a. Plate and Sheet: ASTM B209 (ASTM B209M) Alloy 6061-T-6
b. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T-6
c. Aluminum-alloy Rolled Tread Plate: ASTM B632/B632M Alloy 6061-T-6.
d. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

B. Qualifications: Qualify welding procedures and welding operators in accordance with AWS "Standard Qualification Procedure."

1.06 DELIVERY, STORAGE AND HANDLING

A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.

B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

1.07 PROJECT/SITE CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible, to ensure proper fitting of the Work. Allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Shapes, Plates, Rod, Bars and Bar-size Shapes: ASTM A36.

B. Steel Pipe: ASTM A501 (Fy = 36 ksi), or AST A53, Type E or S, Grade B (Fy = 35 ksi).

C. Steel Tube: ASTM A500 (Fy = 46 ksi).

D. Cold-Finished Carbon Steel Bars: ASTM A108, Grade as selected by fabricator.

E. Hot-rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A1011, pickled and oiled.

F. Cold-rolled Carbon Steel Sheets: ASTM A1008.

G. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.

H. Cold-drawn Steel Tubing: ASTM A512, sunk drawn, butt welded, cold-finished and stress-relieved.
   1. Fasteners: Exposed. MUST be stainless steel. Paint screw head brown.

I. Perforated Metal: ASTM A653
   1. Hole Type: Round
   2. Material: Galvanized, G90
   3. Finish: Mill Finish
   4. Hole Size and Pattern: 3/32” Round on 3/16” Staggered Centers.
   5. Straight Rows parallel to length of sheet.
   6. Percent Open Area: 23%
   7. Sheet Size: 48” x 120”
   8. End Pattern: Sheared both ends.

J. Anchors:
   1. Masonry Anchorage Devices: Expansion shield, FS FF-S-325.
   2. Toggle bolts: Tumble-wing type, FS FF-B-588; type, class and style as required.
   3. Chemical Type Anchors: 2-component chemically curing anchors for concrete or masonry construction, capsule, or injection type, designed to accept manufacturer’s galvanized anchor rod.

4. Threaded-type concrete inserts: Galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts: either malleable iron complying with ASTM A47 or cast steel complying with ASTM A27; hot-dip galvanized in compliance with ASTM A153.
5. Wedge-type concrete inserts: Galvanized box-type ferrous castings, designed to accept 3/4 inch diameter bolts having special wedge-shaped heads, either malleable iron complying with ASTM A47 or cast steel complying with ASTM A27; hot-dip galvanized in compliance with ASTM A153.
6. Provide carbon steel bolts having special wedge-shaped heads, nuts washers and shims; all galvanized in compliance with ASTM A153.

K. Fasteners: Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.
1. Bolts and nuts: ASTM A307, Grade A, regular hexagon head.
2. Bolts, hexagon and square: ANSI B-18.2.1.
3. Bolts, round head: ANSI B-18.5.
4. Lag bolts: Square head type.
5. Wood screws: ANSI B-18.6.1, flat head carbon steel.
6. Plain washers: ASTM F844 helical spring type carbon steel.

L. Gratings: Grating shall be electro-pressure welded construction type as shown on Drawings. Exterior gratings shall be hot-dipped galvanized, after fabrication. Furnish perimeter support angles with welded anchors as detailed.

M. Metal Primer: VOC compliant.
1. Exterior exposed metal fabrications shall have a spray applied epoxy-polyamide type primer, with finish paint coat(s) as described in 09 90 00.
2. Interior exposed metal fabrications shall have spray applied epoxy-polyamide type primer paint with finish paint as described in 09 90 00.
3. See also CSI Number 09 96 00 High Performance Painting.

N. Stainless steel:
1. Tubing and pipe: ASTM A269 and ASTM A312, seamless, and unless indicated otherwise on Drawings, required by design, or as directed by Architect, provide Type 304 with minimum wall thickness equivalent to Schedule 40.
2. Plate, sheet, and strip: ASTM A167 and unless indicated otherwise on Drawings, provide Type 304.
3. Finish: No. 4 unless noted otherwise on Drawings.

2.02 ACCESSORIES

A. Inserts and Anchorages: Furnish inserts and anchoring devices to be set in concrete or built into masonry for installation of Miscellaneous Metal Work. Provide setting Drawings, templates, instructions, and directions for installation of anchorage devices.

B. Concrete Fill (for concrete filled pipe bollards): Comply with requirements of CSI Number 03 30 00 for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi.

2.03 FABRICATION

A. General: For fabrication of Miscellaneous Metal Work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes, including zinc coatings.

B. Shop Assembly: Preassemble items in shop, when possible, to minimize field splicing and assembly of units at the site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Workmanship:
1. Use materials of the size and thickness shown, or if not shown, of the required size and thickness to produce adequate strength and durability of the finished product for the intended use. Work to the dimensions of fabrication and support. Use type of materials shown or specified for various components of Work.
2. Form exposed Work true to line and level with accurate angles, surfaces, and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
3. Weld corners and seam continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flat-head (countersunk) screws or bolts.
5. Provide for anchorage of type shown, coordinated with supporting structure and the progress schedule. Fabricate as required to provide adequate support for the intended use of the Work.
6. Cut, reinforce, drill, and tap Miscellaneous Metal Work as may be required to receive finish hardware and similar items of Work.
7. Use hot-rolled steel bars for Work fabricated from bar stock, unless Work is indicated to be fabricated from cold-rolled, or cold-finished stock.

D. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports which are not a part of the structural steel framework, as required to complete Work.
2. Fabricate miscellaneous units to sizes, shapes and profiles shown, or if not shown, of the dimensions required to receive adjacent grating, plates, doors, or other Work to be retained by the framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars of all welded construction using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and similar items to be anchored to the Work.
3. Equip units with integrally welded anchor straps for casting into concrete or building into masonry wherever possible. Furnish inserts if units must be installed after concrete is poured. Except as otherwise shown, space anchors 24 inches o.c., and provide minimum anchor units of 1-1/4 inch x 1/3 inch x 8 inch steel straps.

E. Support Pedestals and Frames: Provide square steel tube pedestal as indicated on Drawings.
1. Pedestal as manufactured by Chase Security Systems http://www.chasesec.com/
a. Finish: Powder Coated in color selected by Architect.

F. Fabricate bollards from steel pipe or tube of size indicated on Drawings. Metal bollards shall be a minimum of 6 inches in diameter, round or square and be directly or sleeve set a minimum of 1/3 the exposed height below the finished adjacent surface.

G. Miscellaneous Steel Trim: Provide shapes and sizes as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other Work. Metal trim in continuous runs shall have concealed splices and be of sufficient gauge that natural distortions are not visually apparent. All exposed edges to the public shall be radiused or sharp edges eased.

H. Prevent galvanic action and other forms of corrosion by insulating contact points between metals and incompatible metals or materials. Provide separation of resilient gasket or other appropriate material to separate aluminum bar gratings and angles where units are attached to steel.

2.04 FINISHING

A. Galvanizing: All metal fabrications which will be exposed to the exterior in the finished Work, including steel indicated to be painted, shall be hot-dip galvanized after fabrication, including bolts and nuts. Galvanizing shall comply with ASTM A123 and A153 for the hot-dip process after fabrication.

B. Shop Painting:
1. Shop paint Miscellaneous Metal Work, except those members or portions of members to be embedded in concrete or masonry, surfaces, and edges to be field welded, and galvanized surfaces, unless otherwise indicated.
2. Remove scale, rust, and other deleterious materials before shop coat of paint is applied. Clean in accordance with SSPC SP-2, SP-3, or SP-7, as required. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1.
3. Apply one shop coat of metal primer paint to fabricated metal items, except apply 2 coats of paint to surfaces which are inaccessible after assembly or erection.
4. Immediately after surface preparation, brush, or spray on metal primer paint in accordance with Manufacturer's instructions, and to provide a uniform dry film thickness of 2 mils for each coat.
5. Comply with CSI Number 09 91 96 for application of high-performance paint system primer applied to exposed exterior bollards, enclosure gates, steel framed canopies, mechanical screen wall panels, and other items as may be indicated on Drawings indicated to receive high performance paint system.

C. Powder Coated Finish: Provide powder coated finish to items as may be indicated on Drawings.
1. Multi-step oven cured TGIC powder coated finish consisting of thorough cleaning, pretreatment, powder coat primer and Ultra polyester finish (TGIC) at 2-4 mils.
a. Color: Custom color as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurface to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurface.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate Trades.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Shop Drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Install pipe bollards in concrete footings plumb and level, accurately fitted, free from distortion or defects. Provide adequate bracing as required to hold bollard in position until concrete has been placed and cured.
   1. Fill bollards solidly with concrete and mound top surface to shed water.

F. Gates: Securely anchor gates and erect plumb, level, and true, with smooth operating hardware.
   1. Securely anchor gates and erect plumb, level, and true, with smooth operating hardware.
   2. Secure for full opening without interference.
   3. Attach hardware by means which will prevent unauthorized removal.

G. Obtain Architect approval prior to site cutting or making adjustments not scheduled.

H. Prevent galvanic action and other forms of corrosion by insulating contact points between metals and incompatible metals or materials. Provide separation of resilient gasket or other appropriate material to separate aluminum bar gratings and angles where units are attached to steel.

I. Touch-up Painting: Touch-up welds, abrasions, and other areas where shop prime paint has been removed or is damaged with specified prime paint or galvanizing repair paint. Comply with low-emitting material requirements as specified in CSI Number 01 60 00 for field applied paint within building envelope.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch

3.04 ADJUSTMENT

A. Lubricate hinges and adjust gates to operate freely. Adjust hardware for smooth operation.

3.05 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 51 33

METAL LADDERS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Aluminum Access Ladders.
B. Aluminum Ship Ladders.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 50 00 – Metal Fabrications.
B. CSI Number 06 10 53 – Miscellaneous Rough Carpentry.
C. CSI Number 07 54 23 – Thermoplastic-Polyolefin (TPO) Roofing.
D. CSI Number 07 60 00 – Flashing and Sheet Metal.
E. CSI Number 07 72 33 – Roof Hatches & Accessories.
F. CSI Number 07 92 00 – Joint Sealants.

1.03 REFERENCES

A. AA – Aluminum Association.
B. ANSI-ASC A14.3 – Ladders – Fixed – Safety Requirements.
C. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
E. International Building Code (IBC).
F. Occupational Safety and Health Administration (OSHA) Regulations:
   1. OSHA 29 CFR 1910.23.
   2. OSHA 29 CFR 1910.25.
   3. OSHA 29 CFR 1910.27.
   4. OSHA 29 CFR 1910.28.
   5. OSHA 29 CFR 1910.29.
   6. OSHA 29 CFR 1926.1053.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data and technical sheets, written installation instructions and limitations, and recommendations for each product/material to be used, including setting drawings, templates, finish requirements, and details of anchorage devices.
   1. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected Work.
   1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   2. Provide templates for anchors and bolts specified for installation under other CSI Numbers.
   3. Provide reaction loads for each hanger and bracket.
C. Manufacturer’s standard warranty.

D. Manufacturer's qualification data.
E. Installer’s qualification data.
F. Closeout Submittals:
    1. Manufacturer's Installation Instructions and Operation & Maintenance: Indicate installation, operation and maintenance requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing metal ladders similar to those indicated for this Project with a minimum of 5 years of experience.
    1. Record of successful in-service performance.
    2. Sufficient production capacity to produce required units.
    3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.
B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.
C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site ready to use, in manufacturer’s original unopened packaging, with labels intact.
B. Handling: Comply with Manufacturer's instructions. Exercise proper care in handling of Work so as not to damage or disrupt finished surfaces.
C. Store materials under cover in a dry and clean location off the ground to protect against damage while stored at the Project Site.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements prior to fabrication. Proper fit and attachment of parts is required.
    1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.
B. Coordinate the Work to be scheduled with other trades required.

1.08 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this CSI Number for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
    1. Defects in materials and workmanship.
    2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
    3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.
B. Manufacturer shall be notified immediately of defective products and be given a reasonable opportunity to inspect the goods prior to return.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: O'Keeffe's, Inc.,** www.okeeffes.com**.**
   2. Alaco Ladder, www.AlacoLadder.com.
   3. Precision Ladders, LLC, www.PrecisionLadders.com.
   4. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS – ALUMINUM SHIP LADDER

A. **Basis of Design Product: Model 520 (without roof hatch) or 523 (with access to roof hatch).**
B. Configuration:
   1. Incline: 75 degree, or as shown on Drawings.
C. Width: 24" between rails.
D. Length: Verify in field.
E. Materials:
   1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
   2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.
F. Finish: Clear Anodic Finish, AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.
G. Fabrication:
   1. Rungs: Not less than 1-1/4 inches (32 mm) in section, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
      a. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
   2. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.
   3. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.
   4. Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.
H. Rail and Harness Fall Arrest System: In accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
B. Verify tolerances and correct improper conditions.
C. Identify conditions detrimental to providing proper quality and timely completion of work.
D. Do not proceed with installation until detrimental conditions have been corrected. Commencement of Work will be construed as acceptance of subsurfaces.
E. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
F. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

3.02 INSTALLATION

A. Comply with manufacturer's recommendations and install using the manufacturer’s anchoring options as detailed on shop drawings and installation instructions.
B. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.03 CLEANING AND PROTECTION

A. Clean exposed surfaces per manufacturer's written instructions. Touch up damaged metal coatings. Repair or replace damaged products before Substantial Completion.
B. Protect installed products until completion of project.
C. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 05 52 00

METAL RAILINGS & HANDRAILS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. Performance Requirements: Structural performance of handrails and railing systems: shall comply with ASTM E985 based on testing in accordance with ASTM E894 and E935.
   1. Comply with local code and regulatory agency requirements for impact loads and railing design.
   2. Railings and railing assemblies shall be designed and fabricated to resist lateral force of 75 lbs. at any point without set or permanent damage.

B. Design Requirements: Comply with ASTM E985 and IBC Section 1607.

1.02 SUBMITTALS

A. Shop Drawings: Submit Drawings showing dimensions, details and erection diagrams, connections with other work, and calculations sealed by a qualified Structural Engineer registered in the State where the Project is located, certifying conformance with Code and Performance Requirements.

B. High Performance Paint System: In accordance with CSI Number 09 96 00. Provide paint data from manufacturer.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with local code and regulatory agency requirements for handrail and railing design and the following:
   1. ANSI A117.1, 1998 "Accessible and Usable Buildings and Facilities".
   2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
   3. ADA Accessibility Guidelines (ADAAG).

B. Engineer Qualifications: A qualified engineer who is registered in the State of Arizona and who is experienced in providing engineering services of the kind indicated for metal handrails and railing similar to those of this Project in material, design, and extent.

C. Welding: Conforming to AWS D1.1 and performed by certified welders.

1.04 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.

B. Storage: Adequately protect against damage while stored at the Project Site.

C. Handling: Comply with manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Field Measurements: Verify existing conditions by taking field measurements.

PART 2 - PRODUCTS

2.01 MATERIALS – GENERAL

A. Metal used for railings should be tube stock, not solid stock, and conform to ASTM A 500. Unsupported length shall not exceed 6'-0" for diameters 2 inches or less.

B. The use of expansion bolts to secure railing assemblies to vertical or horizontal surfaces is not allowable. Anchorage systems shall consist of direct imbeds (sleeves or plates) and/or welding.

C. Structural Steel Shapes, Plates, Bars and Bar-size Shapes: ASTM A36.

D. Gray Iron Castings: ASTM A48, Class 30.

E. Malleable Iron Castings: ASTM A47, Grade as selected.

F. Steel Pipe: ASTM A53, type as selected, Grade A standard weight (Schedule 40).

G. Metal Primer: VOC compliant.
   1. Exterior exposed metal fabrications shall have a spray applied epoxy-polymide type primer, with finish paint coat(s) as described in the applicable Division 09 Painting specification.
   2. Interior exposed metal fabrications shall have spray applied epoxy-polymide type primer paint with finish paint as described in the applicable Division 09 Painting specification.

H. Wall Bracket (Pipe Handrails): Julius Blum #382 www.juliusblum.com with appropriate fastener and anchor plate.

I. Anchoring Cement: Prepackaged, erosion-resistant, non-shrink hydraulic controlled anchoring cement recommended for exterior use.

J. Nonshrink, Nonmetallic Grout: Prepackaged, non-shrink, nonstaining grout complying with ASTM C 1107 and recommended for interior and exterior use as applicable.

2.02 FABRICATION

A. Shop Assembly:

1. Conform with AISC Standard Specifications, Rules and Practice in the "Steel Construction Manual".
2. Preassemble items in shop to the greatest extent possible to largest practicable sizes to minimize field splicing/welding and assembly of units at the site.
3. Limit size of shop assembled units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
4. Form and fabricate the Work to meet installation conditions.
5. Include accessories to adequately secure the Work in place.
6. Make provisions to connect with or to receive abutting construction.

B. Shop/Factory/Finishing: Clean surfaces of grease, rust, mill scale, and other foreign matter, and apply coat of primer, except galvanized surfaces.

C. Galvanizing: Galvanize all exterior railing, sleeves, brackets and flanges after fabrication to comply with ASTM A123 and ASTM 153 as applicable.

D. Make connections between members, unless otherwise indicated by welding.
1. Cope and cut components for hairline fit prior to welding.
2. Accurately align members.
3. Fabricate joints watertight for exterior applications.
4. Welds shall be flush type, with fillets dressed to uniform radius, using the shielded arc method.
5. Adjoining railing splices shall be fully concealed in runs that appear constant.
6. At elbow bends, the design shall facilitate mitered joints.
7. Provide welded end caps to all exterior railings.

E. Where bolted or screw connections are indicated or necessary, use round or oval head bolts and tamper-resistant screws and conceal in the finished work to the greatest extent possible.

F. Provide metal end caps at exposed or open end conditions.

G. Grind welds, projections and corners in finished surfaces smooth. No identifying marks shall remain exposed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

A. Install steel railings and handrails at locations indicated.

B. Install items anchored in concrete in the formwork, where practicable.

C. Install items to be built into masonry so masonry can be built up to them.

D. Where indicated, anchor posts in concrete with core drilled holes or pre-set sleeves of diameter at least 3/4” more than diameter of post being anchored and not less than 5” deep. Fill space with non-shrink, non-metallic grout or anchoring cement.

E. Install posts and vertical members plumb within 1/8 inch of vertical. Install longitudinal members parallel with each other and to floor surfaces or slope of stairs to within 1/8 inch per 10 running feet.

F. Securely anchor wall brackets.

3.03 CLEANING

A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes: Rough carpentry including, but not limited to:
   1. Fire retardant treated plywood telephone and electrical backer boards.
   2. Fire retardant treated miscellaneous backing, blocking, nailers and curb, including wood construction related to roofing
   3. General: Blocking and Backing.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. Submit technical data for wood preservative and fire retardant products.

1.3 QUALITY ASSURANCE

A. Identify each piece of lumber or plywood used for structural framing with grade and trade mark of a lumber grading organization. Trade mark of manufacturer shall also appear on each piece.

B. Grading Rules: Conform with applicable requirements of American Lumber Standards "Simplified Practice Recommendation R-16" and to grading rules of manufacturer's association under whose rules the lumber is produced.

C. Standards: Conform with requirements of American Plywood Association, U. S. Dept. of Commerce Commercial Standards and American Wood Preservers Association

D. Standards, as they apply.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.

B. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

C. Handling: Comply with manufacturer's instructions.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Store materials for which a maximum moisture is specified in areas where humidity can be controlled.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS - GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable design stresses, as published by manufacturer, shall meet, or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed be a qualified independent testing agency.

2.2 LUMBER MATERIALS

A. Species: Douglas Fir – Larch, Hem Fir graded in accordance with Standard Grading and Dressing Rules of WCLIB. Framing lumber shall be stress grade. All sides shall be surfaced.

B. Lumber Grades: As follows unless noted differently on the Drawings:
   1. Misc. blocking, bridging, etc.; including nailers at roofing: Utility.
   2. Grounds and furring: Construction Grade Douglas Fire or No. 2 White Pine.

C. Moisture Content:
   1. Lumber shall be air-dried or kiln-dried.
   2. At time of installation, moisture content, expressed as a percentage of the
   3. weight of the oven-dry wood, shall not exceed 19 percent for lumber of up to
   4. two inches nominal thickness and 15 percent for exterior trim and siding.
   5. Moisture content of lumber over two inches nominal thickness shall conform to the rules of the association under which it is graded.

D. Blocking and nailers at roofing: Provide longest lengths possible for blocking and nailers to eliminate joints.

2.3 SHEATHING MATERIALS

A. Plywood Backing Panels:
   1. For mounting of telephone and electrical equipment, provide Grade C-D Exposure 1 plywood panels, 15/16 inch thick, unless otherwise indicated.

2. For roofing: 1/2 inch thickness, fire treated Douglas Fir, C-D Exterior glue and shall be stamped with grade trademark of the American Plywood Association and shall meet the requirements of the latest edition of U.S. Product Standard PS-1 for softwood plywood.

2.4 FACTORY WOOD TREATMENT

A. Preservative Treatment:
   1. Materials:
      a. Chromated copper arsenate (CCA) shall not be allowed.
      b. Provide ammoniacal copper quaternary (ACQ) or copper boron azole (CBA) as produced by the following manufacturers:
         a) Arch Wood Protection, Inc., Smyrna, GA (866) 789-4567, www.wolmanizedwood.com or www.naturalselect.com.
         b) Chemical Specialties, Inc., Charlotte, NC (800) 421-8661,
         c) www.treatedwood.com
         d) Osmose, Inc., Wood Preserving Division, Griffin, GA (800) 241- 0240, www.osmose.com.
   2. Locations Required:
      a. Wood sillplates and ledgers bolted in direct contact with concrete or masonry, located at or below grade only shall be pressure treated lumber.
      b. Blocking and nailers occurring on top of or above the roof deck, including the nailer beneath the flashing at parapet caps, shall be treated lumber.
      c. Other locations as required by Code.

B. Fire-Retardant Treatment: Hickson Corp. Dricon FRTW in accordance with UL label.
   1. All, wood studs, plates, sheathing, blocking, etc. shall be fire retardant treated.
   2. Dimensioned lumber shall be kiln dried to a maximum moisture content of 18 percent before and after milling and fire protective treatment.

2.5 ACCESSORIES

A. Nails: Common wire, galvanized for exterior Work, meeting ASTM F1667 of the sizes indicated on the Drawings.

B. Screws: Standard domestic manufacture, bright steel, except galvanized for exterior use and of brass, bronze, aluminum, or stainless steel when used to attach items made of those materials. Screws used for attaching interior trim and finish to drywall partitions shall be Type S self-drilling, self-tapping corrosion resistant coated steel drywall screws of required lengths as specified in CSI Number 09 29 00.
   1. Screws used for attaching preservative and fire treated wood shall be Type S self-drilling, self-tapping corrosion resistant coated steel screws. Acceptable products include the following:
      a. DEC-KING Exterior Wood Screw with Climacoat.
      b. Tapcon Concrete Anchor with Blue Climaseal or White UltraShield.
      c. Wood-To-Metal TEKS with Grey Spex.
      d. Roofgrip with Spex or Blue Climaseal.
      e. GY-FAST Nail with Climacoat.
      f. Maxi-Set Tapcon White UltraShield.

C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers as indicated. Bolts, nuts, and washers wholly or partially exposed on exterior shall be galvanized.

D. Structural Bolts: Machine bolts, or carriage bolts, of structural grade steel with square nuts, conforming to ASTM A307.

E. Steel Plates and angles: ASTM36, galvanized after fabrication.

F. Lag screws, shear plates and split ring connectors: Conform to requirements of the "National Design Specifications for Stress Grade Lumber and its Fastenings" of National Forest Products Association.

G. Power driven inserts for attachment of wood blocking and nailers (including blocking and nailers at roofing): Ramset, or as approved by Structural Engineer through Architect meeting FS GGG-D-777a. Install as per manufacturer's printed directions. Charge shall be powerful enough to prevent spalling of concrete.

H. Galvanizing: ASTM A653.

I. Toggle Bolts: FS FF-B-588.

PART 3 - EXECUTION

3.1 FRAMING

A. Wood Backing: Provide wood backing, furring, stripping or blocking indicated or required for installation and attachment of work of other trades provide fire-proofed wood backing approved by Building Official where required by Code in noncombustible or fire-rated construction.

B. Connections: Subdrill where necessary to avoid splitting.

C. Bolts: Drill bolt holes 1/32 inch larger than bolt diameter. Use square plate or malleable iron washers under heads and nut where they bear against wood. Re-tighten bolts immediately prior to concealing with finish materials. Re-tighten exposed bolts immediately prior to inspection by Building Official.

D. Lag Screws and Screws: Subdrill, use square plate or malleable iron washer under lag screw heads when they bear on wood.

E. At roofs: Provide crickets, cants, equipment curbs (except where indicated to be a pre-manufactured curb specified elsewhere, wood saddles, cant strips, curbs for plywood at parapet walls; other miscellaneous backing, blocking, curbing, and wood nailers bolted to tops of concrete or masonry and at expansion joints, as specified or required).

3.2 PLYWOOD SHEATHING

A. General: Comply with applicable recommendations contained in APA Form No. E30, “APA Engineered Wood Construction Guide,” for types of structural use panels and applications indicated.
   1. Comply with “Code Plus” of the above-referenced guide.

B. Securely attach to substrate by fastening as indicated, complying with the following:
   1. ICC NER-272 for power-driven fasteners.
   2. IBC Table 2304.9.1, “Fastening Schedule.”

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

D. Sheathing shall have edges blocked and nailed for shear wall stresses.

E. At non-tongue and groove sheathing, provide plywood clips at 24 inches O.C. maximum at unsupported or unblocked edges.

3.3 PLYWOOD BACKING PANELS

A. Plywood Backing Panels: Install with the “C” or best face on exposed side.

3.4 CLEANING

A. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of away from premises in a legal manner.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes:
   1. Architectural wood cabinets.
   2. Plastic-laminate-faced architectural cabinets.
   3. Solid surfacing fabrications, including countertops and backsplashes.
   4. Hardwood Plywood
   5. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets, unless concealed within other construction before cabinet installation.

1.02 RELATED CSI NUMBERS

A. CSI Number 07 92 00 – Joint Sealants.

B. CSI Number 08 80 00 – Glazing.

C. CSI Division 22 – Plumbing.

D. CSI Division 26 – Electrical.

1.03 REFERENCES

A. ANSI/AWI 0641 – Architectural Wood Casework Standard.

B. ANSI/NPA A208.2-09 – Medium Density Fiberboard (MDF) for Interior Applications.

C. ASTM C920-14a – Standard Specification for Elastomeric Joint Sealants.

D. ASTM D628-10 – Standard Test Method for Tensile Properties of Plastics.

E. ASTM D785-08 – Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.

F. ASTM D790-10 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

G. ASTM D5420-10 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

H. ASTM E84-14 – Standard Test Method for Surface Burning Characteristics of Building Materials

I. ASTM E228-11 – Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer

J. ASTM G21-13 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

K. ASTM G22-76(96) – Standard Practice for Determining Resistance of Plastics to Bacteria

L. NFPA 255-06 – Standard Method of Test of Surface Burning Characteristics of Building Materials

M. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

A. Product Data: Submit for each type of product, including hardware, adhesives, and accessories, and finishing materials and processes. Submit product data with resistance to list of chemicals.

B. Samples:
1. Submit (2) 3-inch x 5-inch samples of each type or color of plastic laminate.
2. Submit (2) 3-inch x 3-inch samples of each type or color of thermally fused laminate.
3. Submit (2) 6-inch x 6-inch samples of each type or color of solid surface material.
4. Submit (2) 6-inch x 6-inch samples of (2) pieces of solid surface material cut and seamed together as representative of an inconspicuous seam. Approved samples will be retained as standards for the work.
5. Submit (2) 12-inch x 12-inch samples of each wood species to receive transparent finish.

C. Shop Drawings: Submit dimensioned plans, elevations, and large-scale details for each item, including component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, and sizes of furring, blocking, and hanging strips.
1. Include concealed blocking, reinforcement, and coordination requirements with adjacent work.
2. Show locations and sizes of cutouts and holes for electrical switches, outlets, and other items installed in architectural woodwork.
3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Installers: Provide work of this CSI Number executed by competent installers with a minimum 5 years' experience in similar work, and approval and training as required by the product manufacturers.

B. Applicable Standard: Perform work in accordance with the referenced standards. Products shall comply with the following minimum defaults per ANSI/AWI 0641:
1. Aesthetic Performance: Custom Grade.
2. Structural Performance: Duty Level 3 – Institutional.
3. Affix Quality Grade Stamp to each unit of product (e.g., each case; each panel; each bundle of trim).

C. Mock-ups:

1. Erect (1) full-size mockup of each component (base cabinet, upper cabinet, countertop, etc.) at Project site demonstrating quality of materials and execution for Architect review and approval. Provide units with specified countertops and hardware installed.
2. Mock-ups will be examined to ascertain quality and conformity to AWI quality level standards and Specification requirements.
3. Should mock-ups not be approved, rework or remake until approval is secured. Remove rejected mockups from Project site.
4. Mock-up may remain as part of the Work and shall be used as a standard for acceptance of subsequent work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Follow ANSI/AWS 0641 standards for delivery, storage and handling.

B. Do not deliver woodwork until painting and similar operations that could damage woodwork has been completed in installation areas. If woodwork must be stored in areas other than where it is to be installed, store only in areas where environmental conditions comply with Field Conditions in this CSI Number.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until the building is enclosed, wet work is complete, and HVAC system operates and maintains temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

C. Established Dimensions: Where woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related items of Work specified in other CSI Numbers to ensure that architectural woodwork can be supported and installed as shown.

1.09 WARRANTY

A. Submit manufacturer’s standard warranties for materials. Promptly correct any defects or deficiencies identified within the warranty period to the satisfaction of the Architect and Owner at no expense to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS – GENERAL

A. Provide materials that comply with the requirements of AWS's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Provide basis of design materials as noted herein and on Drawings.

2.02 MATERIALS – WOOD

A. Softwood Lumber (Concealed Locations): Graded in accordance with applicable standard for grade of work specified, Douglas Fir species, plain sawn, moisture content of 6- to 8-percent, with flat grain, of quality suitable for transparent finish. Thicknesses as shown on Drawings.

B. Hardwood Lumber (Exposed Locations): Graded in accordance with applicable standard for grade of work specified, Ash species, plain sawn, moisture content of 6- to 8-percent, with flat grain, of quality suitable for transparent finish. Thicknesses as shown on Drawings. Stained to match wood doors, unless noted otherwise on the Drawings.

C. Hardwood Locker Benches, where shown on Drawings: Maple species with clear stain and sealant, and with beveled radius edges.

D. Hardwood edging on woodwork, where shown on Drawings: Maple, Ash or Birch species, stained to match plastic laminate.

2.03 SHEET MATERIALS

A. Medium Density Fiberboard (MDF) with and without a thermally fused laminate (TFL) finish (commonly known as Melamine).
   1. Basis of Design for all woodwork cabinet bodies: Medite II or Medite FR as manufactured by Roseburg Forest Products, www.roseburg.com. Provide Medex in lieu of Medite II at all wet areas or within 2 feet of any sink or source of water. Or other MDF products approved by Architect.
   2. See Drawings for thickness, dimensions, and specific details.
   3. Thermally fused laminate color: As shown on Drawings or as selected by Architect from the full range of manufacturer's standard colors.

B. Softwood Plywood: DOC PS 1, MDO (Medium Density Overlay), or other plywood product approved by Architect. Provide ¾-inch thick Marine Core/Grade plywood for underlayment at all countertops.

C. Hardwood Plywood: Type of glue recommended for application. Face veneers, cuts, stains, and finishes as shown on Drawings.

2.04 MATERIALS – PLASTIC LAMINATES

A. High Pressure Laminate (HPL):

1. Premium high pressure laminate from the following approved manufacturers or as shown on Drawings:
    a. Formica
    b. Pionite
    c. Wilsonart
2. Finishes, Colors and Patterns: As shown on Drawings or selected by Architect.

2.05 MATERIALS – SOLID SURFACE MATERIALS

A. Solid Surface Material: Non-pourous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler, and pigment.
1. From the following approved manufacturers, or as shown on the Drawings:
    a. Corian.
    b. Formica Everform.
    c. LX Hausys.
    d. Wilsonart.
2. Finishes, Colors and Patterns: As shown on Drawings or selected by Architect.
3. Nominal Thickness – Horizontal Applications: ½ inch (12mm) minimum or as shown on Drawings.
4. Nominal Thickness – Vertical Applications: ½ inch (12mm) minimum or as shown on Drawings.
5. Backsplash color to match countertop, unless noted otherwise in the Drawings.
6. Finish: Ensure surfaces have uniform finish.

B. Fabrication and Installation: Work must be carried out by a certified installer acceptable to the manufacturer for issuance of the full manufacturer's warranty at completion of the Work.

2.06 ACCESSORIES

A. Adhesives:
1. Laminate Adhesive: 3M Fastbond 30, or equivalent to suit application.
2. Wall Panel Adhesive: Cartridge type compatible with paneling and wall substrate.
3. Wood Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
4. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.

B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application. Threaded steel for concealed joints.

2.07 HARDWARE

A. Concealed Overlay Cabinet Hinges – 100-to-110-degree operability, meeting ANSI/BHMA A156.9 Grade 2 requirements, with hinge arm and cup cover caps:
1. **Basis of Design: Blum, Inc. CLIP top BLUMOTION 110 degree, Nickel (NI) finish.**
2. Salice, www.salice.com/us/en.
3. As approved by Architect and in compliance with substitution requirements.

B. Drawer and Door Pulls – 4" (102mm) satin stainless steel (US32D / 630) wire pull:
1. Trimco #562-4 with 630 finish

2. Doug Mockett & Company, Inc. #DP57B
3. Richelieu Hardware #BP221170
4. GlideRite Hardware #5102-SS

C. Shelf Pin Supports for Cabinet Mounted Shelving:
1. Richelieu Hardware #128180 Metal Shelf Pin, Solid Brass with Nickel Finish
2. Brusso Hardware #K-10S Shelf Support, Stainless Steel
3. Or equivalent approved by Architect.

D. Drawer Slides – Light Duty, 100 lb. capacity, 1" over-travel, BHMA and AWI certified, polymer ball bearings, clear zinc finish:
1. Accuride International Inc. #3017, or equivalent approved by Architect.

E. Cabinet Door/Drawer Locks – Die-cast zinc body; bar, face plate and parts made of steel; chrome finish; for interior and exterior applications:
1. National Hardware by Assa Abloy or equivalent approved by Architect.
2. Provide locks on all cabinet doors and drawers as shown on the drawings.
3. Keying of locks shall be different for each room or as directed by Owner.

F. Grommets: 3" or as shown on Drawings.
1. Doug Mockett & Company, Inc., or equivalent approved by Architect.
2. Color: To match surface it is installed in, or as selected by Architect.
3. Quantity: 2 per person at countertop and desk surfaces, unless shown otherwise on the drawings.

G. Pilaster Shelf Standards and Supports:
1. Standards: Knape & Vogt (KV) 255 series steel pilaster standards with Zinc (ZC) finish; 23-gauge high strength steel and ½" vertical slot adjustability, or equivalent approved by Architect.
2. Shelf supports: Knape & Vogt (KV) 256 steel supports with Zinc (ZC) finish, or equivalent approved by Architect.

H. Countertop Support Brackets:
1. CounterBalance Workstation Bracket, www.counterbalanceshop.com, or equivalent approved by Architect.
2. Sizes as shown on Drawings or as recommended by manufacturer for depth of countertop.
3. Provide with 3" x 3" 45-degree notch that allows for wall cleat and wire run clearance.
4. Load Limit: 1,400 lbs. minimum per pair.
5. Finish: Textured powder coat.
6. Color: As shown on Drawings or as selected by Architect.

I. Provide left- or right-handed versions as necessary to conceal fasteners from view to the greatest extent possible. Architect shall be the final judge of the appropriate handing at each installation location

J. Gate Hinges and Latches:
1. Gate Hinge: Mechanical Spring Door Hinge to return gate to latch, subject to approval by Architect.
2. Gate Latch: Assa Abloy, Rockwood 602 – Secret Gate Latch, US26D/626 Satin Chrome finish; or equivalent approved by Architect.

K. Provide all other hardware necessary to fulfill the function of architectural woodwork and cabinets as shown on Drawings, subject to approval by Architect. Typical hardware finish shall be satin

stainless steel or satin chrome, unless indicated otherwise. All hardware finishes subject to approval by Architect.

2.08 FABRICATION

A. Fabricate architectural woodwork and cabinets in conformance with AWI **Custom** Grade Standards.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges of solid wood lumber to 1/16-inch radius, unless otherwise shown on Drawings.

D. Exposed fasteners are not allowed in the finish Work on exposed and semi-exposed surfaces.

E. Shop assemble woodwork for delivery to site in units easily handled and to permit passage through building openings.

F. Exposed Edges: Cap exposed edges of plastic laminate casework with moisture-curing reactive polyurethane hot melt adhesive (PUR) applied 1mm PVC banding with eased corners. Use one piece for full length only.

G. Shelves: Fabricate shelves with ¾-inch MDF, unless otherwise indicated.
   1. Laminate, Shelves within Casework: Thermally fused laminate (TFL) at all exposed shelf edges, unless otherwise shown on Drawings.

H. Drill holes for shelf pin supports at 1 inch center to center spacing. Locate shelf pin holes 3 inches from front and back of shelves, typical, unless shown otherwise in Drawings or approved by Architect.

I. Drawer Boxes:
   1. Fabricate sides and back from minimum ½-inch (9-ply) plywood.
   2. Fabricate bottoms from minimum 3/8-inch (7-ply) plywood.
   3. Fabricate with dovetail joinery only and reinforce corners as necessary to prevent racking.

J. Door and Drawer Fronts: ¾-inch, or as shown on Drawings.

K. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

L. Semi-exposed Surfaces (Interior surfaces of plastic laminate casework): Thermally fused laminate (TFL), unless otherwise shown on Drawings.

M. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing to walls.

N. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arrises. Locate counter butt joints minimum 2 feet from sink cut-outs.

O. Provide cutouts, rough openings, and recesses for appliances, outlet boxes, lighting fixtures, plumbing components, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges. Extend J-boxes as required by NEC.

2.09 SHOP FINISHING

A. Sand Work smooth and set exposed fasteners; apply wood filler.

B. Seal all exposed surfaces not otherwise constructed of prefinished materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

C. Examine cabinets upon which countertops are to be installed. Verify cabinets are level to within 1/8” in 10’-0”.

3.02 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation area.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.03 INSTALLATION

A. Set and secure cabinetry and other woodwork in place, rigid, plumb, and level, and in accordance with applicable standard specified herein for grade of work specified.

B. Install woodwork level, plumb, true and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Secure and align adjoining cabinet units and counter tops with concealed joint fasteners.

E. Scribe casework abutting other components, including walls with variable decorative finishes, with maximum gaps of 1/32 inch (0.80 inch). Do not use trim or additional overlay trim for this purpose. Excessive gaps will require correction by the Contractor.

F. Secure cabinet and bases to floor using appropriate angles and anchorages.

G. Exposed fasteners are not allowed in the finish Work except at field applied moldings and trim. When exposed fastening is required to complete installation, exposed fasteners shall e set in quirks, reveals, and reliefs 9to be least visible when installation is complete) Fasteners in concealed locations shall be countersunk and concealed with plugs to match surrounding materials – finish flush with surrounding surfaces.

H. Seal between wall and components with joint sealant as specified in CSI Number 07 92 00.

3.04 REPAIRS

A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with each material manufacturer's "Technical Bulletins".

3.05 CLEANING

A. Clean all surfaces in accordance with each finish manufacturer's recommendations. Remove excess adhesive and sealant from visible surfaces. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 06 83 16

FIBERGLASS REINFORCED PANELING (FRP)

PART 1 - GENERAL

1.1 SUMMARY

A. This CSI Number includes furnishing all materials, labor, equipment, and related services necessary to supply and install architectural glass fiber reinforced plastic (FRP) fabrications as indicated in the contract documents, and in compliance with applicable codes.

1.2 RELATED CSI NUMBERS

A. CSI Number 07 92 00 Joint Sealants.

B. CSI Number 09 22 16 Non-Structural Metal Framing.

C. CSI Number 09 29 00 Gypsum Board.

1.3 REFERENCES

A. ASTM International (ASTM)

1. D790 - Standard Test Methods of Flexural Properties of Unreinforced and Reinforced Plastics
2. D638 - Standard Test Method For Tensile Properties of Plastics
3. D256 - Standard Test Methods For Determining the Izod Pendulum Impact Resistance of Plastics.
4. D570 - Standard Test Method For Water Absorption of Plastics
5. D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
6. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

A. Product Data: Submit product data sheets for each specified product.

B. Past Projects: Submit a minimum of 3 previously completed installations of similar materials and complexity. Include contact name, e-mail address and phone number for each project.

C. Shop Drawings: Submit drawings for approval showing plans, sections, details, joint treatment, reinforcing, fastening devices and the relation of the FRP parts to the surrounding construction.

D. Samples: Submit a minimum of 3 flat samples of FRP material for each color and texture indicated.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

a. Manufacturer shall have a minimum of 10 years experience having successfully supplied FRP parts for other projects similar in scope and complexity for the work of this Contract.
b. Manufacturer shall have a minimum of 10 years' experience using 3D modelling software and CNC machines for the creation of master patterns used to make molds for fabricated FRP components.

B. Installer Qualifications: Installer shall have a minimum of 5 years' experience having successfully completed projects similar in scope and complexity for the work of this Contract.

C. Substrates to accept FRP parts shall be installed straight and true within 1/8 in. in 8 linear ft. (3mm in 2500mm) and shall be free of obstructions and interference that prohibits the correct alignment and attachment of the FRP parts.

D. Where the work schedule permits, confirm dimensions and site conditions prior to manufacturing FRP parts specified in this CSI Number. Any deviations from the design conditions or dimensions to be provided to the manufacturer for inclusion in the shop drawings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle and transport FRP parts to avoid damage. Place non-staining resilient spacers between parts and support parts during shipment.

B. Parts shall be kept clean and dry and stored to prevent distortion, warping, and other physical damage in accordance with the manufacturer's recommendations.

C. Place stored panels so part identification labels are clearly visible.

D. The installing contractor is responsible for damage to the FRP parts after delivery.

1.7 WARRANTY

A. Manufacturer Warranty: Provide manufacturer's standard product warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Formglas Products Ltd. – Tel: +1.416.635.8030 | +1.866.635.8030
Contact your local Formglas representative – www.formglas.com/contact
or send requests for quotations directly to estimating@formglas.com

B. As approved by Architect.

2.2 GLASS FIBER REINFORCED PLASTIC (FRP) FABRICATIONS

A. Fabrications: Molded FRP parts shall have a Class 1 (or A) fire rating with a Flame Spread Rating: ≤ 25; Smoke Development Index: ≤ 450, when tested in accordance to ASTM E84 (See 1.3 References).

B. Gelcoat: The FRP parts shall have an ultra violet stabilized polyester gelcoat with a minimum thickness of 15-20 mil.

C. Back-up Laminate: Glass reinforcement shall consist of a glass fiber polyester composite with 25-30% glass fiber content.

D. All reveals, set backs or returns to have a minimum of 3º draft angle.

E. All outside corners to have a minimum 1/8" (3mm) radius.

F. Identification: All FRP parts to have labels affixed to the back individually identifying them with the same part numbers used on the shop drawings.

2.3 PHYSICAL PROPERTIES

A. Matrix: Polyester Resin
Shell thickness: 3/16" (4.5 mm) nominal
Edge thickness: 3/4" (19 mm) typical
Density: ~110 lb/ft³ (1675 kg/m³)
Weight: 1¾ - 2¼ lb/ft² (8.5-11 kg/m²)
Glass Fiber: 25-30% typical
Embedments: Core mat, or other reinforcements as required
Color: As shown on the Drawings or as selected by Architect from the manufacturer's full range of available colors.
Surface: Smooth, unless otherwise specified
Flexural Strength (ASTM D790): 32,000 psi (221 MPa)
Tensile Strength (ASTM D638): 15,950 psi (110 MPa)
Compressive Strength (ASTM D695): 33,100 psi (228 MPa)
Modulus of Elasticity (ASTM D790): 1,080,000 psi (10.5Gpa)
Impact Resistance (ASTM D256): 12 ft·lbf/in. (643 J/m)
Hardness (ASTM D2583): 44 Barcol
Coefficient of Linear Thermal Expansion (ASTM D696): $2.73x10^{-5}$ in/in/ºF
(1.5×10^{-6} in/in/ºC)
Heat Deflection: > 513ºF (285ºC)
Taber Abrasion (ASTM D4060): 0.87 mg weight loss after 500 cycles
Water Absorption (ASTM D570): 0.3%
Nail push-through: 1050 lbf (4,670 N)
Surface Burning Characteristics (ASTM E84):
Flame Spread: ≤ 25 (Class A)
Smoke Development: ≤ 450 (Class A)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Site Conditions: Verify the conditions for compliance with the requirements including environmental conditions, installation tolerances and other conditions affecting the installation and performance of FRP parts. Any unsatisfactory conditions to be corrected prior to installation.

B. Field Dimensions: Field dimensions are to be verified including those not shown on the drawings. Any discrepancies are to be brought to the attention of the Architect with resolutions to the discrepancies to be mutually agreed upon by all parties involved. Details of any changes required must be incorporated into the manufacturer's shop drawings prior to commencing the manufacture of the FRP parts.

C. Design Dimensions: Where field measurements can not be made without delaying the Work, the installing contractor is to confirm with the Architect whether to proceed with fabricating the FRP parts to the design dimensions with construction coordinated to ensure the actual dimensions correspond with the design dimensions.

3.2 PREPARATION

A. Substrate: Substrates to accept FRP parts, provided by others, shall be installed straight and true within 1/8 in. in 8 ft. (3mm in 2500mm) and shall be free of obstructions and interference that prohibits correct attachment of FRP parts.

B. Structural framing members and bearing surfaces, provided by others, shall be true and level, of the proper size, spacing and design for the intended use and shall be sufficient to properly support the installed FRP parts.

3.3 INSTALLATION

A. Install in accordance with the manufacturer's instructions, contract documents and shop drawings.

B. The Installing contractor to provide all support brackets, connection hardware, adhesives, and other accessories required for the proper installation of the FRP fabrications in accordance to the manufacturer's requirements and applicable building codes.

C. Position and secure FRP parts carefully into place plumb, level and aligned with adjacent parts, shimmed where necessary.

D. Anchors and fasteners to be type 304 stainless steel where exposed; hot dipped galvanized steel where unexposed.

E. Provide temporary supports or bracing as required to maintain position, stability and alignment of parts until permanently secured.

F. Installing contractor to repair and patch holes or defects to match the original work. Provide joint spacing between parts as detailed for expansion and the application of joint treatment materials.

G. Provide joint spacing between parts as detailed in the approved drawings for expansion and the application of joint treatment materials.

3.4 JOINT PROTECTION

A. Caulk all joints with a low modulus exterior elastomeric sealant recommended by the manufacturer. Color of caulk to be selected by the Architect. (If joint treatment follows under a separate CSI Number of this contract, this does not apply).

3.5 CLEANING AND PROTECTION

A. Perform cleaning procedures, if necessary, according to FRP manufacturer's written instructions. Take precautions to prevent damage to FRP surfaces and staining of adjacent materials.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 10 00

DAMPPROOFING AND WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes:
   1. Sheet and Liquid Waterproofing Membranes.
   2. Protection Boards.
   3. Wall-Drainage Boards.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. C836: Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
   2. D412: Standard Test Methods for Rubber Properties in Tension
   3. D570: Standard Test Methods for Water Absorption of Plastics.
   4. D882: Standard Test Method for Tensile Properties of Thin Plastic Sheeting
   5. D903: Standard Test Method for Peel of Stripping Strength of Adhesive Bonds.
   6. D1876: Standard Test Method for Peel Release of Adhesives (T-Peel)
   7. D1970: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
   8. D3767: Standard Practice for Rubber – Measurements of Dimensions
   9. D5385: Standard Test Method for Hydrostatic Pressure resistance of Waterproofing Membranes.
   10. E 96: Standard Test Methods for Water Vapor Transmission of Materials
   11. E 154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Wall, or as Ground Cover.

1.03 SUBMITTALS

A. Product Data: Submit Manufacturer's data, installation instructions, limitations, and recommendations. Include certification of data indicating VOC content of components.

B. Samples: Submit samples of membrane, protection board and composite drainage material, as applicable to the Project.
   1. Sheet Membrane
   2. Protection Board
   3. Prefabricated drainage composite

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Minimum 3 years' experience with Projects of similar scope and complexity.
   2. Applicator shall be approved by Membrane Manufacturer.
   3. Applicator shall furnish written evidence that applicator is currently approved by manufacturer to install the products required or specified for this project.

B. Materials: For each type of material required for the work of this CSI Number, provide primary materials which are the products of one manufacturer.

C. Mockups: Before beginning installation, install waterproofing to 100 sq. ft. of surface to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, texture, and execution quality. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in Manufacturer's original unopened packages with Manufacturer's labels intact.

B. Material shall be protected from rain and physical damage. Store materials away from sparks or flames. Store membrane where it will not receive high temperature exposure for extended periods of time.

   1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

   2. Protect mastic and adhesive from moisture and potential sources of ignition.

   3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.

C. Protect from damage from sunlight, excessive temperatures weather, and construction operations.

1.06 PROJECT/SITE CONDITIONS

A. Perform Work only when existing and forecasted weather conditions are within the limits established by the Manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation Work is complete and in condition to receive sheet membrane waterproofing.

C. Maintain adequate ventilation during application of curing of waterproofing materials.

1.07 WARRANTY: WATERPROOFING MEMBRANES:

D. Special Installer's Warranty: Signed by installer, covering Work of this CSI Number, for warranty period of **two years**.

E. Special Manufacturer's Water-tightness Warranty: Manufacturer's standard form in which waterproofing manufacturer agrees to make, or cause to be made, repairs necessary to correct leaks resulting from ordinary wear and tear and the effects thereof and improper workmanship by the Installer. Conditions:
   1. Project pre-approved by manufacturer.
   2. Project installed by approved Installer.
   3. Independent inspector shall be engaged by manufacturer.
   4. Warranty Period: **Ten years** from date of Substantial Completion.

F. Exclusion: Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or information of new joints and cracks in substrate exceeding 1/8 inch in width.

G. Repairs required, either permanent or temporary, to waterproofing membrane under this warranty to keep the decks watertight shall be made within 3 days after notice of the need for repairs. Should the Installer fail to make such repairs withing the time period, the Owner may have such repairs made and charge the cost to the Installer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Membrane Waterproofing (Vertical): Self-adhesive, cold applied composite sheet consisting of a thickness of 56 mils of rubberized asphalt laminated to a 4 mil thick polyethylene film with release liner on adhesive side. No special adhesives or heat shall be required to form laps.

B. Waterproof Membrane: Bituthene 3000 or 4000 membrane (as required by prevailing VOC requirements); minimum self-adhering membrane of 56 mils of rubberized asphalt integrally bonded to 4 mils of polyethylene sheeting.

C. Specifications are based upon Bituthene as manufactured by W.R. Grace Construction Products Division.

   1. Physical Properties:
      a. Tensile Strength: 250 psi minimum, ASTM D 412, Die C, modified.
      b. Ultimate Elongation: 300 percent minimum, ASTM D 412 Die C, modified.
      c. Pliability: No cracks when bent 180 degrees over a 1 inch mandrel at minimum 25 degrees F, ASTM D 146.
      d. Crack Cycling: Unaffected after 100 cycles of 118 inch movement, ASTM C 836.
      e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
      f. Hydrostatic-Head Resistance: 150 feet minimum, ASTM D 5385.
      g. Water Absorption: 0.15 percent weight gain maximum after 48 hour immersion at 70 degrees F, ASTM D 570.
   2. Manufacturers: Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
      a. W. R. Grace Bituthene www.grace.com
      b. W. R. Meadows Sealtight Mel-Rol www.wrmeadows.com
      c. Carlisle CCW-860 www.carlisle-ccw.com
      d. As approved as Architect.

D. Specifications are based upon Bituthene as manufactured by W. R. Grace Construction Products Division.

2.02 ACCESSORIES

E. Primer, Elastomeric Mastic and Protection Board Adhesive: As furnished by Membrane Manufacturer.

F. Sheet Strips: Self adhering, rubberized asphalt composite sheet strips of same materials and thickness as sheet waterproofing.

G. Termination Bar: 1 inch wide by .125 inch thick extruded aluminum with continuous sealant ledge and pre-punched 6 inches o.c. and 1 inch from ends.

H. Protection Material - Vertical: One inch thick expanded polystyrene.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
   3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION OF SUBSTRATES

C. Refer to Manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate, and sharp protrusions. Remove contaminants such as grease, oil, and wax from exposed surfaces. Remove dust, dirt, loose stone, and debris. Use repair materials and methods which are acceptable to Manufacturer of sheet membrane waterproofing.

D. Patch honeycomb, form tie holes, and irregular surfaces of concrete. Patch with Porland cement grout, concrete, or epoxy grout.

E. Remove concrete fins and projections, concrete splatter, general surface dirt, and other foreign materials so as to leave wall and horizontal surfaces in a generally clean conditions suitable for application of membrane. Clean surfaces with high pressure air to remove dust, loose stones, and debris.

F. For existing masonry or concrete surfaces, pressure clean using power washer unit at pressure of 2,000 – 5.000 psi with flow rates of 4 to 14 gallons per minute. Use only clean, fresh water to remove oil, dirt, grease, chalk and other debris. Vary tip size and distance from the surface to be cleaned according to type/amount of contaminants on surface. Wash surface with clean water after cleaning to remove residue.

G. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer. Delay application of membrane until primer is completely dry. Dry time will vary with weather conditions.

H. Seal cracks greater than 1/16 inch in width with polyurethane sealant or covered with a membrane strip as recommended by manufacturer. Remove dust and dirt from joints and cracks according to ASTM D4258.

I. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.

J. Prepare, treat, and seal vertical surfaces at terminates and penetrations through waterproofing, and at drains and protrusions according to ASTM D6135.

3.03 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks, complying with ASTM D 4258, before coating surfaces.

B. Prime substrate and apply a single thickness of preparation strip extending a minimum of 6 inches along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

3.04 SHEET MEMBRANE INSTALLATION

A. General Requirements:
   1. Install materials and products in strict accordance with manufacturer's written installation instructions and recommendations in ASTM D6135.
   2. Install membrane within temperature limits recommended by manufacturer.
   3. Prime all surfaces with products manufactured by the membrane manufacturer in accordance with their instructions.
   4. Apply membrane waterproofing on outside face of foundation walls where elevation of interior floors are below the ground level and elsewhere as indicated. Extend waterproofing up from top of footings to top of foundation wall or from top of foundation wall at interior locatins to a point at least 12 inches below the lower floor grade.
   5. Apply membrane waterproofing from the low point to the high point across the fall line so that laps shed water. Apply membrane in double thickness over properly sealed joints. Stagger membrane joints from those of the substrate.
   6. Roll al sheets after application. Double-roll all seams.
   7. At conclusion of work, cut out and patch all fish-mouths and wrinkles.

B. Edges:

1. Apply membrane waterproofing over the edge of the slab or over the top of the foundation. Terminations on horizontal applications must be finished with a troweled bead of Bituthene Mastic.
2. At exterior walls, cover top edges of membrane with continuous termination bar, located 3 inches below top surface of required finish grades. Maintain straight bar lines horizontally and at slopes in grade, as approved by the Architect. Make bar ends square, tightly butt lengths together, and miter at changes of direction.
    a. Back-coat bar with elastomeric mastic and secure to wall with termination bar fasteners. Locate a fastener one inch from a cut edge and space others uniformly at 6 inch centers.
    b. Fill gap between top of bar and wall with multi-part polyurethane sealant.
    c. Coat exposed surface of bar with elastomeric mastic.
3. At exterior walls, extend membrane horizontally over top of foundation wall footing in one continuous piece as recommended by the manufacturer.
4. Where vertical and horizontal membranes meet, extend membrane horizontally over top of foundation wall footing in one continuous piece, overlap under slab membrane 3 inches minimum and apply tape recommended by manufacturer centered over the lap. Roll firmly to assure tight seal.

C. Seams:
    1. For applications, overlap seams at least 2-1/2 inches. Apply succeeding sheet with a minimum 2-1/2 inch overlap and roll the entire membrane firmly and completely as soon as possible to minimize bubbles caused by out gassing of air or water vapor from the concrete.
    2. Slit and overlap flaps, and repair with a patch, pressed, or rolled to make the seal and seal edges of the patch with a troweled bead of Mastic.
    3. Patch misaligned or inadequately lapped seams with membrane.
    4. For vertical applications, use heavy hand pressure and a seam roller on the laps.

D. Terminations, Drains, Corners, and Flashing:

    1. Double cover outside corners with an initial strip of sheet membrane 11 inches minimum width centered on the axis of the corner. Completely cover by the regular application (36 inches wide) of membrane waterproofing. Outside corners must be free of sharp edges. Inspect surfaces adjacent to corners and repair if necessary to provide a smooth dense surface.
    2. At inside corners apply a fillet formed with epoxy mortar or latex modified cement mortar and a double coverage of membrane. Do not use fiber or wood cant strips.
    3. Apply a double layer of membrane waterproofing around posts or projections at least 6 inches in directions and seal termination with mastic.

E. Vertical installation requirements:
    1. Instruct masonry contractor to strike all joints flush.
    2. Install compatible drainage board system per membrane manufacturer and board system manufacturer’s recommendations.
    3. Instruct contractor to carefully backfill over membrane and drainage systems.

3.05 DRAINAGE BOARD INSTALLATION

K. Install per manufacturers directions using materials approved by manufacturer of drainage boards and membrane.
   1. Install against retaining walls, foundation walls (both waterproofed and non-waterproofed).
   2. Terminate at the top of the footing or form at right angles to cover the top of the footins, as detailed.
   3. Place backfilling within two weeks, to at least 6” above the top edge of the drainage board.

L. Refer to Manufacturer's literature for recommendations on installation, including but not limited to,

M. At the end of each working day, water cut-offs must be installed to protect against water penetration under installed membrane. Temporary water cut-offs shall be removed before Work is resumed. Seal daily terminations with a trowelled bead of elastomeric membrane.

N. Where metal edging occurs set flanges in mastic and secure as shown on Drawings. Strip in with membrane.

O. Install protection material the same day the membrane is applied. Secure protection material in place by an approved method until concrete or backfill is placed. Nails or other fasteners shall not penetrate through the membrane.

3.06 COMPLETION AND CLEANING

A. Cure waterproofing according to manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing.

B. Protect installed insulation drainage panels from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Immediately after installation, provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction.

C. Do not permit foot or vehicular traffic on unprotected membrane.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes: Water repellent coating for exposed exterior concrete surfaces.

1.02 DEFINITIONS

A. Water Repellent: Resistant to penetration of water from rainfall.

1.03 SYSTEM DESCRIPTION

A. Water repellent shall penetrate into can chemically bond with substrate. Treated surface shall resist penetration by water and water-borne salts, ions, and other contaminants for the warranty period specified herein.

B. Water repellent shall not change surface texture, appearance, or vapor permeability.

C. Masonry walls treated with water repellent shall show no evidence of moisture penetration when field quality control tested after application.

1.04 SUBMITTALS

A. Product Data: Submit recommended method of application and coverage rate.

B. Submit sample of manufacturer’s warranty and any special procedures required to obtain warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be able to show evidence that the firm has been engaged in producing such material for at least 5 years and that the product has a satisfactory field performance record of at least 5 years.

B. Applicator Qualifications: Applicators shall be trained, approved, and accepted by the Manufacturer and have a minimum of 2 years’ experience spraying specialty coatings.

C. Regulatory Requirements: Comply with volatile organic compound (VOC) regulations in effect within the jurisdiction of the Project site.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Delivery shall be made to the job site in Manufacturer's original containers with seals unbroken and labeled with Manufacturer's batch number

B. Storage and Protection: Store materials in original, unopened containers in compliance with Manufacturer's printed instructions and protect from damage.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Temperature and relative humidity conditions for a period before, during, and after application shall be as recommended by the Manufacturer. If rain occurs, allow surfaces to dry a minimum of 5 days.

1.08 WARRANTY

A. Manufacturer shall provide a written warranty for a period of 5 years from date of project completion.
   a. Written warranty shall include the following provisions:
      a Walls where water repellent has been applied shall show no evidence of moisture penetration on the interior surface of the wall for the full warranty period.
      b Coating will not cause changes in surface texture and color for the full warranty period, regardless of number of applications required to comply with performance requirements.
   b. Upon satisfactory completion of the installation, and as a condition of its acceptance, the warranty shall be delivered to the Owner.
   c. If at any time during the warranty period, any such failure occurs resulting from ordinary weather conditions in any area to which the coating has been properly applied, the manufacturer shall agree to supply all material and labor needed to repair such affected area at no additional cost.

B. The applicator shall guarantee the installation against poor workmanship for a period of 2 years from the date of Final Completion. Applicator shall make necessary repairs without charge to Owner during that period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, subject to compliance with Specification requirements:
   1 BASF Corporation Construction Chemicals, Shakopee, MN 800.433.9517. www.master-builders-solutions.BASF.us
   2 Euclid Chemical company www.euclidchemical.com
   3 ProSoCo., Inc. www.prosoco.com
   4 Protectosil; Div. of Evonik Industries www.protectosil.com

2.02 MATERIALS

A. Water Repellent Sealer:
   1. Protectosil Aqua-Trete Concentrate, Protectosil.
   2. Baracade M.E. or Weather-Guard, Euclid Chemical Company.
   3. Siloxane WB Concentrate, ProSoCo., Inc.
   4. MasterProtect H 400 (formerly Enviroseal 40) BASF.
   5. Equivalent penetrating siloxane, silene, or siloxane/silene blend for use on CMU masonry as approved by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   a. Carefully Inspect the installed Work of other Trades, and verify that such Work is complete to the point where water repellent application may commence.
   b. The manufacturer's representative shall verify that the water repellent can be applied in accordance with the Manufacturer's recommendations.
   c. Verify that cracks which exceed 1/64 inch wide have been filled with pointing
   d. mortar or caulking material. Defective mortar joints shall be routed out, pointed with mortar, and tooled.
   e. Verify that masonry has been cleaned as specified in CSI Number 04 01 20.52
   f. Verify sealants have been installed and are properly cured.
   g. Advise Architect in writing of unsatisfactory conditions. Do not apply water repellent until conditions have been corrected.

3.02 PREPARATION

A. Protection:
   h. Use all means necessary to protect clear water repellent before, during, and after installation and to protect the installed Work of other Trades.
   i. Metal, glass, and other such items shall be protected by suitable masking and materials to protect against overspray.
   j. In the event of damage, immediately make repairs and replacements necessary as acceptable to the Architect.
   k. Protect concrete sidewalks from runoff by soaking with water immediately prior to application of adjacent walls.

B Surface Preparation:
   1 Allow walls to cure at least 30 days before clear water repellent is applied.
   2 Walls shall be free of excess mortar.
   3 Follow Manufacturer's instructions regarding allowable moisture level.

3.03 APPLICATION

A. Water Repellent: Apply in accordance with Manufacturer's printed directions.

B. Mixing:
1. Concentrates: Concentrated products shall be mixed as recommended by the manufacturer for type of substrate where applied.
2. Strictly observe all mix ratios and consistently measure field mixes with containers calibrated in standard volume units.

C. Surfaces to be coated:
1. All exposed exterior surfaces of concrete and concrete masonry unit walls, including surfaces not exposed to view but left exposed in the finished work, such as backs of parapet walls, horizontal projections, etc.
2. Surfaces indicated above which will be covered by another finish material such as metal wall panels, paint, etc., do not require application of water repellent.

D. Application:
1. Apply water repellent to dry surfaces using airless spray equipment as recommended by the manufacturer at consistent minimum rate.
2. Apply product in saturating one or two coat application allowing time between coats as recommended by the manufacturer.
3. Apply product from bottom of the vertical surface to the top, saturating the surface until “run-down” is achieved, but avoiding excessive rundown in accordance with manufacturer’s printed instructions.
4. At no time shall rate of coverage be less than required by Manufacturer’s written instructions and additional procedures established in the pre-installation conference.

E. Protect surfaces where water repellent has been applied from rain, dirt, dust, traffic, wind-blown debris and other materials that could harm performance of materials for a period of not less than 4 hours after application, but not less than protective time recommended by the manufacturer.

3.04 FIELD QUALITY CONTROL

A. Water Penetration Tests:

1. Twenty days after completion of this portion of the Work, and as a condition of its acceptance, demonstrate by running water test that the Work of the CSI Number will successfully repel water.
2. Notify the Architect and Manufacturer at least 72 hours in advance and conduct the test in the presence of Architect and/or manufacturer’s representative.
3. By means of an outrigger or similar acceptable equipment, place 3/4 inch garden hose with garden type spray nozzle, at a point designated by the Architect, 8 feet to 10 feet away from the wall, aiming the nozzle so that water will strike the wall at a 45 degree downward angle.
4. Run the water onto the wall at full available force for not less than 4 hours. Provisions shall be made to collect the run off water into a container, and if possible to reuse it in the test.
5. Upon completion of the four hour period, inspect the interior surface of the wall for evidence of moisture penetration.
6. If evidence of moisture penetration is discovered, perform corrective procedures recommended by the manufacturer and as established during the pre-installation conference to the areas where leakage occurred.

7. Successful application of water repellent will show not evidence of moisture penetration on the interior surface of the wall after four hour period.
8. An additional area or areas designated by the Architect shall be tested and corrected if leakage occurs, at no additional cost to Owner.
9. Application of water repellent is subject to rejection upon failing field quality control testing after corrective procedures have been performed at areas failing initial field quality control testing.

3.05 CLEANING

A. Clean spillage and overspray as recommended by Manufacturer.

B. During the course of the Work and on completion, remove excess materials, equipment and debris and dispose of away from premises.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Thermal insulation.
B. Thermal insulation accessories.
C. Insulation Covers.
D. See CSI Number 09 81 00 for Acoustic Insulation.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 30 00 – Cast-in-Place Concrete.
B. CSI Number 05 10 00 – Structural Metal Framing.
C. CSI Number 06 16 43 – Exterior Gypsum Sheathing.
D. CSI Number 07 92 00 – Joint Sealants
E. CSI Number 08 41 13 – Aluminum-Framed Entrances and Storefronts.
F. CSI Number 08 80 00 – Glazing.
G. CSI Number 09 22 16 – Non-Structural Metal Framing.
H. CSI Number 09 29 00 – Gypsum Board.
I. CSI Number 09 81 00 – Acoustic Insulation.

1.03 REFERENCES

A. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
B. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
C. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
D. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
E. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
F. ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
G. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
H. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
I. ASTM C1320 – Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
J. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
K. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
L. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
M. ASTM E136 – Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C.

N. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
O. UL 723 – Test for Surface Burning Characteristics of Building Materials.
P. UL 1479 – Standard for Fire Tests of Through-Penetration Firestops.

1.04 SUBMITTALS

A. Product Data: Submit Manufacturer's data, installation instructions, limitations and recommendations. Include warranty information and certification and test data substantiating R-values and combustibility of each type of insulation.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable codes for fire resistance ratings and surface burning characteristics.
B. Provide certificate of compliance acceptable to Authority Having Jurisdiction (AHJ) indicating conformance to fire-resistance requirements.
C. Fire safing insulation and assemblies for closure of various voids with fire safing insulation shall comply with IBC Chapter 7 requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation from physical damage and from becoming wet, soiled, or covered with sources of moisture. Comply with manufacturer's written recommendations for handling, storage and protection during installation.
B. Materials shall be delivered to project site in manufacturer’s packaging and properly identified on each package with the Manufacturer's name, material name, production date, and R-value.

1.07 FIELD CONDITIONS

A. Limitations:
   1. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation.
   2. Kraft and standard foil facings will burn and must not be left exposed. The facing must be installed in substantial contact with the unexposed surface of the ceiling, wall or floor finish. Protect facing from any open flame or heat source.

1.08 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. Batt and Semi-Rigid Batt Insulation:
      a. CertainTeed LLC; Saint-Gobain, www.certainteed.com.
      b. Johns-Manville, A Berkshire Hathaway Company, www.johnsmanville.com.
      c. Knauf Insulation, www.knaufinsulation.com.
      d. Owens Corning, www.owenscorning.com.
      e. As approved by Architect and in compliance with substitution requirements.
   2. Board Insulation:

a. Dow, www.Dow.com.
b. Dupont, www.dupont.com.
c. Johns-Manville, A Berkshire Hathaway Company, www.jm.com.
d. Knauf Insulation, www.knaufinsulation.com.
e. Owens Corning, www.owenscorning.com.
f. As approved by Architect and in compliance with substitution requirements.

3. Fire Safing Insulation:
a. Johns-Manville, A Berkshire Hathaway Company, www.jm.com.
b. Knauf Insulation, www.knaufinsulation.com.
c. Owens Corning, www.owenscorning.com.
d. Rockwool, www.rockwool.com.
e. As approved by Architect and in compliance with substitution requirements.

B. To the greatest extent possible, obtain each type of insulation product from a single Manufacturer.

2.02 MATERIALS - INSULATION

A. Batt Insulation:
1. Unfaced glass fiber thermal batt insulation complying with ASTM C665, Type I and ASTM E136, where shown on the Drawings.
2. Kraft faced glass fiber thermal batt insulation complying with ASTM C665, Type I and ASTM E136, where shown on the Drawings.
3. Foil faced glass fiber thermal batt insulation complying with ASTM C665, Type I and ASTM E136, where shown on the Drawings.
4. Provide unfaced mineral fiber thermal batt insulation complying with ASTM C553, Type I, where used within walls with gypsum or cement boards applied to one or both sides, within shaft wall construction, or where shown on Drawings.
5. Surface-Burning Characteristics, when tested in accordance with ASTM E84 / UL 723:
i. Flame spread value: Less than or equal to 25.
b. Smoke-developed value: Less than or equal to 50.
6. Combustion Characteristics: Unfaced insulation shall pass ASTM E136 test.
7. Dimensional Stability: Linear shrinkage less than 0.1%.
8. Thickness: As indicated on Drawings or minimum thickness to provide the R-values indicated on Drawings. Batts shall be a single thickness to meet the required R-value; multiple layers of batts will not be accepted.

B. Rigid Board Insulation:
1. Polyisocyanurate board insulation complying with:
a. ASTM C1289, Type I, Class 1 or 2
b. Compressive strength: 25 psi minimum.
c. Surface-Burning Characteristics, when tested in accordance with ASTM E84 / UL 723:
i. Flame spread value: Less than or equal to 25.
ii. Smoke-developed value: Less than or equal to 450.
2. Thickness: As indicated on Drawings or minimum thickness to provide the R-values indicated on Drawings.

C. Fire Safing Insulation:
1. Unfaced mineral wool insulation complying with ASTM C612, C665, E119, and E136, with 4.0 pounds per cubic foot (pcf) density per ASTM C518.
2. Thickness: As required by Manufacturer to provide a fire rating equal to that of the assembly of which it is a part. Where smoke stop protection also is required, install caulking compound as needed to meet UL Standard 1479 and ASTM E814 procedures.

D. Acoustic Insulation: See Acoustic Insulation specification.

2.03 MATERIALS – ACCESSORIES

A. Provide materials, not specifically described but required for a complete and proper installation of the work in this CSI Number.
B. Spindle Anchors, Washers, and Shields: Provide copper coated low carbon steel spindles, angled type where required for attachment, with steel insulation retainer plates, washers and shields that are listed and labeled for use. Protect ends of spindles with capped self-locking washers where exposed to contact.
    1. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
        a. Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable.
        b. Stic-Klip Mfg. Co., Type A or B as necessary, with Type S adhesive
        c. Miracle Adhesive Corp. “Miracle SukUps” with Type HT994 adhesive.
        d. As approved by Architect and in compliance with substitution requirements.
C. Adhesive for Bonding Insulation: Product as recommended by insulation Manufacturer, with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
D. Fire Safing Clips: Galvanized steel safing clips approved by Manufacturer of safing insulation for holding safing insulation in place.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions to receive the Work of this CSI Number and report detrimental conditions in writing to Architect. Verify that adjacent materials are dry and ready to receive insulation. Commencement of Work shall be construed as acceptance of subsurfaces. Verify, before proceeding with the Work of this CSI Number, that required inspections of existing conditions, such as mechanical, plumbing and electrical services within walls, have been completed, tested and passed inspections.

3.02 PREPARATION

A. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.03 INSTALLATION

A. Comply with ASTM C1320 and manufacturer's instruction for particular conditions of installation in each case.
B. Batt Insulation:
    1. Delay installation until Construction has progressed to the point that inclement weather will not damage or wet the insulation material.
    2. Friction-fit blanket insulation in place. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.
    3. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such contact/use.
    4. Fully insulate small areas between closely spaced framing members, pipes, conduits, or other obstructions by cutting and fitting insulation material as required to maintain the integrity of the insulation. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

5. Insulation of scheduled thickness / R-value is required at all exterior walls, soffits, underside of roofs where indicated, and projections, whether shown on Drawings or not to provide a completely insulated building envelope.
6. At metal framing, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs or framing members.
7. Provide supplementary support to hold the insulation in place until finish surface is applied when insulation is installed in heights over 8 feet.
8. Secure batt insulation to underside of roof sheathing with wire.
9. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.
10. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation. End match neatly with ends fitting snugly.
11. Place insulation tight to exterior wall or roof substrate without airspace between insulation and exterior sheathing or roof substrate.
12. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
13. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts or misalignments in membrane.

C. Rigid Board Insulation:
1. Install board insulation between furring members, hat channels, or Z-shaped furring where shown on Drawings or where finish surface will be applied. Use appropriate fastener per furring strip manufacturer's recommendations.
2. Insulate small areas between closely spaced framing members, pipe, conduit or other obstructions by cutting and fitting insulation materials as required to maintain the integrity of the insulation.
3. Fit ends snugly.

D. Fire Safing Insulation: Install in proper sizes on safing clips as needed but not to exceed 24 inches O.C. Leave no voids between walls and edges of slabs.
1. Install safing clips where required to support insulation as required by Code.
2. Cut safing insulation 1/2-inch wider than gap to be filled to ensure compression fit. Leave no voids in completed installation.

E. Insulation Covers:
1. Adhesive apply over exposed surfaces of insulation with joints lapped and glued or mechanically fasten per manufacturer requirements and as approved by Architect.
2. Adhesive shall be low-emitting.
3. **No insulation shall be left exposed, including in areas accessed for maintenance above ceilings.**
4. Membrane shall be closely fitted around pipes, conduits, columns, and other protrusions.
5. Use manufacturer approved tape to secure seams – color to match.
6. Do not paint cover sheet material.

F. Maintain air/vapor barrier integrity by tightly abutting adjacent insulation. Repair punctures or tears in air/vapor barrier per barrier manufacturer's recommendations.

3.04 CLEANING AND PROTECTION

A. During the course of the Work and on completion of the Work, remove excess materials, equipment, and debris and dispose of away from premises in a legal manner. Leave Work in clean condition.

B. Protection: Take precautions to protect insulation, both during and after installation, from damage of any kind until covered.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 25 00

WEATHER BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number includes: Wall membrane system for above grade vertical wall applications over sheathing beneath exterior finishes as noted on Drawings.

B. The design intent is that the exterior sheathing for vertical wall application shall have membrane applied continuously prior to the application of the finish.

1.02 SUBMITTALS

A. Product Data: Submit Manufacturer's data, installation instructions, limitations and recommendations. Include certification of data indicating VOC content of components.

B. Samples: Submit samples of membrane, protection board and composite drainage material, as applicable.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications:
1. Minimum 3 years experience with Projects of similar scope and complexity.
2. Applicator shall be approved by Membrane Manufacturer.
3. Applicator shall furnish written evidence that applicator is currently approved by manufacturer to install the products required or specified for this project.

B. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this Work with related and adjacent Work. Agenda for meeting shall include review of special details and flashing.

C. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the Manufacturer on-site periodically to review waterproofing installation procedures.

1.04 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in Manufacturer's original unopened packages with Manufacturer's labels intact.

B. Material shall be protected from rain and physical damage. Store materials away from sparks or flames. Store membrane where it will not receive high temperature exposure for extended periods of time.

C. Outdoors, place cartons on raised pallets and cover completely. Follow Manufacturer's directions.

1.05 PROJECT/SITE CONDITIONS

A. Perform Work only when existing and forecasted weather conditions are within the limits established by the Manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation Work is complete and in condition to receive sheet membrane waterproofing.

1.06 WARRANTY

A. Provide Manufacturer's written warranty for a period of 2 years, against failure of waterproofing system to perform in accordance with the terms expressed in the manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Membrane:
1. Description: .9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to .1 mm (4 mils) of cross-laminated, high-density polyethylene film to provide a min. 1 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
2. Performance Requirements:
a. Water Vapor Transmission: ASTM E 96, Method B - 2.9 ng/m2sPa (0.05 perms) maximum
b. Water Absorption: ASTM D 570 - Max. 0.1% by weight c. Puncture Resistance: ASTM E 154 - 178 N (40 lbs.)
d. Tear Resistance:
e. Initiation - ASTM D 1004 - min. 58 N (7.0 lbs.) M.D.
f. Propagation - ASTM D 1938 - min. 40 N (4.0 lbs.) M.D.
g. Lap Adhesion at –4°C (25°F): ASTM D 1876 - 880 N/m (5.0 lbs./in.) of width
h. Low Temperature Flexibility - ASTM D 1970 - Unaffected to –43°C (-45°F)
i. Tensile Strength: ASTM D 412, Die C Modified - Min. 2.7 MPa (400 psi)
j. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412 - Die C - Min. 200%
3. Basis of Design Product: Perm-A-Barrier Wall Membrane manufactured by Grace. https://gcpat.com
Construction Products.
a. W.R. Meadows
b. Henry Company
c. Carlisle Coatings
d. Other: as approved by Architect.

B. Accessories:
1. Surface Conditioner:
a. Description: Water-based latex liquid for substrate preparation.
1) Flash Point: No flash to boiling point
2) Solvent Type: Water
3) VOC Content: Not to exceed 125 g/l
4) Application Temperature: -4°C (25°F) and above
5) Freeze/Thaw Stability: 5 cycles min.

6) Freezing point (as packaged): -10°C (14°F)

b. Acceptable Product: Perm-A-Barrier Surface Conditioner manufactured by Grace Construction Products.

2. Termination Mastic:

a. Description: Rubberized asphalt-based mastic with 200 g/l max. VOC Content.

b. Acceptable Product: Bituthene Mastic manufactured by Grace Construction Products.

3. Optional Primer:

a. Description: Water-based latex primer

1) Specially designed for glass mat surfaced exterior gypsum boards

2) VOC Content: Not to exceed 10 g/l

b. Acceptable Product: Perm-A-Barrier WB Primer by Grace Construction Products.

C. Protection Material: Not applicable. Final finish shall provide protection.

D. Other materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Coordination: Coordinate with other work that affects, connects with, or will be concealed by this Work.

3.02 SURFACE PREPARATION

A. Substrate to be smooth and free of voids, spalled areas, loose aggregate and sharp protrusions that would hinder the adhesion or regularity of the weather resistive barrier membrane.

B. Remove all deleterious materials from surfaces to be covered.

3.03 INSTALLATION

A. General: Install weather resistive barrier to dry surfaces at air and surface temperatures of 25°F and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.

B. Weather Resistive Barrier Membrane:

1. Precut pieces of weather resistive barrier into easily-handled lengths.
2. Remove silicone-coated release paper and position membrane carefully before placing length horizontally against the surface.

3. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
4. When properly positioned, place against surface by pressing firmly into place.

   Roll membrane with extension-handled countertop roller immediately after placement.
5. Overlap horizontally-adjacent pieces 50 mm (2 in.) and roll seams.
6. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2 in.). Roll firmly into place.
7. Seal around masonry reinforcing or ties and all penetrations with termination mastic.
8. Continue the membrane into all openings in the wall, such as doors, windows, etc., and terminate at points that will prevent visibility from interior.
9. At end of each working day seal top edge of weather resistive barrier to substrate with termination mastic.
10. Do not allow the rubberized asphalt surface of the weather resistive barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
11. Do not expose weather resistive barrier membrane to sunlight for more than thirty days prior to enclosure.
12. Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.

C. Accessories:
1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture or if it becomes difficult to adhere the weather resistive barrier to the substrate, apply surface conditioner by spray, brush, or roller at the rate recommended by manufacturer, prior to membrane installation. Allow surface conditioner to dry completely before membrane application.
2. Apply a bead or trowel coat of mastic along membrane edges, seams, cuts, and penetrations.
3. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.

D. Install final finish material the same day the membrane is applied. Secure finish material in place by an approved method. Nails or other fasteners which penetrate through the membrane shall be treated in a manner acceptable to the waterproofing manufactured.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 42 13

METAL WALL & CEILING/SOFFIT PANELS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Metal wall & fascia panels.
B. Metal soffit panels.
C. Metal panel accessories.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 10 00 – Structural Metal Framing
B. CSI Number 05 31 00 – Steel Decking
C. CSI Number 05 50 00 – Metal Fabrications
D. CSI Number 07 60 00 – Flashing and Sheet Metal
E. CSI Number 96 00 – High-Performance Coatings

1.03 REFERENCES

A. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
B. ASTM A792/A792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
C. ASTM A1011/A1011M – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
D. ASTM D522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
E. ASTM D523 – Standard Test Method for Specular Gloss.
F. ASTM D870 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
G. ASTM D968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
H. ASTM D1005 – Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.
I. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
J. ASTM D1400 – Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base.
K. ASTM D2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
L. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
M. ASTM D3359 – Standard Test Methods for Rating Adhesion by Tape Test.
N. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.
O. ASTM D4138 – Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
P. ASTM D4145 – Standard Test Method for Coating Flexibility of Prepainted Sheet.

Q. ASTM D4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
R. ASTM D5796 – Standard Test Method for Measurement of Dry Film Thickness of Thin-Film Coil-Coated Systems by Destructive Means Using a Boring Device.
S. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
T. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) – Architectural Sheet Metal Manual.
U. UL 263 – Fire Tests of Building Construction and Material.

1.04 SUBMITTALS

A. Product Technical Data: For each type of product required, including manufacturer's preparation recommendations, storage and handling requirements, and recommended installation methods.
B. Shop Drawings: Plans, sections, elevations, and details of metal wall and soffit panels, showing layout, material and fastening methods, specified loads, flashings, vents, sealants, interfaces with all materials not supplied by the metal panel system manufacturer, and identification of proposed component parts and their finishes. Do not proceed with fabrication prior to approval of shop drawings.
C. Samples: Submit one physical sample of each type of panel, trim, clip and fastener required.
D. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.
F. Manufacturer Qualification Statement.
G. Installer Qualification Statement.
H. Mockups: Install at Project site using required products and manufacturer's approved installation methods. Obtain Architect approval of finish, color, texture, pattern, trim, fasteners, fastener spacing, edge conditions, and quality of installation prior to proceeding with Work.
    1. Size: 6’ wide x 6’ high minimum or as directed by Architect.
    2. Maintain mock-up during construction for quality comparison. Remove and lawfully dispose of mock-up construction when no longer required.
    3. Incorporation: Mock-up may be incorporated into final construction with Architect and Owner approval.
I. Closeout Submittals:
    1. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.
    2. Warranty: Submit standard manufacturer warranty documents executed by authorized company official.
    3. Warranty shall be extended by paint manufacturer’s standard multi-year warranty. The warranty shall be in writing and shall be signed by the manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 10 years of experience in manufacturing metal wall panel systems.
    1. Products shall be produced by manufacturer in a permanent factory environment with fixed roll-forming equipment.
    2. Manufacturer shall be a provider of advanced installer training.
B. Installer Qualifications:
    1. Minimum of 5 years of experience in the installation of metal wall panels.

2. Experience on at least five projects within the past 5 years of similar size, type and complexity as this Project that have been in service for a minimum of two years with satisfactory performance of the wall panel system.
3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated and who shall be supervised at all times when material is being installed.

C. Preinstallation Conference: Conduct preinstallation meeting at the site with the Architect, Contractor, and Installer to clarify Project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.
D. Welding: Performed by certified welders in compliance with AWS D.1.3 requirements and procedures for manual shielded metal arc welding.
E. Fire Resistance Ratings: Determined by testing identical products and assemblies according to UL 263 and ASTM E84 by a testing agency acceptable to Authorities Having Jurisdiction (AHJ).

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with manufacturer's current printed product storage recommendations.
B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
C. Storage: Store materials above ground, under waterproof covering, protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Provide proper ventilation of metal panel materials to prevent condensation build-up between each panel and trim or flashing component. Tilt and stack to drain in wet conditions. Remove strippable plastic film before storage under high-heat conditions. Store products in manufacturer's unopened packaging until just prior to installation.
D. Handling: Exercise caution in unloading and handling metal panel materials to prevent bending, warping, twisting and surface damage.

1.07 FIELD CONDITIONS

A. Field Measurements:
1. Verify actual supporting and adjoining construction by field measurements prior to fabrication and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that wall panel assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work. Proper fit and attachment of items is required.

1.08 WARRANTY

A. Special Warranty: Installer's standard form in which installer agrees to repair or replace metal wall panels that fail due to poor workmanship or faulty installation within the specified warranty period.
1. Warranty Period: Two (2) years from date of Substantial Completion.
B. Finish Warranty: Manufacturer's standard 30 year limited warranty against chalking and fading.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance Criteria: Structural engineering provided. Any changes in material gauge or rib depth as specified to be accompanied by contractor-provided calculations with Shop Drawing submittals. See Structural GSN in Drawings.

2.02 QUALITY CONTROL REQUIREMENTS

A. Obtain metal wall and soffit panels, trim and other accessories from a manufacturer capable of providing on-site technical support and installation assistance.

2.03 MATERIALS – METAL WALL & CEILING/SOFFIT PANELS (TYPE MWP-1)

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: ATAS International, Inc., www.atas.com.**
   2. AEP Span, www.aepspan.com.
   3. Pac-Clad Petersen; A Carlisle Company, www.pac-clad.com.
   4. Western States Metal Roofing, www.westernstatesmetalroofing.com.
   5. As approved by Architect and in compliance with substitution requirements.
B. **Basis of Design Product: Corra-Max BWM354.**
C. Properties:
   1. Coverage: 35-7/16”.
   2. Minimum Length: 6’-0”.
   3. Panel Depth: 1-15/16”.
   4. Panel Length: As shown on Drawings.
   5. Orientation: As shown on Drawings.
   6. Perforations: Hexagon, 0.500” hex x 1.000” staggered, 25% open area.
   7. Material: Aluminum.
   8. Material Thickness: 0.040”.
   9. Texture: Smooth.
   10. Manufacturer’s Finish: 70% polyvinylidene fluoride (PVDF).
   11. Color: Premium - As shown on Drawings.
   12. Fasteners: Exposed – Exposed Finish Color to match panel color.
D. Source Limitations: Obtain metal wall panels, trim and other accessories from a single manufacturer.
E. Provide all accessories, fasteners, and other items necessary for a complete installation.

2.04 MATERIALS – METAL WALL PANELS (TYPE MWP-2)

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: ATAS International, Inc., www.atas.com.**
   2. AEP Span, www.aepspan.com.
   3. Pac-Clad Petersen; A Carlisle Company, www.pac-clad.com.
   4. Western States Metal Roofing, www.westernstatesmetalroofing.com.
   5. As approved by Architect and in compliance with substitution requirements.
B. **Basis of Design Product: Belvedere 6” Short Rib BWK360.**
C. Properties:
   1. Coverage: 36”.
   2. Minimum Length: 6’-0”.
   3. Panel Depth: 1 ½”.
   4. Panel Length: As shown on Drawings.
   5. Orientation: As shown on Drawings.
   6. Perforations: None.
   7. Material: Metallic coated steel.
   8. Gauge: 20.
   9. Texture: Smooth.
   10. Manufacturer’s Finish: 70% polyvinylidene fluoride (PVDF).
   11. Color: Premium - As shown on Drawings.

12. Fasteners: Exposed.

D. Source Limitations: Obtain metal wall panels, trim and other accessories from a single manufacturer.

E. Provide all accessories, fasteners, and other items necessary for a complete installation.

2.05 MATERIALS – METAL WALL & CEILING/SOFFIT PANELS (TYPE MWP-3)

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: ATAS International, Inc., www.atas.com.**
   2. AEP Span, www.aepspan.com.
   3. Pac-Clad Petersen; A Carlisle Company, www.pac-clad.com.
   4. Western States Metal Roofing, www.westernstatesmetalroofing.com.
   5. As approved by Architect and in compliance with substitution requirements.

B. **Basis of Design Product: Opaline OPW085.**

C. Properties:
   1. Coverage: 8 ½”.
   2. Minimum Length: 1’-6”.
   3. Panel Depth: 3/4”.
   4. Panel Length: As shown on Drawings.
   5. Orientation: As shown on Drawings.
   6. Reveal: ½”.
   7. Perforations: None.
   8. Material: Metallic coated steel.
   9. Gauge: 22.
   10. Texture: Smooth.
   11. Manufacturer’s Finish: 70% polyvinylidene fluoride (PVDF).
   12. Color: Standard - As shown on Drawings.
   13. Fasteners: Concealed.

D. Source Limitations: Obtain metal wall panels, trim and other accessories from a single manufacturer.

E. Provide all accessories, fasteners, and other items necessary for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions and verify substrate conditions are acceptable for product installation. Report detrimental conditions in writing to Architect. Proceed with installation only after correcting unsatisfactory conditions. Commencement of Work shall be construed as acceptance of subsurfaces.

3.02 PREPARATION

A. Miscellaneous Framing: Install furring, angles, sub-purlins, and other miscellaneous wall panel support members and anchorage according to metal wall panel manufacturer's recommendations.

B. Install temporary coverings and protection measures of adjacent conditions as necessary.

3.03 INSTALLATION

A. General: Comply with panel manufacturer’s installation instructions including but not limited to special techniques, interface with other work, and integration of systems.

B. Fasten metal wall panels to supports using proper fasteners and spacing as recommended by panel manufacturer.
C. Accessory Installation:
    1. General: Install accessories using techniques recommended by manufacturer which will assure positive anchorage to building and weather tight mounting. Provide for thermal movement. Coordinate installation with flashings and other components.
    2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and the SMACNA "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and install units to true level. Install work with laps, joints, and seams that will be permanently watertight.

3.04 CLEANING AND PROTECTION

A. Remove temporary coverings and protection of adjacent work areas.
B. Repair or replace any installed products that have been damaged.
C. Clean installed panels in accordance with manufacturer’s instructions prior to Owner’s acceptance.
D. Remove and lawfully dispose of construction debris from Project site.
E. Protect installed product and finish surfaces from damage during construction.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 54 23

THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING (ON STEEL DECKING)

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Thermoplastic Polyolefin (TPO) Roofing Membrane.
B. Cover boards.
C. Insulation.
D. Thermoplastic Polyolefin Flashings.
E. Thermoplastic Polyolefin Accessories.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 31 00 – Steel Decking.
B. CSI Number 05 50 00 – Metal Fabrications.
C. CSI Number 06 10 53 – Miscellaneous Rough Carpentry.
D. CSI Number 07 60 00 – Flashing and Sheet Metal.
E. CSI Division 22 – Plumbing.
F. CSI Division 23 – Heating, Ventilating, and Air Conditioning (HVAC).
G. CSI Division 26 – Electrical.

1.03 REFERENCES

A. American Society of Civil Engineers (ASCE)/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
B. ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
C. ASTM C140/C140M – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
D. ASTM C208 – Standard Specification for Cellulosic Fiber Insulating Board.
E. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
F. ASTM C1278/C1278M – Standard Specification for Fiber-Reinforced Gypsum Panel.
G. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
H. ASTM D41/D41M – Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
I. ASTM D1079 – Standard Terminology Relating to Roofing and Waterproofing.
J. ASTM D1970/D1970M – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
K. ASTM D2178/D2178M – Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
L. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
M. ASTM D4601 – Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
N. ASTM D4897/D4897M – Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing.

O. ASTM D6878/D6878M – Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.
P. ASTM D7877 – Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes.
Q. ASTM D8231 – Standard Practice for the Use of a Low Voltage Electronic Scanning System for Detecting and Locating Breaches in Roofing and Waterproofing Membranes.
R. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
S. ASTM E1980 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
T. ASTM G155 – Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials.
U. Factory Mutual (FM) – Approval Guide.
V. FM 4470 – Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.
W. FM 4474 – American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.
X. FM DS 1-28 – Wind Design.
Y. National Roofing Contractors Association (NRCA) – The NRCA Roofing Manual.
Z. NRCA – The NRCA Waterproofing Manual.
AA. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) – Architectural Sheet Metal Manual.
BB. Single Ply Roofing Industry (SPRI) RP-4 – Wind Design Standard for Ballasted Single-Ply Roofing Systems.
CC. Underwriters Laboratories (UL) – Online Certifications Directory.
DD. UL – Fire Resistance Directory.
EE. UL 580 – Safety Testing for Uplift Resistance of Roof Assemblies.
FF. UL 1897 – Standard for Safety, Uplift Tests for Roof Covering Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at least one (1) week before starting work of this CSI Number.
   1. Attendees: Owner, Contractor, Architect, Roofing Installer, Roofing Manufacturer's technical representative, and installers whose work interfaces with or affects the work of this CSI Number.
   2. Review project requirements, including the following:
      a. Preparation and acceptance of substrates.
      b. Sequencing and coordination between trades and acceptance of substrates for roofing installation.
      c. Approved materials, details and sequencing for transitions, tie-ins, flashings, drainage, penetrations, and curbs.
      d. Protection of installed materials.
      e. Repair procedures.
B. Roofing Terminology: Refer to ASTM D1079 and the glossary of The NRCA Roofing Manual for definitions of roofing terms related to this CSI Number..

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's data for all roofing system materials, components, and accessories indicated in this CSI Number..
B. Shop Drawings: Include roof plans and details showing terminations, flashings, penetrations, attachment methods, tie-ins, and interface with adjacent work.

1. Indicate insulation thicknesses and slopes.
2. Include project-specific tapered insulation layout prepared by roofing manufacturer.
3. Roof plan indicating orientation of steel roof deck (if applicable) and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.

C. Samples: Submit (1) sample 6” x 6” in size of roof membrane materials, insulation, fasteners (if applicable), and accessories for verification of quality by Architect.
D. Manufacturer’s Letter: Certify products meet or exceed specified requirements.
E. Wind Uplift Resistance Submittal: Indicate compliance with wind uplift performance requirements.
F. Field Quality Control Submittals: Field testing and inspection reports.
G. Manufacturer's qualification statement.
H. Installer's qualification statement.
I. Testing firm's qualification statement.
J. Sample/Specimen Warranty: For approval.
K. Closeout Documents: Executed Warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this CSI Number with minimum five (5) years of documented experience.
B. Installer Qualifications: Company specializing in performing work of this CSI Number with at least five (5) years of documented experience and approved by manufacturer for specified warranty.
C. Testing Firm Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.
D. Source Limitations: All components listed in this CSI Number shall be provided by a single manufacturer or approved by the primary roofing manufacturer.
E. Final Inspection: Manufacturer’s representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals unbroken and labels intact.
B. Store materials in their original undamaged containers in weather protected environment, clear of ground and moisture, and within temperature range required by manufacturer.
C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof structure.
E. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.
F. Protect liquids and foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Contact roofing manufacturer to confirm acceptable assemblies for special applications. Conform with manufacturer's instructions.
B. Do not apply roofing membrane during unsuitable weather. Proceed with roofing only when existing and forecasted weather conditions are suitable.
C. Do not apply roofing materials when ambient temperature is below 45 degrees Fahrenheit, unless otherwise permitted by manufacturer in writing.
D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered the same day.
F. Schedule applications so no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. System Guarantee: Provide manufacturer's system guarantee.
   1. Guarantee: GAF EverGuard® Diamond Pledge NDL Roof Guarantee.
   2. Term: 20 years.
   3. Liability Limit: No dollar limit on covered repairs.
   4. Scope of Coverage:
      a. Repair of covered leaks resulting from manufacturing defects, ordinary wear and tear, or workmanship in applying the covering materials, subject to certain exclusions.
      b. Leaks due to winds up to 100 mph, excluding hurricanes and tornados.
      c. Hail up to 2 inches in diameter.
      d. Provide GAF Well Roof Extension for a term up to 25 percent of the original guarantee duration (up to maximum duration of 35 years) when roofing system is inspected and maintained in accordance with manufacturer’s terms and conditions.
B. Extended Correction Period: Correct defective work within 2-year period commencing on date of Substantial Completion.
C. Existing Roofing Alterations: Submit statement from existing roof membrane manufacturer that existing roof warranty has not been affected by work performed under this CSI Number.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: GAF, www.GAF.com.**
   2. Carlisle SynTec Systems, www.carlislesyntec.com.
   3. Elevate; Holcim Group, www.holcimelevate.com.
   4. Johns-Manville, www.jm.com.
   5. As approved by Architect and in compliance with substitution requirements.

B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.02 ROOFING SYSTEM

A. Roofing System Description: Listed from top of roof down.
   1. Single Ply Membrane: Mechanically attached.
   2. Cover Board: High density polyisocyanurate board; mechanically fastened.
   3. Insulation: Minimum two layers, having maximum individual board thickness of 2 inches.
      a. System Minimum R-value (RSI-value): As shown on Drawings.
      b. Total Thickness: As shown on Drawings.
      c. Slope: Provide minimum slope as shown on Drawings.
      d. Top Layers: Polyisocyanurate foam board, noncomposite; mechanically fastened.
      e. Bottom Layer: Polyisocyanurate foam board, noncomposite; mechanically fastened.
      f. Crickets: Tapered insulation of same type as specified for top layer; minimum slope as shown on Drawings and to comply with code requirements.
   4. Vapor Retarder: Not used.
   5. Deck Sheathing: Not used.
B. Performance Requirements:

1. General: Roofing system to withstand specified uplift pressures, thermally induced movement, and exposure to ordinary weather conditions.
2. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes, and any other requirements of the Authority Having Jurisdiction (AHJ).
3. Material Compatibility: Provide roofing materials and accessories compatible with one another under conditions of service and application, as demonstrated by roof membrane manufacturer based on testing and field experience
4. Wind Uplift Resistance: Design to withstand wind uplift forces in accordance with applicable local building code requirements as demonstrated by roofing manufacturer's independent testing.
    a. Roofing System: Tested in accordance with FM 4474, UL 580, or UL 1897.
    b. Design Pressures: As indicated in Drawings.
5. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 80, when calculated in accordance with ASTM E1980.
6. Roof Covering External Fire Resistance Classification: Class A when tested per UL 790.
7. Factory Mutual Classification: Provide roofing system listed in FM Approvals RoofNav, and having membrane, base flashings, and component materials complying with FM 4450.
    a. Fire and Windstorm Classification: Class 1A and windstorm resistance of 1-90, in accordance with FM DS 1-28.
    b. Hail Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

2.03 MATERIALS – MEMBRANE

A. Membrane:
    1. TPO Membrane: Thermoplastic polyolefin sheet complying with ASTM D6878/D6878M with internally reinforced scrim.
        a. Smooth Membrane: 60 mil, 0.060 inch (1.5 mm) nominal TPO thickness.
    2. Impact Resistance: Membrane to resist impact damage when tested in accordance with the "Resistance to Foot Traffic Test" in FM 4470.
    3. Color: White.
    4. Products:
        a. GAF EverGuard® TPO Membrane, www.gaf.com.
        b. As approved by Architect and in compliance with substitution requirements.
B. Membrane Attachment: Mechanically attached in accordance with roofing manufacturer's requirements.
C. Membrane Fasteners: Membrane manufacturer's recommended type.
D. Flexible Flashing: Manufacturer's standard TPO sheet flashing matching primary membrane in type and color, minimum 55 mil, 0.055 inch (1.4 mm) thickness.
E. Protection Sheet: None – not used.
F. Separation Mat: None – not used.

2.04 MATERIALS – COVER BOARDS

A. Cover Board: High-density polyisocyanurate (ISO) insulation board, complying with ASTM C1289, and the following characteristics:
    1. Classification: Type II, Class 4 - faced with coated glass-fiber-mat facers on both major surfaces of core foam.
    2. Compressive Strength: Grade 1, 80 psi (Grade 1, 550 kPa).
    3. Thickness: 1/2 inch (12.7 mm).
    4. Insulation Thermal Resistance, R-value (RSI-value): 2.5 (0.44), nominal.
    5. Products:
        a. GAF EnergyGuard® HD Polyiso Cover Board, www.gaf.com.

b. As approved by roofing Manufacturer and Architect, and in compliance with substitution requirements.

B. Mechanical Attachment: Mechanically attached in accordance with roofing manufacturer's requirements.

C. Fasteners: Approved and in accordance with roofing manufacturer's requirements.

2.05 MATERIALS – INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289. Total R-value or minimum thickness as indicated on Drawings.
   1. Classification: Type II, Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
   2. Mold Growth Resistance: Passing ASTM D3273.
   3. Compressive Strength: Grade 2, 20 psi (138 kPa) minimum.
   4. Board Size: 48 by 96 inches (1220 by 2440 mm).
   5. Tapered Board: Same type as primary roof insulation. Taper to provide slope as shown on Drawings.
   6. Products:
      a. GAF; EnergyGuard® Polyiso Insulation: www.gaf.com.
      b. As approved by roofing Manufacturer and Architect, and in compliance with substitution requirements.

B. Mechanical Attachment: Mechanically attached in accordance with roofing manufacturer's requirements.

C. Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

2.06 MATERIALS – VAPOR RETARDER

A. Not used.

2.07 DECK SHEATHING

A. Not used.

2.08 MATERIALS – ACCESSORIES

A. Miscellaneous Accessories: Provide pourable sealers, primers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories as necessary for a complete roofing system installation.

B. Prefabricated Flashing Accessories: Same material as membrane in manufacturer's standard thicknesses, including:
   1. Inside corners, outside corners, universal corners, and fluted corners.
   2. Square tube wraps.
   3. Conical pipe boots and split pipe boots.
   4. Pourable sealer pockets.
   5. T-Joint cover patches.

C. Wood Nailers, Curbs, and Blocking: See Miscellaneous Carpentry specification.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

E. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.1 inch (2.5 mm) thick.

F. Sealants: As recommended by membrane manufacturer.

G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

H. Welded Flexible Walkways: Heavy-duty, slip-resistant, textured TPO walkway roll, suitable for maintenance traffic and visually distinctive from roof membrane:
   1. Roll Width: 34 inches (860 mm).
   2. Surface Color: Gray.
   3. Products:
      a. GAF EverGuard® TPO Walkway Roll, www.gaf.com.
      b. As approved by roofing manufacturer and Architect, and in compliance with substitution requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify surfaces and site conditions are ready to receive work.
B. Verify deck is supported and secure.
C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped (if applicable) and suitable for installation of roof system.
D. Verify deck surfaces are dry and free of moisture, snow or ice.
E. Verify roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.
F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PROTECTION DURING WORK

A. Protect building surfaces against damage and contamination from roofing work.
B. Where work must continue over or adjacent to completed roof areas, protect the finished roofing systems from damage as necessary.

3.03 PREPARATION – METAL DECK

A. Verify metal deck conforms with manufacturer's minimum requirements, Structural Drawings, and Steel Decking Specification.
   1. Meeting the gauge and span requirements in the current Factory Mutual FM Approval Guide and installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
B. Verify surface plane flatness and fastening of steel roof deck complies with requirements in Steel Decking Specification.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION – GENERAL

A. Perform work in accordance with manufacturer's instructions and FM Approvals RoofNav.
B. Do not apply roofing components during cold or wet weather conditions outside of manufacturer’s approved conditions.
C. Do not apply roofing membrane when ambient temperature is outside of manufacturer’s required temperature range.
D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered the same day.
F. Coordinate this work with installation of associated counterflashings as work of this CSI Number proceeds.

G. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty or guarantee for existing roofing system.
H. Coordinate installation and transition of roofing system component serving as an air barrier with specified air barrier.
I. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
J. Install night seal at end of each workday or when rain is forecast. Provide temporary seals to prevent water from entering completed sections of roofing system. Ensure stagger and offset of underlying insulation to prevent thermal breaks. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 INSTALLATION – DECK SHEATHING

A. Not used.

3.06 INSTALLATION – VAPOR RETARDER

A. Not used.

3.07 INSTALLATION – INSULATION

A. Installation over Metal Deck: Attach insulation in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements. Where insulation is installed directly over metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
   1. Base Layer: Mechanically fasten base layer of insulation using fasteners specifically designed and sized for fastening specified roof insulation to metal decks.
   2. Upper Layers: Mechanically fasten upper layers of insulation using fasteners specifically designed and sized for fastening specified roof insulation to metal decks.
B. Lay subsequent layers of insulation with joints staggered from joints of preceding layer in accordance with manufacturer's instructions.
C. Place tapered insulation to required slope pattern in accordance with manufacturer's instructions.
D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
E. At roof drains, slope insulation down to roof drains with each side equal to the diameter of the drain bowl plus 36 inches (914 mm).
F. Do not install more insulation than can be covered with membrane in same day.

3.08 INSTALLATION – COVER BOARD

A. Install cover board over insulation with joints staggered from joints of insulation in accordance with manufacturer's instructions.
B. Trim cover board neatly to fit around penetrations and projections as directed by cover board manufacturer.
C. Mechanical Attachment: Fasten cover board in accordance with manufacturer's instructions and FM (AG) Factory Mutual requirements.

3.09 INSTALLATION – MEMBRANE

A. Install membrane and flashings in accordance with roofing system manufacturer's instructions.
B. Roll out membrane, free from wrinkles or tears.

C. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Shingle joints on sloped substrates in direction of drainage where possible.
D. Mechanical Attachment:
    1. Install membrane and mechanical attachment devices in accordance with manufacturer's instructions. Attach securely at terminations, penetrations, and perimeter of roofing.
E. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings. Test lap edges with probe to verify seam weld continuity in accordance with manufacturer’s technical bulletins.
F. At intersections with vertical surfaces terminate and seal top of sheet flashings with termination bars secured to nailing strips or structural backing or in conformance with roofing manufacturer's approved details.
    1. Insert flashing into reglets and secure.
G. Extend membrane under copings and secure to outside face of wall.
H. Around roof penetrations, seal flanges and flashings with flexible flashing.
I. Install roofing expansion joints where shown on Drawings. Make joints watertight.
J. Coordinate installation of roof drains and related flashings. Terminate membranes according to manufacturer’s approved details. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
K. Walkways: Install walkways in accordance with roofing system manufacturer's instructions at locations shown on Drawings. Provide manufacturer's minimum clearance between units.

3.10 FIELD QUALITY CONTROL

A. Provide on-site attendance of roofing manufacturer's representative as necessary during installation of this work.
    1. Probe heat welded seams and test seams in accordance with manufacturer’s recommendations.
B. Repair or remove and replace components of roofing system where tests or inspections indicate they do not comply with specified requirements. Perform repairs using manufacturer’s approved repair procedures.
C. Perform additional testing and inspecting at Contractor's expense to determine if repaired or additional work complies with specified requirements.

3.11 CLEANING AND PROTECTION

A. Properly dispose of all product wrappers, pallets, cardboard, scrap, waste and debris in a legal manner. Replace damaged material with new materials.
B. Clean adjacent construction where soiled by work of this CSI Number. Comply with manufacturer of adjacent construction's instructions and procedures.
C. Protect installed roofing system from construction operations.
D. Correct deficiencies in work in accordance with warranty/guarantee requirements. Repair or replace defaced or damaged finishes caused by work of this CSI Number.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Flashings, sheet metal work, and related items including, but not limited to:
   1. Metal copings (wall caps).
   2. Metal Fascia.
   3. Flashing at roof penetrations.
   4. Edge Flashing.
   5. Counterflashing at vertical surfaces.
   6. Sheet metal scuppers, gutters, and downspouts.
   7. Self-adhering waterproofing underlayment under copings, wall caps, and sills.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 10 00 – Structural Metal Framing.
B. CSI Number 06 10 53 – Miscellaneous Carpentry.
C. CSI Number 07 42 13 – Metal Wall Panels.
D. CSI Number 54 23 – Thermoplastic-Polyolefin (TPO) Roofing.
E. CSI Number 07 92 00 – Joint Sealants.
F. CSI Number 09 96 00 – High-Performance Coatings.

1.03 REFERENCES

A. Factory Mutual (FM) Property Loss Prevention Data Sheet 1-49 – Perimeter Flashing.
B. National Roofing Contractors Association (NRCA) – The NRCA Roofing Manual.
C. NRCA – The NRCA Waterproofing Manual.
D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) – Architectural Sheet Metal Manual.
E. ANSI / SPRI (Single Ply Roofing Industry) ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's latest product and written installation data for factory fabricated copings, reglets, and counterflashing.
B. Shop Drawings: Submit plan, elevation, section and detail drawings indicating type of material, gauge, dimensions, profiles, locations where used, fastening and anchoring methods, joints, and provisions for expansion and contraction.
C. Samples: Submit (1) sample 6" x 6" in size of each prefinished metal finish for verification or selection of color by Architect.

1.05 QUALITY ASSURANCE

A. Comply with the following standards:
   1. Comply with design and installation methods of SMACNA Architectural Sheet Metal Manual.
   2. Comply with The NRCA Roofing and Waterproofing Manual installation details.

3. Comply with ANSI / SPRI ES-1.

B. Performance Requirements: Designed and installed to withstand wind pressures in compliance with ANSI / SPRI ES 1, or FM Property Loss Prevention Data Sheet 1-49 for Class 1-90 wind rated design, or wind load design criteria indicated on General Structural notes in Drawings, whichever is greater.

C. Mock-ups:
   1. Prior to the start of Work, construct a sample of each metal coping (wall cap) and scupper type for review and acceptance by Architect prior to ordering materials, and fabricating and installing the scuppers. Mockup to show details of the scupper construction, including integration of the roofing system. This mockup section may be included as part of the finished building if approved by the Architect.
   2. Mock-ups shall provide a standard of workmanship, and shall include flashings, joints, and sealant systems.
   3. Construct successive mock-ups as necessary until a mock-up is accepted by the Architect.
   4. When accepted, mock-up shall be the standard of comparison for the remainder of the Work.
   5. Upon completion of the project, remove mock-ups from the site and dispose of them in a legal manner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials in manufacturer's original containers, dry and undamaged, with seals unbroken and labels intact.

B. Store materials in their original undamaged containers in weather protected environment, clear of ground and moisture, and within temperature range required by manufacturer.

C. Handling: Comply with Manufacturer's instructions. Handle with care so as not to buckle or warp metal, or damage solder joints.

1.07 WARRANTY

A. General: Furnish 5-year warranty against flashing and sheet metal failure, in which contractor agrees to repair or replace flashing and sheet metal as necessary to maintain work in watertight condition during the warranty period. Warranty to cover workmanship, materials and repair or replacement of same, at no cost to Owner.

B. Metal Coping: Furnish 20-Year Warranty. Manufacturer shall guarantee that a standard size roof edge system, when installed per manufacturer’s instructions, will not blow off, leak, or cause membrane failure, even in wind conditions up to 110 mph, or the manufacturer shall at their option repair or replace their materials at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. ATAS International, Inc., https://www.atas.com.
   2. Fry Reglet Corporation, https://fryreglet.com.
   3. GAF Materials LLC, www.gaf.com.
   4. Hickman Edge Systems, www.hickmanedgesystems.com.
   5. Lumabuilt, https://lumabuilt.com.
   6. Pac-Clad Petersen; A Carlisle Company, www.pac-clad.com.
   7. Western States Metal Roofing, www.westernstatesmetalroofing.com.
   8. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS – GENERAL

A. Galvanized Steel: ASTM A653, 24 gauge minimum and as indicated, with G-60 coating.
B. Prefinished Metal:
    1. Hot-dipped galvanized, ASTM A653 Structural Quality, Grade 40, G90 coating 24-gauge core steel, or prefinished Galvalume – ASTM A792.
    2. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14.
    3. Finish: Full strength polyvinylidene fluoride (PVDF) coating, applied by the manufacturer on a continuous coil coating line, with top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil.
        a. Bottom side: Coated with primer with a dry film thickness of 0.25 mil.
        b. Finish: Conform to all tests for adhesion flexibility, and longevity as specified by the polyvinylidene fluoride (PVDF) finish supplier.
        c. Color: As shown on Drawings. Color selection may include multiple colors to match adjacent finish and cladding materials.
    4. Strippable film: Liquid applied to top side of painted coil to protect finish during fabrication, shipping and field handling.

2.03 MATERIALS – METAL COPINGS (WALL CAPS)

A. Coping: Metal coping cap with galvanized steel anchor cleats and gutter support chairs for capping any parapet wall. The system shall be watertight, maintenance free, and not require exposed fasteners or sealant. Joints shall be butt type with concealed splice plates.
B. Performance characteristics:
    1. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
    2. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
    3. All coping cover joints shall be underlayed with gutter/support chairs capable of draining water.
C. Metal: 24-gauge galvanized steel with polyvinylidene fluoride (PVDF) coating, unless noted otherwise on the Drawings.
D. Coping cap: Length of 10'-0” (3048 mm); width as required.
E. Coping vertical face and back leg: standard 4” (100 mm) nominal.
F. Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.
G. Coping Cleat: 20-gauge galvanized steel anchor cleat; normally 12” wide @ 5'-0” on center to be mechanically fastened as indicated and detailed.
H. Gutter/support chair: Metal Gutter Chair in color and finish to match coping cap.
I. Fasteners: Shall be stainless steel screw type with a minimum pull-out resistance of 240 # (109 kg) as supplied by the manufacturer per substrate application. No exposed fasteners shall be permitted.
J. Finish & Color: As shown on Drawings. Color selection may include multiple colors to match adjacent finish and cladding materials.
K. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer.
L. Welded or METAL-LOCK® style assembly shall be used to maintain watertight integrity.

2.04 MATERIALS – ACCESSORIES

A. Reglets and Counterflashings: Fry Reglet Corporation, Type SM at masonry and Concrete, or fabricated as indicated on Drawings. Provide prefabricated inside and outside reglet and counterflashing corners.
B. Solder: ASTM B32, 50/50 type.
C. Flux: FS O-F-506.

D. Sealant: As specified in Joint Sealant Specification.
E. Plastic Cement: ASTM D4586.
F. Bituminous Coating: FS TT-C-494 or SSPC paint - 12, dry film 15 mils per coat.
G. Sheet Metal Fasteners: Galvanized steel with soft neoprene washers at exposed fasteners.
H. Self-Adhering Waterproofing Underlayment:
    1. High-temp resistant, flexible, self-adhering rubberized asphalt sheet membrane underlayment with polymer film and removable treated release film on adhesive side.
        a. Grace Perm-A Barrier.
        b. Tamko waterproofing.
    2. High-temperature resistant, flexible, self-adhering butyl-based sheet membrane underlayment with high density cross laminated polyethylene backed and removable plastic release film on adhesive side, self-adhering flashing membrane, Grace Ultra or equivalent www.grace.com/construction/en-us.
I. Prefinished Metal Seam Sealers and Adhesives: As recommended by prefinished metal manufacturer for waterproof and weather-resistant seaming and adhesive applications of flashing and sheet metal work.
    1. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape.
    2. Butyl Sealant; ASTM C1311, single-compound, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

2.05 FABRICATION

A. Fabricate sheet metal with lines, arise, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Hem exposed edges to form a 1/2 inch wide hem on the side concealed from view.
    1. Provide concealed stiffeners and reinforcements as necessary to provide surfaces free of objectionable wave, warp, or buckle.
B. Fabricate scuppers, gutters, and downspouts in accordance with the following Figure(s) and Table(s) from the SMACNA Architectural Sheet Metal Manual and as indicated on drawings
    1. Scuppers: Figures 1-26A through 1-30C, as applicable to design indicated on drawings.
C. Forming, anchoring, expansion and contraction details shall conform to referenced quality standards.
D. Provide for thermal expansion of running trim, flashing, expansion joints, and other items exposed for more than 15 feet continuous length.
E. Fabricate cleats and starter strips of same material as sheet.
F. Form pieces in longest practical lengths, except form flashing and fascia in 8- to 10-foot units.
G. Fabricate corners from one piece with minimum 18 inch long legs, with mitered corners; solder for rigidity, seal with sealant.
H. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.
I. Where prefabricated counterflashing and reglet system is used, form upper edge of counterflashing with an approved snap lock flange to engage reglet receiver and to provide a spring action at bottom edge against built-up flashing.
J. Flashing Pans: Form sheet metal pans 6 inch nominal square size, with 3 inch upstand, and 4 inch flanges. Fill pans watertight with plastic cement.

2.06 FINISH

A. Shop prepare and prime exposed ferrous metal surfaces of unfinished galvanized steel sheet.
B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 1.5 mil.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work shall be construed as acceptance of subsurfaces.
   1. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
   2. Verify membrane termination and base flashings are in place, sealed, and secure.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Installation shall conform to NRCA and SMACNA manuals.

B. Self-Adhering Waterproofing Underlayment: Install self-adhering waterproofing underlayment under copings, wall caps, and similar horizontal locations.
   1. Install waterproofing underlayment in widths to cover top of wall or horizontal surface being installed. Extend underlayment down each side of wall as detailed on Drawings.
   2. Waterproofing membrane shall be completely concealed by metal coping.
   3. Make end laps 4 inches minimum. Where width of wall requires multiple widths of waterproofing underlayment, make side laps 4 inches minimum.
   4. Install coping and wall caps over installed waterproofing underlayment.

C. Expansion Seams: Maintain a watertight installation at expansion seams. Locate expansion seams as shown or if not shown, at the following maximum spacing for each general flashing use.
   1. Flashing, expansion joints, gravel stops, and trim: At 10 foot intervals, 24 inches on each side of corners and intersections.
   2. Sealant-type expansion joints: Where sealant-filled expansion joints are used, embed the hooked flanges of the joint members not less than 1 inch into the sealant. Form joints to completely conceal the sealant. When ambient temperature is moderate at the time of installation (40 to 70 degrees F.), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40 degrees F. Installation of sealant is specified in the Joint Sealants Specification.

D. Where dissimilar materials abut, provide proper separation or protection to minimize the possibility of galvanic action.

E. Soldering:
   1. Solder joints at corner fabrications.
   2. Except where other methods of joining are indicated or specified, solder joints and connections of Sheet Metal Work.
   3. Remove grease and dirt from metal surfaces to be joined.
   4. Remove flux residue by scrubbing, neutralizing with ammonia or a 5 to 10 percent solution of washing soda, followed by a clear water rinse.
   5. Assemble parts and solder using regular non-corrosive resin flux. Heat metal thoroughly to completely sweat solder through full contact area.

F. Sealed Joints: Form nonexpansion, but movable joints in metal with flat lapped seams to accommodate elastomeric sealant to comply with SMACNA Standards. Fill joint with sealant and form metal to completely conceal sealant.

G. Reglets: Install reglets in masonry, concrete, or stucco to receive flashings.

H. Counterflashing:
   1. Provide metal counterflashing at top edges of built-up base flashings and at other locations indicated.
   2. Lap end joints a minimum of 3 inches. Do not solder or weld joints. Make flashing continuous at angles. Counterflashing shall overlap base flashing a minimum of 4 inches, unless otherwise indicated.
   3. Where counterflashing terminates in reglets, fasten flashing with lead wedges every 12 inches. Fill reglets continuously with synthetic rubber type sealant.

I. Copings and Wall Caps:
   1. Cover top of parapet walls with prefinished metal coping formed to design shown.
   2. Coordinate installation of sheet metal coping with installation of self-adhering waterproofing underlayment placed over wall caps and copings. Waterproofing membrane shall be completely concealed by metal coping.
   3. Extend front edge of coping covering down over the lock into a previously placed continuous cleat. Secure edge strips with nails spaced 6 inches apart.
   4. Where flashing is indicated at back of wall or parapet where coping/wall cap is installed, join rear edge of coping covering to adjacent flashings as indicated.

3.04 CLEANING AND PROTECTION

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 72 33

ROOF HATCHES & ACCESSORIES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Roof Hatches.
B. Roof Accessories:
   1. Safety Railing Systems.
   2. Ladder Safety Posts.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 50 00 – Metal Fabrications.
B. CSI Number 05 51 33 – Metal Ladders.
C. CSI Number 06 10 53 – Miscellaneous Rough Carpentry.
D. CSI Number 07 54 23 – Thermoplastic-Polyolefin (TPO) Roofing.
E. CSI Number 07 60 00 – Flashing and Sheet Metal.
F. CSI Number 07 92 00 – Joint Sealants.

1.03 REFERENCES

A. International Building Code (IBC).
B. Occupational Safety and Health Administration (OSHA) Regulations:
   1. OSHA 29 CFR 1910.23.
   2. OSHA 29 CFR 1910.28.
   3. OSHA 29 CFR 1910.29.
   4. OSHA 29 CFR 1926.501.
   5. OSHA 29 CFR 1926.502.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data and technical sheets, written installation instructions and limitations, and recommendations for each product/material to be used, including setting drawings, templates, finish requirements, and details of anchorage devices.
   1. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected Work. Include plan and section views.
   1. Hatch Units: Show types, elevations, thickness of metals, and full-size profiles.
   2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
   3. General: Show connections of units and hardware to other Work. Include schedules showing location of each type and size of unit.
C. Manufacturer’s standard warranty.
D. Closeout Submittals:
   1. Manufacturer's Installation Instructions and Operation & Maintenance: Indicate installation, operation and maintenance requirements and rough-in dimensions.

1.05 QUALITY ASSURANCE & COORDINATION

A. Regulatory Requirements:
   1. OSHA regulations for guarding floor and wall openings and holes.
   2. OSHA regulations for fall protection systems and falling object protection-criteria and practices.
   3. OSHA regulations for fall protection systems criteria.
   4. IBC standards for roof access.
B. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a watertight installation.
C. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site ready to use, in manufacturer’s original unopened packaging, with labels intact.
B. Handling: Comply with Manufacturer's instructions. Exercise proper care in handling of Work so as not to damage or disrupt finished surfaces.
C. Store materials under cover in a dry and clean location off the ground to protect against damage while stored at the Project Site.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify dimensions shown on Drawings by taking field measurements; proper fit and attachment of parts is required.
B. Coordinate the Work to be scheduled with other trades required.

1.08 WARRANTY

A. Provide manufacturer's standard 5-year warranty. Products shall be free from manufacturing defects in materials and fabrication for a period of 5 years from the date of shipment. Should a product fail to function in normal use within this period, manufacturer shall furnish a replacement or new part at no charge to the Owner, freight included.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: Babcock-Davis, www.BabcockDavis.com.**
   2. Acralight Solar, www.acralightsolar.com.
   3. JL Industries, Activar Construction Products Group, www.activarcpg.com.
   4. Milcor Company, Duravent Group, www.MilcorInc.com.
   5. Nystrom, www.nystrom.com.
   6. Precision Ladders, LLC, www.PrecisionLadders.com.
   7. The Bilco Company, www.bilco.com.
   8. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS – ROOF ACCESS HATCH

A. **Basis of Design Product: Model BG3636 (with vertical access ladder) or BG3054 (with ship ladder).**
B. Type: Personnel, single-leaf metal lid for ladder, ship stair, or alternating tread stair access.
C. Size: 36 inches x 36 inches (with vertical access ladder) or 30 inches x 54 inches (with ship ladder).

D. Performance Requirements:
   1. Hatch shall be reinforced to support live load of 40-lbf/sq. ft. (1.9-kPa) with a maximum deflection of 1/150th of the span with a wind load of plus or minus 140-lbf/sq. ft. (6.70-kPa).
E. Loads:
   1. Units less or equal to than 60 inches (152 cm) in length: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load with a maximum deflection of 1/150 of the span and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
   2. Units greater than 60 inches (152 cm) in length: Minimum 40-lbf/sq. ft. (1.9-kPa) external uplift load with a maximum deflection of 1/150 of the span and 90-lbf/sq. ft. (4.31-kPa) internal uplift load.
F. Hatch Material:
   1. Cover: 14-gauge minimum, 0.07895 inch (1.9 mm) galvanneal steel.
   2. Cover Insulation: 1-inch (25mm) polyisocyanurate.
   3. Curb: 14-gauge minimum, 0.07895 inch (1.9 mm) galvanneal steel with a single wall, curb and integral railing ready EZ tabbed counter flash. Mounting flange continuous around base of frame.
      a. Fabricate curbs to minimum height of 12-inches above roofing surface unless otherwise indicated.
      b. Sloping Roofs: Where slope or roof deck exceeds 7:12, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level
   4. Curb Insulation: 1-inch (25 mm) polyisocyanurate.
G. Finish: 70% polyvinylidene fluoride (PVDF) or powder coat.
H. Color: As selected by Architect from manufacturer’s full range of available colors.
I. Hardware: Zinc plated steel.
   1. Hinge Assembly: Pintle hinge with stainless steel hinge pin.
   2. Spring: Gas spring with integrated damper.
   3. Hold Open Device: Automatic zinc plated steel hold open arm with red vinyl grip handle.
   4. Latch: Zinc plated steel spring-type slam latch with inside and outside operating turn handles and padlock hasp provisions.
   5. Pull Handle: Interior pull down handle, powder coated safety yellow.
   6. Gasket: Extruded EPDM adhesive back seal, continuous around cover, permanently adhered.
J. Provide each roof hatch shown on the Drawings with a safety railing system and ladder safety post, unless noted otherwise on the Drawings.

2.03 MATERIALS – LADDER SAFETY POST

A. **Basis of Design Product: Model BSPY**
B. Type: Roof hatch manufacturer’s standard device for attachment to roof-access ladder.
C. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
D. Height: 42 inches above finished roof deck.
E. Material: Steel tube.
F. Post: 1-1/2 inch (38.1mm) by 1-1/2 inch (38.1mm) by 1/8 inch (2.3mm) high strength square tubing with a pull-up loop provided at the upper end to facilitate raising of post.
G. Finish: Powder coat or baked enamel.
H. Color: As selected by Architect from manufacturer’s full range of available colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
B. Verify that deck, curbs, roof membrane, base flashing, and other items affecting Work of this Section are in place and positioned correctly.
C. Verify tolerances and correct improper condition.
D. Identify conditions detrimental to providing proper quality and timely completions of work.
E. Do not proceed with installation until detrimental conditions have been corrected. Commencement of Work will be construed as acceptance of subsurfaces.

3.02 PREPARATION & COORDINATION

A. Refer to manufacturer’s product literature for surface preparation requirements. Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges. Remove dust, dirt, debris or any other foreign materials.
B. Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.03 INSTALLATION

A. Comply with manufacturer's recommendations and install using the manufacturer’s anchoring options as detailed on shop drawings and installation instructions for the appropriate curbs.
B. Coordinate installation of components of this Section with installation of roof deck, roof structure, roofing membrane, and base flashing.
C. Coordinate installation of sealant and roofing cement with Work of this Section to ensure water tightness.
D. Install roof hatches and accessories at locations indicated on the Drawings.
E. Securely anchor roof accessories in compliance with manufacturer's instructions
F. Set units plumb, level, and true to line without warp or rack. Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.
G. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

3.04 ADJUSTING

A. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust movable parts for smooth operation.

3.05 CLEANING AND PROTECTION

A. Clean exposed surfaces per manufacturer's written instructions. Touch up damaged metal coatings. Repair or replace damaged products before Substantial Completion.
B. Protect installed products until completion of project.
C. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Joint Sealants.
B. Backer Rods.
C. Acoustical Sealant.
D. Dual-purpose Acoustic/Smoke Sealant.

1.02 RELATED CSI NUMBERS

A. CSI Number 08 80 00 – Glazing.
B. CSI Number 09 29 00 – Gypsum Board.

1.03 REFERENCES

A. ASTM C794 – Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
B. ASTM C834 – Standard Specification for Latex Sealants.
C. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications.
D. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
E. ASTM C1193 – Standard Guide for Use of Joint Sealants.
F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
G. ASTM C1382 – Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints.
H. ASTM C1521 – Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
I. ASTM D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.

1.04 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product data sheets and recommended installation procedures for each product/material to be used. Clearly indicate and label each product’s data sheets as to what application and location it will be used for.
   2. Submit sample warranty to be jointly signed by both manufacturer and applicator.

B. Samples:
   1. Submit current manufacturer’s printed, physical color chart showing the full range of color options available for Architect selection.
   2. Submit physical samples of joint sealant colors as selected by Architect for approval prior to application.

C. Shop Drawings:
   1. Illustrations in sufficient detail to show installation and interface of the Work of this CSI Number with the Work of adjacent trades.

2. Indicate the locations where each sealant type will be installed.

D. Project Closeout:
1. Submit jointly signed manufacturer's warranty.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:
1. An approved manufacturer's installer shall perform the work and have not less than (5) years of successful experience in the installation of sealants in similar projects.
2. Installers shall be thoroughly trained and experienced in the necessary skills necessary to perform the Work of this CSI Number, and shall be thoroughly familiar with the specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's original unopened packaging with labels intact.
B. Storage: Adequately protect against damage while stored at the site. Maintain products and materials in accordance with manufacturers' written recommendations with proper precautions to ensure fitness of material when installed.
C. Handling: Comply with manufacturer's written instructions.

1.07 FIELD CONDITIONS

A. Physical Requirements for Proper Application: Observe manufacturer's written temperature service range. Do not apply sealant when weather conditions inhibit bonding and curing.

1.08 WARRANTY

A. Provide warranty in writing and jointly signed by the applicator and sealant manufacturer, to replace sealants which fail, at no additional cost to the Owner due to:
1. Loss of cohesion or adhesion.
2. Improper curing.
3. Fail to achieve air-tight and water-tight seal.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents and this specification**,** provide materials from a single manufacturer for each different product required.
1. Sika Corporation.
2. Dow Corning Corporation.
3. 3M.
4. As approved by Architect and in compliance with substitution requirements.

B. If sealants from separate manufacturers must be used and could come in contact with each other, provide written certification from every manufacturer involved that the sealants are compatible with each other and will adhere to each other.

2.02 MATERIALS

A. General:

1. Sealants, primers, backer materials, preformed joint fillers, bond breakers and related materials shall be compatible with adjoining materials. Verify compatibility prior to installation.

B. Sealant:
   1. The selection of proper sealant for a particular joint shall be in accordance with the current published recommendations of the manufacturer. Ensure sealant(s) will not cause staining on adjacent materials.
   2. General Use: Silicone base, conforming to ASTM C-920, installed at joints and where required to weatherproof and waterproof the building.
   3. Sealant at fire penetrations: See Firestopping specification.
   4. Dual Purpose Acoustic/Smoke Sealant:
      a. Provide one of the following products:
         i. Hilti CP 506 Smoke and Acoustic Sealant.
         ii. USG Sheetrock® Brand Acoustical Sealant.
         iii. Specified Technologies, Inc. (STI) SpecSeal® Smoke 'N' Sound Acoustical Sealant.
   5. Color: Colors as selected by Architect. In general, colors shall match adjacent materials unless otherwise directed by Architect.

C. Acoustical Sealant:
   1. Provide one of the following products:
      a. Owens Corning QuietZone Acoustic Sealant.
      b. Sikaflex® NP 1.
      c. Tremco Acoustical/Curtainwall Sealant.
      d. USG Sheetrock® Brand Acoustical Sealant.

D. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

E. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

F. Joint Filler (Backer): Compatible with sealant.
   1. Buildings: Comply with ASTM C1330, Type B; round bi-cellular or closed cell polyethylene or polyolefin, or open cell polyurethane foam rod as recommended by the sealant manufacturer for the application; oversized 25 to 30 percent.
      a. Approved manufacturers:
         i. Nomaco SOF® ROD.
         ii. As approved by Architect and in compliance with substitution requirements.
   2. Pavement: Comply with ASTM D5249, Type 3, round bi-cellular or closed cell polyethylene, urethane, or neoprene foam rod; oversized 25 to 30 percent.
      a. Approved manufacturers:
         i. Nomaco SOF® ROD.
         ii. As approved by Architect and in compliance with substitution requirements.

G. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

H. Gloss Reducer: Silica sand No. 20, color to match adjacent surface. Gloss reducer shall be provided at traffic sealant applications.

I. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the sealant manufacturer as compatible, subject to review by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work shall be construed as acceptance of subsurfaces. Verify, before proceeding with the Work of this CSI Number, that required inspections of existing conditions have been completed.
B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Clean, prepare, and prime joints in accordance with manufacturer's instructions. Remove loose materials and other foreign matter which may impair adhesion of sealant.
B. Verify that joint shaping materials and release tapes are compatible with sealant.
C. Examine joint dimensions and size materials to achieve required width/depth rations.
D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
E. Use bond breaker where required.
F. Protect adjacent surfaces from damage by masking when necessary.

3.03 APPLICATION / INSTALLATION

A. General:
   1. Install sealant in accordance with manufacturer's instructions.
   2. In general, seal openings and other locations which normally require sealant to seal again infiltration from air, water and most insects, including, but not limited to:
      a. Construction and expansion joints.
      b. Joints between dissimilar materials.
      c. Joints around windows, door frames, louvers and other penetrations and openings in the exterior wall. Provide minimum 3/8-inch sealant installation (exteriors only) around doors and windows.
      d. Interior wall openings.
      e. Other locations shown on drawings.

B. Joints:
   1. Free of air pockets, foreign embedded matter, ridges, and sags.
   2. Tool joints concave.

C. Apply sealant under pressure with hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed.

D. Neatly dry tool joint surfaces to provide slightly concave surfaces, free of wrinkles and skips, uniformly smooth and with perfect adhesion along both sides of joint.

E. Dual Purpose Acoustic/Smoke Sealant: Apply in accordance with applicable UL Joint Systems and as follows:
   1. Installation of sealant shall not begin until building is enclosed and building temperatures are as required by manufacturer.
   2. Openings to receive sealant shall be cleaned of loose debris, dirt, oil, wax, grease, and other contaminants. The surface shall be moisture and frost free.
   3. Apply sealant at required depth using method recommended by manufacturer as required for the individual fire-rated system.
   4. Smooth sealant with a trowel before the skin forms.

5. Acoustical sealant shall be applied in accordance with ASTM C919.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces of sealant as work progresses.
B. Use solvent or cleaning agent as recommended by sealant manufacturer.
C. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Hollow Metal Doors.
B. Hollow Metal Frames.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 30 00 – Cast-in-Place Concrete.
B. CSI Number 05 10 00 – Structural Metal Framing.
C. CSI Number 06 40 00 – Architectural Woodwork.
D. CSI Number 07 92 00 – Joint Sealants.
E. CSI Number 08 14 00 – Wood Doors.
F. CSI Number 08 71 00 – Door Hardware.
G. CSI Number 08 80 00 – Glazing.
H. CSI Number 09 22 16 – Non-Structural Metal Framing.
I. CSI Number 09 29 00 – Gypsum Board.
J. CSI Number 09 91 00 – Painting.
K. CSI Number 09 96 00 – High-Performance Coatings.

1.03 REFERENCES

A. ANSI A156.7 – Hinge Template Dimensions.
B. ANSI A250.3 – Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
C. ANSI A250.8 – Recommended Specifications for Standard Steel Doors and Frames.
D. ANSI/DHI A115 – Specifications for Hardware Preparations in Standard Steel Doors and Frames.
E. ANSI/DHI A115.IG – Installation Guide for Doors and Hardware.
F. ANSI/SDI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors.
G. ANSI/SDI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
H. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
I. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or ZincIron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
J. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
K. ASTM A1008/A1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, and High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
L. ASTM A1011/A1011M – Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy, and High Strength Low-Alloy with Improved Formability and Ultra High Strength.
M. ASTM C143/C143M – Standard Test Method for Slump of Hydraulic-Cement Concrete.
N. ASTM C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of Hot Box Apparatus.

O. ASTM E90 – Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
P. ASTM E413 – Classification for Rating Sound Insulation.
Q. HMMA 820 TN01-03 – Grouting Hollow Metal Frames.
R. HMMA 840 – Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
S. HMMA 841 – Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.
T. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
U. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives.
V. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.
W. NFPA 257 – Standard on Fire Test for Windows and Glass Block Assemblies.
X. SDI 108 – Recommended Selection and Usage Guide for Standard Steel Doors.
Y. SDI 111 – Recommended Details and Guidelines for Standard Steel Doors and Frames and accessories.
Z. SDI 111-H – High Frequency Hinge Preparation.
AA. SDI112 – Zinc-Coated (Galvanized/Galvannealed) Standard for Steel Doors and Frames.
BB. SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames.
CC. SDI 118 – Basic Fire Door Requirements.
DD. SDI 122 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
EE. SDI 124 – Maintenance of Standard Steel Doors and Frames.
FF. UL 9 – Standard for Fire Tests of Window Assemblies.
GG. UL 10B – Standard for Fire Test of Door Assemblies.
HH. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies.
II. UL 1784 – Standard for Air Leakage Tests of Door Assemblies.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's current product literature for each type of product, showing compliance with specified performance characteristic and physical properties.
   1. Recognized independent test lab certifications that products comply with ANSI/SDI 250.4 and UL10(c) positive pressure testing as required by the International Building Code (IBC).
   2. Installation instructions, including hardware products, other materials, and work requirements necessary to maintain compliance with UL10(c) positive pressure testing as required by the International Building Code (IBC).
B. Installer's qualification statement.
C. Shop Drawings:
   1. Show dimensioned door and frame product elevations and sections. Include details of each frame type, and conditions of openings, wall anchoring, details of construction, location and installation requirements of door and frame hardware reinforcements, and details of joints and connections.
   2. Show verified actual dimensions of existing wall openings in which hollow metal frames are to be installed.
   3. Show listing of opening descriptions including locations, material thickness, and anchors.
   4. Show location and details of openings.
   5. Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Include the following information at a minimum:
      a. Location of opening.
      b. Material thickness and/or gauge.
      c. Jamb Depth and Throat Size.
      d. Handing of opening.
      e. Door core material.
      f. Mortises and reinforcements.

g. Anchorage types.
h. Locations of exposed fasteners.
i. Glazed, louvered and paneled openings.
j. Mounting locations of standard hardware.
k. Independent Lab Certification of Compliance per ANSI A250.4.

1.05 QUALITY ASSURANCE

A. Manufacturer shall be a member in good standing of the Steel Door Institute (SDI).
B. Doors and frames shall be furnished by a single manufacturer.
C. Doors and frames shall be certified to comply with ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing, and ANSI A250.8, Recommended Specifications for Standard Steel Doors and Frames.
D. Installer Qualifications: Installer shall have a minimum of 3 years of experience successfully completing projects similar to this one.
E. Contractor is responsible for coordination and installation of products covered under this CSI Number and is required to:
   1. Verify that substrate conditions, whether existing or installed under other CSI Numbers, are as detailed in the Drawings.
   2. Coordinate procuring products provided under this CSI Number and comply with the hollow metal manufacturer's ordering instructions and lead time requirements to avoid delays.
   3. Provide to the manufacturer:
      a. Approved submittal drawings, approved hardware schedules, templates and/or template numbers and all pertinent information prior to the fabrication of products.
      b. Field measurements and opening conditions of openings when necessary.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver welded frames with spreaders and doors with wrappers, per manufacturer's instructions.
B. Store doors and frames under protective cover in dry, enclosed spaces at the site. Place doors and frames on non-staining blocking. Raise bottoms of doors at least 4 inches high and provide 1/4 inch air space between stacked doors to avoid metal to metal contact and permit air circulation.

1.07 FIELD CONDITIONS

A. Verify actual dimensions of existing wall openings in which hollow metal frames are to be installed by field measurements prior to fabrication. Indicate field measurements on shop drawings.

1.08 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: Steelcraft; Allegion, www.allegion.com.**
   2. Republic Doors and Frames; Allegion, www.republicdoor.com.

3. Ceco Door; Assa Abloy, www.cecodoor.com.
4. Curries; Assa Abloy, www.curries.com.
5. Fleming Door Products, Assa Abloy, www.flemingdoor.com.
6. Mesker Door, www.meskerdoor.com.
7. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS

A. Doors and frames shall be manufactured of commercial quality cold rolled steel per ASTM-A366 and A568 general requirements or galvannealed to A60 coating weight standard per ASTM-A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.
B. Supports and anchors shall be fabricated of not less than 18 gauge sheet steel, galvanized where galvanized frames are used.
C. Where items are to be built into exterior walls, inserts, bolts, and fasteners shall be hot dipped galvanized in compliance with ASTM-A153, Class C or D as applicable.
D. Rust inhibitive enamel or paint primer shall be used, baked on, and suitable as a base for specified finish paints complying with ANSI A224.1, “Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces on Steel Doors and Frames”.

2.03 DOORS

A. **Basis of Design Products:**
   1. **Interior Doors: Steelcraft LW Series**
   2. **Exterior Doors: Steelcraft LW Series**
B. Interior Doors: Level 2 – Heavy Duty Commercial, Model 2 Seamless.
   1. Cold rolled steel, ASTM A1008, 18 gauge (0.042”) cold rolled or galvannealed steel.
   2. Include galvannealed components and internal reinforcements with galvannealed doors.
   3. 1-3/4” thick, unless noted otherwise on Drawings.
C. Exterior Doors: Level 3 – Extra Heavy Duty Commercial, Model 2 Seamless.
   1. Hot-dip galvannealed steel, ASTM A653, Class A60, 16 gauge (0.053”), with closed tops.
   2. Include galvannealed components and internal reinforcements with galvannealed doors.
   3. Close tops of exterior swing-out doors to eliminate moisture penetration. Galvannealed steel top caps are permitted.
D. Factory prime paint all hollow metal doors.
E. Hardware Reinforcements:
   1. Hinge reinforcements for full mortise hinges: minimum 7 gauge (0.180").
   2. Lock reinforcements: minimum 16 gauge (0.053").
   3. Closer reinforcements: minimum 14 gauge (0.067"), 20” long.
   4. Galvannealed doors include galvanized hardware reinforcements.
   5. Projection welded hinge and lock reinforcements to the edge of the door.
   6. Provided adequate reinforcements for other hardware as required.
F. Full Flush Type Doors Construction:
   1. Doors construction conforming to ANSI-A250.4 criteria and tested to 5,000,000 operating cycles.
   2. Approved door core constructions:
      a. Interior Doors: Honeycomb.
         i. Reinforced, stiffened, sound deadened and insulated with phenol formaldehyde free Kraft honeycomb core completely filling the inside of the doors and laminated to inside faces of both panels using contact adhesive applied to both panels and honeycomb core.
      b. Exterior Doors: Polyurethane.
         i. Reinforced, stiffened, sound deadened and insulated with a rigid polyurethane core bonded to the inside faces of both panels with contact adhesive. All Polystyrene doors are full width and height polyurethane core filled.

ii. Maximum thermal U-factor = 0.37.

3. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges with visible edge seams, or a one piece full height 14 gauge channel. Apply a continuous bead of structural epoxy in the internal vertical connection.
   a. Welded Vertical Edges (W): Continuous vertical mechanical interlocking joint; edge seams welded, filled with structural adhesive, and ground smooth.
4. Bevel hinge and lock door edges 1/8 inch in 2 inches. Square edges on hinge and/or lock stiles are not acceptable.
5. Reinforce top and bottom of doors with galvannealed 14 gauge, welded to both panels.

G. Electrical Requirements:
   1. General: Coordinate electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.
   2. Doors with Electric Hinges:
      a. General: Furnish conduit raceway to permit wiring from electric door hardware.
      b. Hinge Locations: Provide electric hinge at intermediate or center location. Top or bottom electric hinge locations are not acceptable.
      c. See Door Hardware specification for electrified hardware items.

H. Fire-Rated Doors: Provide fire rated doors investigated and tested as fire doors, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors. Label shall be located on the hinge jamb side of the door. Doors required to meet smoke and draft control assembly requirements shall have labels that identify that the door has been tested and approved for smoke and draft control assemblies (S-label). Construct doors to comply with NFPA 80 and UL-10(c).

2.04 FRAMES

A. **Basis of Design Products:**
   1. **Interior Frames: Steelcraft F Series**
   2. **Exterior Frames: Steelcraft F Series**

B. Provide frames for doors, transoms, sidelights, borrowed lights, windows, and other openings of types and styles shown on Drawings. Conceal fastenings and anchors unless indicated otherwise in the Drawings. Construct frames to the following profiles, designs and gauges.
   1. Exterior Frames: Hot-dip galvannealed steel, ASTM A 653, Class A60, 16 gauge (0.053") hot dipped galvannealed steel.
      a. Include galvannealed components and internal reinforcements with galvannealed frames.
   2. Interior Frames in Masonry: 16 gauge (0.053") cold rolled or galvannealed steel.
      a. Include galvannealed components and internal reinforcements with galvannealed frames.
   3. Other Interior Frames: 16 gauge (0.053") cold rolled frames.

C. Flush Frames: Set-up and arc-welded with temporary shipping bars. Factory die-mitered corner connections reinforced with four integral tabs to secure and interlock at jambs to head. Unless otherwise indicated, frame shall have 2" faces and 5/8" stops. Frame depths per Drawings.
   1. Provide frames with a minimum of six wall anchors and two adjustable base anchors of manufacturer’s standard design.

D. Frames in Gypsum Board Walls: Same as flush frames, except:
   1. Form frames with double return backbends to prevent cutting into gypsum board surface.
   2. Locate adjustable anchors in each jamb 4" from the top of the door opening to hold frame in rigid alignment.
      a. Provide security anchor at strike jambs on all frames 7´6" high or higher.
   3. Base Anchors: Weld-in base anchor attaching plate in each jamb for field installation of loose base anchors to allow proper anchoring at base of frame.

E. Except on weatherstripped frames, prepare all frames to receive inserted type door silencers (3) per strike jamb on single doors, and (2) per head for pair of doors. Stick on silencers are not permitted.
F. Provide minimum 0.0179” thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
G. Frame Hardware Reinforcements:
    1. Mortise hinge reinforcement: minimum 7 gauge (0.180").
        a. Provide high frequency hinge reinforcement for top hinge on all exterior, cross corridor, and stairwell frames, in accordance with SDI 111-H, Example “A” Application, where full mortise hinges are specified.
    2. Strike reinforcements: minimum 16 gauge (0.053") and prepared for an ANSI-A115.1-2 strike.
    3. Closer reinforcement: minimum 14 gauge (0.067") steel.
    4. Projection weld hinge and strike reinforcements to the door frame.
    5. Provide metal plaster guards for all mortised cutouts.
    6. Provide adequate reinforcements for other hardware as required.
    7. Include galvanized hardware reinforcements in all galvannealed frames.
H. Electrical Requirements:
    1. General: Coordinate all electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.
        a. Provide cutouts and reinforcements required for metal door frame to accept electric components.
        b. Frame with Electrical Hinges: Weld UL listed grout guard cover box welded over center hinge reinforcing. Top or bottom hinge locations are not permitted. Contractor to reference 3.01.D, for continuous hinges.
        c. Provide cutouts and reinforcements required to accept security system components.
        d. See Door Hardware specification for electrified hardware items.
    2. Provide mortar box, welded in head of door frame at exterior frames for future door contact switch provided by owner. Size, type, location and conduit requirements to be provided by Owner.
I. Construct frames for UL labeled doors in accordance with UL requirements and label as scheduled on Drawings. Frames required to meet smoke and draft control assembly requirements shall have labels that identify that the frame has been tested and approved for smoke and draft control assemblies (S-label).

2.05 GLAZING FRAMES

A. Construct in accordance with applicable parts of door frame Specification and as detailed. Extend partition frames around all four sides of openings.
B. Provide glazing stops, removable one side and integral from the other side, secured with countersunk flat head Phillips screws spaced at not more than 16 inches on center and 2 inches from corners. Miter stops at corners.
C. Provide glazing, including fire-rated and security type, as shown on Drawings.

2.06 LOUVERS

A. Where louvers will be utilized in an exterior door, provide weatherproof, stationary, Z- blade type (minimum 20 ga. galvanized). Provide insect screen on interior face of louver. Where louvers will be utilized in an interior door, provide sight proof inverted V or Y louver (minimum 18 ga.), blades spaced for minimum 20 percent free area.

2.07 FABRICATION

A. Allowable Tolerances for Fabrication: As specified in SDI 117.
B. Face Welded Frames:
    1. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.
    2. Externally weld, grind, prime paint, and finish smooth face joints at meeting mullions or between mullions and other frame members as per ANSI/SDI A250.8.
    3. Provide two temporary steel spreaders (welded to the jambs at each rabbet of door openings) on welded frames during shipment. Remove temporary steel spreaders prior to installation of the frame.

2.08 FINISHES

A. Doors, frames and frame components are required to be cleaned, phosphatized, and finished with one coat of baked-on rust inhibiting prime paint in accordance with the ANSI/SDI A250.10 “Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames”.
B. After fabrication fill and sand all tool marks and surface imperfections as required to make face sheets, vertical door edges, and frame weld joints free from irregularities and dressed smooth.
C. Primer must be cured prior to shipment.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine locations and door frames to receive doors prior to hanging doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics.
C. Ensure frames are solidly anchored, allowing no deflection when doors are installed.
D. Ensure frames are plumb, level, square, and within tolerance.

3.02 PREPARATION

A. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 48 hours before installation.

3.03 INSTALLATION

A. Perform installation with skilled, experienced, and trained personnel who have successful experience in installations of similar size and scope.
B. Install doors and frames in accordance with Steel Door Institute’s recommended erection instructions for steel frames per ANSI/SDI A250.11. Install doors at locations shown on the Drawings. Install doors plumb, level, and square in a neat and workmanlike manner, free from hammer or tool marks.
C. Install label doors and frames in accordance with NFPA 80.
D. **Remove temporary steel spreaders prior to installation of frames.**
E. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary spreaders.
    1. Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
F. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In metal stud walls, attach wall anchors to studs with screws.

G. Provide full height 3/8" to 1 1/2" strip of polystyrene insulation at frames requiring grouting where continuous hinges are specified. Apply the strip to the back of the frame, where the hinge is to be installed, to allow for field drilling or tapping.
H. Where grouting is required in masonry, provide and install temporary bottom and intermediate wood spreaders to maintain proper width and avoid bowing or deforming of frame members. Refer to ANSI A250.11 standard.
    1. Hollow Metal Frames to receive grouting comply with ANSI/SDI Standard A250.8.2003, 4.2.2, whereby grout will be mixed to provide a 4" maximum slump consistency and hand troweled into place. Do not use grout mixed to a thinner, pumpable consistency is not recommended and not be used. Refer to HMMA 820 TN01-03 Grouting Hollow Metal Frames.
I. Provide a vertical wood brace during grouting of frame at openings over 4´0" wider, to prevent sagging of frame header.
J. Apply hardware in accordance with hardware manufacturers' instructions and Door Hardware specification. Install all hardware with only factory provided fasteners. Adjust door installation to provide uniform clearance at head and jambs, to achieve maximum operational effectiveness and appearance.
K. Install glazing material(s) in accordance with glazing manufacturer's instructions and the Glazing specification.
L. Operating Clearances:
    1. Ensure that the edge clearance for swinging hollow metal doors provides for the functional operation of the assembly and does not exceed the following:
        a. Between door and frame products at head and jambs: 1/8" +/- 1/16".
        b. Between edges of pairs of doors: 1/8" +/- 1/16".
    2. Floor clearance for fire-protection rated swinging hollow metal doors shall not exceed 0.75 inches. Floor clearance shall be provided for the functional operation of all swinging hollow metal doors and shall not be less than 0.125 inches.

3.04 ADJUSTING

A. Final Adjustments: Adjust operating doors and hardware items just prior to final inspection and acceptance by the Owner and Architect. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are damaged, bowed or otherwise unacceptable.
    1. Adjust doors to swing freely, without binding in frame.
    2. Adjust hardware and other moving or operating parts to function smoothly and correctly.
B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
C. Repair minor damages to finish in accordance with the manufacturer's instructions and as approved by Architect.
    1. If scratches or handling marks go into the base color coats, repairs shall be made under the direction of the door manufacturer.
D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's representative shall inspect fire rated doors (including frames and hardware as a unit) and verify compliance with UL 10C (positive pressure testing) as required by the International Building Code (IBC). Fire rated doors (including frames and hardware as a unit) which do not comply with UL 10C (positive pressure testing) as required by the IBC shall be removed and replaced at no additional cost to Owner.

3.06 CLEANING AND PROTECTION

A. Clean doors and hardware promptly after installation per manufacturer's instructions. Do not use harsh cleaning materials or methods that could damage the finish.
B. Provide protective measures required throughout the construction period to ensure that door and frame units will be without damage or deterioration, other than normal weathering on exterior doors, at time of acceptance.
C. During the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises in a legal manner. Leave Work in clean and operable condition.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number includes standard steel and stainless-steel construction access doors and frames.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of door and frame indicated including materials and finishes and installation details.

B. Shop Drawings: Submit Drawings showing sizes, door construction, proposed locations, fabrication and installation details, and relationship with and attachment to wall/ceiling construction where installed.

C. Samples: Minimum 3-inch x 5-inch Samples of each face material.

1.3 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver and store items in dry, protected areas. Adequately protect against damage while stored at the site.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Steel Framed Access Doors and Frames, Sound gasketed Access Doors, Stainless Steel Access Doors: Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements and Finish Requirements:
   1. Acudor Products, Inc. www.acudor.com
   2. Babcock-Davis www.babcockdavis.com
   3. Nystrom Building Products www.nystrom.com
   4. Karp Associates www.karpinc.com
   5. Activar, Inc. Construction Products Group; J.L. Industries www.activarcpg.com
   6. Milcor Brand, Hart Cooley Inc. www.milcorinc.com

2.2 ACCESS DOORS

A. Steel and Stainless Steel Doors: Units shall be prime painted steel at painted wall construction and stainless steel in tile and other locations as indicated, in types as required by wall construction, as follows (based on Babcock-Davis):
   1. Non-Rated Access Panels:
      a. Drywall Walls and Ceilings:
         1) All Public and Administrative Spaces: Babcock-Davis B-RW recessed access panel with concealed pivoting rod hinge.
         2) Mechanical, Utility, Equipment and Other Back-of House/Industrial Spaces: Babcock-Davis B-NW access panel.
   2. Fire-Rated Access Panels:
      a. Drywall Walls and Ceilings: Babcock-Davis B-IW, Insulated, Fire-Rated access panel.
      b. Masonry, Tile Walls, Etc.: Babcock-Davis B-UT, Insulated, Fire-Rated access panel.

B. Door and Frame: 16 gauge steel. Provide key-operated cylinder locks. At large doors where recommended by the door Manufacturer, provide additional screw driver operated cam locks in sufficient quantity as recommended by Manufacturer to hold door in flush closed position. 16 gauge steel shall be used for door and frame. Type K door shall have concealed spring hinges to allow door to open a minimum of 175 degrees. Size as required.

C. Access Doors in Fire Rated Construction: Door and frame assemblies shall comply with NFPA 80 and the following:
   1. Doors shall be UL or Warnock Hershey labeled and meet self-closing and self latching requirements for fire rated assembly where they are installed.
   2. Doors shall be UL 1-1/2 hour fire rated when located in a fire rated wall assembly.

D. Sizes and Locations: Provide doors in quantities and sizes necessary for access to valves, dampers and other devices or equipment requiring periodic access, including locations indicated on drawings (if any).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors in accordance with Manufacturer’s directions at locations shown on Drawings or necessary for access to valves, dampers and other devices or equipment requiring periodic access. Do not install panels in locations where frame will extend over transition between two separate wall or ceiling finish materials (i.e. tile to gypsum board).

B. Install fire-rated access doors and frames to comply with NFPA 80 and Manufacturer’s printed instructions for a fire-rated assembly.

C. Install plumb and level, true to line.

D. Remove PVC protectant film of hatch covers and frames following application of adjacent final finishes (painting, etc.) for wall and ceiling units and following concrete pouring and finishing operations for floor/sidewalk mounted units.

E. See Specification CSI Numbers 09 91 00 and 09 96 00 for finish painting materials.

3.2 CLEANING

A. During the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Insulated rolling service doors.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 50 00 – Metal Fabrications.
B. CSI Number 07 92 00 – Joint Sealants.
C. CSI Number 09 91 00 – Painting.
D. CSI Number 09 96 00 – High-Performance Coatings.
E. CSI Division 26 – Electrical.

1.03 REFERENCES

A. ANSI/DASMA 108 – Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference.
B. ANSI/NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
C. ANSI/NEMA MG 1 – Motors and Generators.
D. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
E. ASTM A666/A666M – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
F. ASTM A924/A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
G. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
H. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
I. ASTM E330/E330M – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
J. NFRC 102 – Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. and acceptable to Authority Having Jurisdiction (AHJ) as suitable for purpose specified.
C. Design exterior doors to withstand wind loads per General Structural Notes (GSN).

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's current product data sheets on each product to be used, including:
    1. Preparation instructions and recommendations.
    2. Storage and handling requirements and recommendations.
    3. Details of construction and fabrication, including finishes.
    4. Installation instructions.
B. Installer's qualification statement.
C. Shop Drawings: Include detailed plans with dimensions, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Also indicate relationships with adjacent construction.
D. Selection Samples: For each finish product specified, provide two (2) complete sets of color chips representing manufacturer's full range of available colors and patterns.
E. Verification Samples: For each finish product specified, provide two (2) samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this CSI Number with a minimum of five (5) years experience in the fabrication and installation of security closures.
B. Installer Qualifications: Company specializing in performing Work of this CSI Number with minimum three (3) years experience and approved by manufacturer.
C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
    1. Finish areas designated by Architect.
    2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
    3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's original, unopened packaging until ready for installation, with labels intact. Protect materials from damage while stored at the site.
B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
C. Store materials in a dry, warm, ventilated and weathertight location.
D. Handling: Comply with Manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.
B. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.09 WARRANTY

A. Warranty: Manufacturer’s limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for three (3) years or 20,000 cycles, whichever occurs first.

B. Provide Manufacturer's best performance finish applied to curtain, guides, bottom bar, and headplates for a warranty of five (5) years minimum.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: Overhead Door Corporation; https://www.overheaddoor.com.**
   2. Clopay; https://www.clopaydoor.com.
   3. Cookson; https://www.cooksondoor.com.
   4. As approved by Architect and in compliance with substitution requirements.

2.02 INSULATED ROLLING SERVICE DOORS

A. **Basis of Design Product: Overhead Door Corporation Model 625.**
   1. Curtain: Interlocking roll-formed slats as specified. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
      a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
      b. Front slat fabricated of twenty-two (22) gauge galvanized steel.
      c. Back slat fabricated of twenty-four (24) gauge galvanized steel.
      d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation:
         i. R-Value: 7.7, U-Value: 0.13.
         ii. Sound Rating: STC-21.
   2. Performance:
      a. Through Curtain Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E90.
      b. Installed System Sound Rating: STC-21 as per ASTM E90.
      c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
      d. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.
   3. Slats and Hood Finish:
      a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A653/A653M and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
         i. Polyester Top Coat:
            A) Gray polyester.
         ii. Powder Coat:
            A) PowderGuard Max powder coat, color as selected by Architect from the Manufacturer's full range of available colors.
         iii. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
   4. Weatherseals:
      a. Vinyl bottom seal, exterior guide and internal hood seals.
   5. Bottom Bar:
      a. Two galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
   6. Guides: Three structural steel angles.
   7. Brackets:
      a. Galvanized steel to support counterbalance, curtain and hood.
   8. Finish: Bottom Bar, Guides, Headplate and Brackets:

a. PowderGuard Max powder coat, color as selected by Architect from the Manufacturer's full range of available colors.

9. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
10. Hood: Provide with internal hood baffle weatherseal.
    a. 24 gauge galvanized steel with intermediate supports as required.
11. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
    a. Sensing Edge Protection:
        i. Electric sensing edge.
    b. Operator Controls:
        i. Push-button operated control stations with open, close, and stop buttons.
        ii. Controls for interior location.
        iii. Controls surface mounted. Confirm location with Architect prior to rough-in.
        iv. Provide constant contact controls, requiring continuous control engagement during operation.
    c. Special Operation:
        i. Vehicle detector operation.
    d. Motor Voltage: 208/230, 460v, 3 phase, 60 Hz.
12. Manual Operation: Provide auxiliary chain hoist for use in power outages.
13. Wind Load Design:
    a. Standard wind load shall be 20 PSF.
14. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
15. Locking:
    a. Chain keeper locks for chain hoist operation.
16. Wall Mounting Condition: Face-of-wall mounting.
17. Insulated Vision Lites: Provide with uniformly spaced openings. As shown on Drawings or selected by Architect.
    a. Size: 10 inch by 1 inch (254 mm by 25.4 mm).

PART 3 - EXECUTION

3.01 EXAMINATION & COORDINATION

A. Verify opening sizes, tolerances and conditions are acceptable.
B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation or conditions before proceeding. Commencement of Work will be construed as acceptance of subsurfaces.
D. Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the Manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION & DEMONSTRATION

A. Install in strict accordance with Manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
E. Coordinate installation of electrical service with electrical Drawings and Specifications. Complete wiring from disconnect to unit components.
F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Joint Sealants specification.
G. Install perimeter trim and closures.

3.04 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 DEMONSTRATION

A. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.06 CLEANING AND PROTECTION

A. Clean curtain and components using non-abrasive materials and methods recommended by Manufacturer.
B. Remove labels and visible markings.
C. Touch-up, repair or replace damaged products before Substantial Completion.
D. During the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises in a legal manner. Leave Work in clean and operable condition.
E. Protect installed products until completion of the project.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Aluminum-Framed Storefront – Non-Thermal.
B. Aluminum-Framed Storefront – Thermal.
C. Aluminum-Framed Window Wall – Thermal.
D. Aluminum Doors – Non-Thermal.
E. Aluminum Doors – Thermal.
F. Fasteners, anchors, attachment devices.
G. Perimeter seals and accessories.

1.02 RELATED CSI NUMBERS

A. CSI Number 07 92 00 – Joint Sealants.
B. CSI Number 08 14 00 – Wood Doors.
C. CSI Number 08 71 00 – Door Hardware.
D. CSI Number 08 80 00 – Glazing.
E. CSI Number 12 24 00 – Roller Window Shades.

1.03 REFERENCES

A. Aluminum Association (AA) DAF-45 – Designation System for Aluminum Finishes.
B. ASTM A36 – Standard Specification for Carbon Structural Steel.
C. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
D. ASTM B209/B209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
F. ASTM C1401 – Standard Guide for Structural Sealant Glazing.
G. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
H. ASTM E283/E283M – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
K. ASTM E1425 – Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.
L. Federal Specification (FS) TT-P-641G Amendment 1 – Primer, Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
M. Federal Specification (FS) TT-P-645A – Primer, Paint, Zinc Chromate, Alkyd Type.
N. Fenestration & Glazing Industry Alliance (FGIA) / AAMA 501 – Methods of Test for Exterior Walls.

O. FGIA / AAMA 501 – Methods of Test for Exterior Walls.
P. FGIA / AAMA 501.2 – Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
Q. FGIA / AAMA 611 – Specification for Anodized Architectural Aluminum
R. FGIA / AAMA 701/702 – Performance Specification for Pile Weatherstrips and Polymer Weatherseals.
S. FGIA / AAMA 1503 – Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
T. FGIA / AAMA 1801 – Voluntary Specification for the Acoustical Rating of Exterior Windows, Doors, Skylights and Glazed Wall Sections.
U. FGIA / AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coal Coating Appendix).
V. FGIA / AAMA CW-10 – Care and Handling of Architectural Aluminum from Shop to Site.
W. FGIA / AAMA SFM-1 – Aluminum Storefront and Entrance Manual.
X. National Glass Association GANA Glazing Manual.
Y. Steel Structures Painting Council (SSPC) – Cold-Applied Asphalt Mastic (Extra Thick Film).
Z. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary.

1.04 SYSTEM REQUIREMENTS

A. Design Requirements:
1. Comply with the applicable provisions of FGIA / AAMA SFM-1 for design, materials, fabrication, and installation of component parts.
2. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
3. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
4. Provide concealed fastening.
5. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
6. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
7. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
8. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
9. Stresses placed on structural silicone sealants (if used) shall be kept within sealant manufacturer’s recommended maximum.

B. Performance Requirements:
1. General Performance:
a. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.
b. Aluminum storefront systems shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
c. Failure includes any of these events:
i. Thermal stresses transferring to building structure.

ii. Glass breakage.
iii. Loosening or weakening of fasteners, attachments, and other components.
iv. Failure of operating units.

2. Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer if necessary or required, using performance requirements and design criteria indicated.
3. Wind Loads: Provide framing system capable of withstanding wind loads as indicated on the Drawings. The design pressures shall be based on the International Building Code, see Drawings for applicable edition as adopted by the Authority Having Jurisdiction (AHJ).
4. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.2 psf.
5. Water infiltration: No uncontrolled water leakage when tested in accordance with ASTM E331 at test pressure of 8 psf as defined in FGIA / AAMA 501.
6. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13’-6” shall be limited to [1/175] of its clear span and for spans greater than 13’-6” deflection shall be limited to [1/240] of its clear span + 1/4”, except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.
7. Thermal Movements:
   a. Allow for thermal movements resulting from the following:
      i. 0°F (-18 C) to 180°F (82 C) maximum change (range) in ambient and surface temperatures.
      ii. 75°F (24 C) test interior ambient air temperature
   b. Test performance shows no buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.
8. Seismic testing shall conform to FGIA / AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
9. Thermal Transmittance (U-factor): When tested to FGIA / AAMA 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Glass to Exterior: 0.54 (clear)
   b. Glass to Center: 0.56 (clear)
   c. Glass to Interior: 0.51 (clear)
   d. See Drawings for maximum U-Factor required by applicable codes.
10. Condensation Resistance (CRF): When tested to FGIA / AAMA 1503, the condensation resistance factor shall not be less than:
    a. Glass to Exterior: 70frame and 69glass (low-e)
    b. Glass to Center: 62frame and 68glass (low-e)
    c. Glass to Interior: 56frame and 67glass (low-e)
11. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): In accordance with FGIA / AAMA 1801 and tested to when tested to ASTM E1425 and ASTM E90, the STC and OITC Ratings shall not be less than:
    a. Glass to Exterior: STC 38 and OITC 31,
    b. Glass to Center: STC 37 and OITC 30.
    c. Glass to Interior: STC 38 and OITC 30.
    d. Note: Glass is based upon 1" (25.4 mm) clear double laminated insulating glass with PVB interlayer (1/8", 0.030", 1/8", 1/2" AS, 1/8", 0.030", 1/8").
12. National Fenestration Rating Council (NFRC) specific application evaluation.

C. Testing Requirements:
   1. Provide components that have been previously tested by an independent testing laboratory.

1.05 SUBMITTALS

A. Product Data: For each type of product/system indicated, include the following:
   1. Manufacturer's descriptive literature, material descriptions, and product specifications.
   2. Dimensions of individual components and profiles.
   3. Hardware, accessories, and other required components.
   4. Factory finishes, including color charts indicating manufacturer's standard colors available for selection by Architect.
   5. Installation instructions.
B. Shop Drawings: Include fabrication, installation, and finish of specified systems, along with the following:
   1. Fully dimensioned plans, elevations, sections and details showing the construction.
   2. Show verified actual dimensions of existing wall openings in which storefronts are to be installed.
   3. Locations of exposed fasteners and joints.
   4. Provide detailed drawings of:
      a. Composite members.
      b. Joint connections for framing systems and for entrance doors.
      c. Anchorage.
      d. System reinforcements.
      e. System expansion and contraction provisions.
      f. Glazing methods and accessories.
      g. Internal sealant requirements.
      h. Thermal improvements.
   5. Schedule of Finishes.
C. Door Hardware Schedule (if applicable): See Door Hardware Specification for requirements.
D. Samples:
   1. Provide samples for items with factory-applied color finishes indicating quality of finish.
   2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
E. Test Reports:
   1. Provide certified test reports for each type of aluminum-framed system used in the project.
   2. Test reports must indicate compliance with performance requirements.
   3. Include other supportive data as necessary.
F. Installer Qualification Data.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: To ensure quality of appearance and performance, obtain aluminum-framed storefront and window wall systems through one source from a single manufacturer.
B. Manufacturer Qualifications:
   1. Manufacturer must be capable of providing aluminum-framed storefronts and window walls that meet or exceed the stated performance requirements and product specifications.
   2. Manufacturer must document this performance by the inclusion of certified test reports and calculations.
C. Installer Qualifications:
   1. Installer must have five (5) years minimum experience successfully installing the same or similar storefront and window wall systems for other projects of similar size and scope.
D. Door Hardware Installer Qualifications: See Door Hardware Specification.
E. Product Options:

1. Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront and window wall systems and are based on the specific system indicated. Do not modify size and dimensional requirements without prior approval from Architect.
2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Mockups:
1. Build mockups if necessary to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockups for the type(s) of systems, elevation(s) indicated, and in location(s) shown on drawings.

G. Perform Work in accordance with FGIA / AAMA SFM-1 – Aluminum Storefront and Entrance Manual and manufacturer's written instructions.

H. Structural-Sealant Glazing must comply with ASTM C1401 for design and installation of structural-sealant-glazed systems.

I. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces as necessary to prevent damage, per manufacturer's written instructions.

B. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.

C. Do not leave coating residue on any surfaces.

D. Replace damaged units.

1.08 FIELD CONDITIONS

A. Verify actual dimensions of aluminum-framed storefront and window wall openings by field measurements prior to fabrication. Indicate field measurements on shop drawings.

1.09 WARRANTY

A. Provide written warranty ensuring the work is free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within five (5) years from date of Substantial Completion.

B. Warranty shall cover the following:
1. Complete watertight and airtight system installation within specified tolerances.
2. System is structurally sound and free from distortion.

C. Warrant aluminum finishes against excessive fading, excessive non-uniformity of color or shade, cracking, peeling, pitting, or corroding (all within the limits defined). Warranty shall include replacement at no charge (material and labor) for a period of five (5) years beginning on the date of Substantial Completion.

D. Defective materials and workmanship are hereby defined to include, but are not limited to, evidence of:
1. Penetration of water into the building through fixed glazing and framing components.
2. Air infiltration exceeding specified limits.
3. Structural failure of components resulting from forces within specified limits.
4. Failure of insulated glass units.
5. Cracking, crazing, flaking, of coatings or opacifiers on glass/
6. Secondary glass damage and/or damage due to failing components.
7. Adhesive or cohesive failure of sealant.
8. Crazing on surface of non-structural sealant.
9. Non-structural sealant hardening beyond Shore A durometer 50 or softening below 20.
10. Failure of operating parts to function normally.

E. For aluminum-framed storefront and window wall systems with a high performance fluoropolymer finish indicated, provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for two (2) years from date of Substantial Completion and agreeing to promptly correct defects.
F. Upon notification of defects within the warranty period, make the necessary repairs and replacements at the convenience of the Owner. Repairs and replacements shall include resultant damage to adjacent materials, systems, and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents, provide products from one of the following manufacturers:
   1. Arcadia Inc., https://arcadiainc.com.
   2. Kawneer, https://www.kawneer.us.
   3. Oldcastle BuildingEnvelope, https://obe.com.
   4. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS – STOREFRONT

A. Non-thermal, 2” x 4-1/2” deep mullion profile.
   1. Properties:
      a. Center-set glazing configuration, from ¼” to 1-1/16” thick.
      b. Screw spline, shear block, stick, or punched opening.
   2. Finish: Clear Anodized.
   3. Acceptable products, subject to compliance with Specification requirements:
      a. Arcadia Inc., AG451 Series.
      b. Kawneer, Trifab VersaGlaze 451 System.
      c. Oldcastle BuildingEnvelope, FG-3000 Series.
      d. As approved by Architect and in compliance with substitution requirements.

B. Thermal, 2” x 4-1/2” deep mullion profile.
   1. Properties:
      a. Front-set glazing configuration, up to 1-1/16” thick.
      b. Screw spline, shear block, stick, or punched opening.
   2. Finish: Clear Anodized.
   3. Acceptable products, subject to compliance with Specification requirements:
      a. Arcadia Inc., AG451T Series.
      b. Kawneer, Trifab VersaGlaze 451 System.
      c. Oldcastle BuildingEnvelope, Series 3000 Thermal MultiPlane.
      d. As approved by Architect and in compliance with substitution requirements.

2.03 MATERIALS – WINDOW WALL

A. Thermal, 2” x 6” deep mullion profile.
   1. Properties:
      a. Front-set glazing configuration, up to 1-1/16” thick.
      b. Mullion depth can be up to 6-1/2”.
      c. Screw spline, shear block, stick, or punched opening.
   2. Finish: Clear Anodized.
   3. Acceptable products, subject to compliance with Specification requirements:
      a. Arcadia Inc., AFG601T Offset Glazed System.
      b. Kawneer, Trifab VersaGlaze 601T System.

c. Oldcastle BuildingEnvelope, Series 6000 Thermal MultiPlane.
d. As approved by Architect and in compliance with substitution requirements.

2.04 MATERIALS – DOORS

A. Non-Thermal, Medium Stile, 1-3/4” thick.
1. Properties:
a. Bottom rail: 6-1/2” tall minimum.
b. Glazing Stops: Square snap-in type for ¼” up to 1” thick glazing.
2. Finish: Clear Anodized.
3. Acceptable products, subject to compliance with Specification requirements:
a. Arcadia Inc., MS362 Series.
b. Kawneer, 350 Medium Stile.
c. Oldcastle BuildingEnvelope, MS-375.
d. As approved by Architect and in compliance with substitution requirements.

B. Thermal, Medium Stile, 1-3/4” or 2-1/4” thick.
1. Properties:
a. Bottom rail: 6-1/2” tall minimum.
b. Glazing Stops: Square snap-in type for 1” thick glazing.
2. Finish: Clear Anodized.
3. Acceptable products, subject to compliance with Specification requirements:
a. Arcadia Inc., MS362T Series.
b. Kawneer, 350T Insulpour.
c. Oldcastle BuildingEnvelope, MS-375TC.
d. As approved by Architect and in compliance with substitution requirements.

2.05 MATERIALS – FRAMING AND ACCESSORIES

A. Aluminum:
1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
B. Internal Reinforcing:
1. ASTM A36 for carbon steel.
2. Shapes and sizes to suit installation.
3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.
4. Properly isolate steel from aluminum.
C. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
3. Properly isolate steel from aluminum.
D. Fasteners
1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
2. Provide concealed fasteners wherever possible.
3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
4. For concealed locations, provide manufacturer's standard fasteners.
5. Properly isolate steel from aluminum.
E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.
H. Glazing Gaskets:
   1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
   2. Profile and hardness as required to maintain uniform pressure for watertight seal.
   3. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
I. Weatherstripping:
   1. Wool pile conforming to AAMA 701.2.
   2. Provide EPDM or vinylblade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
J. Internal Sealants and Baffles.
K. Bituminous Paint:
   1. Cold-applied asphalt-mastic paint.
   2. Complies with SSPC-Paint 12 requirements except containing no asbestos.
   3. Formulated for 30-mil (0.762 mm) thickness per coat.

2.06 MATERIALS – JOINT SEALANTS

A. For installation at perimeter of aluminum-framed systems, see the Joint Sealants Specification.

2.07 MATERIALS – GLAZING AND GLAZING ACCESSORIES

A. See Glazing Specification and Drawings.

2.08 MATERIALS – DOOR HARDWARE

A. See Door Hardware Specification and Drawings.

2.09 FINISHES

A. See Materials specification above and Drawings for applicable finishes selected by Architect.
B. Clear Anodized:
   1. Conforming to AA-M12C22A31 / AA-M12C22A41 and FGIA / AAMA 611.
   2. Architectural Class I or II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.
C. Color Anodized:
   1. Conforming to AA-M12C22A34 / AA-M12C22A44 and FGIA / AAMA 611.
   2. Architectural Class I or II, etched, medium matte, colored anodic coating as specified above or in Drawings, 0.7 mil minimum thickness.
D. Organic Coating (high performance fluorocarbon):
   1. Comply with requirements of FGIA / AAMA 2605.
   2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
   3. Finish coat of 70% minimum fluorocarbon resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil minimum dry film thickness.
   4. Acceptable coatings are Trinar by Akzo Coatings, Inc.; Nubelar by Glidden Company; Fluoroceram by Morton International, Inc.; Duranar by PPG Industries Inc.; and Fluropon by Valspar Corporation.
   5. Provide in either a 2, 3, or 4 coat system as required for color selected.
   6. Colors as specified above or in Drawings.

2.10 FABRICATION

A. Coordination of Fabrication:
   1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
   2. Fabricate units to withstand loads that will be applied when system is in place.
B. General:
   1. Conceal fasteners wherever possible.
   2. Reinforce work as necessary for performance requirements, and for support to structure.
   3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.
   4. Comply with Glazing Specification for glazing requirements.
C. Aluminum Framing:
   1. Provide members of size, shape and profile indicated.
   2. Provide manufacturer's standard thermal break between exterior and interior aluminum surfaces.
   3. Fabricate frame assemblies with joints straight and tight fitting.
   4. Reinforce internally with structural members as necessary to support design loads, for hardware attachment, and as indicated.
   5. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
   6. Seal horizontals and direct moisture accumulation to exterior.
   7. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
   8. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
D. Welding:
   1. Comply with recommendations of the American Welding Society.
   2. Use recommended electrodes and methods to avoid distortion and discoloration.
   3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
E. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".
F. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
G. Hardware Installation at Factory:
   1. Cut, reinforce, drill, and tap frames as required to receive hardware except do not drill and tap for surface-mounted items until the time of installation at the Project Site. Comply with Hardware Manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
   2. Install hardware, except surface-mounted hardware, at fabrication plant. Remove only as required for final finishing operations, and for delivery and installation of the Work at the Project Site.
H. Structural-Sealant-Glazed Framing Members:
   1. Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine conditions and verify substrate conditions are acceptable for product installation. Report detrimental conditions in writing to Architect. Proceed with installation only after correcting unsatisfactory conditions. Commencement of Work shall be construed as acceptance of subsurfaces. Items to examine include:
   1. Rough opening dimensions.

2. Levelness of sill plate.
3. Operational clearances.
4. Wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
5. Masonry surfaces:
    a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.
6. Wood-framed Walls:
    a. Wood frame walls must be dry, clean, sound, well nailed, free of voids, and without offsets at joints.
    b. Ensure that nail heads are driven flush with surfaces in opening and within 3" of opening.
7. Metal Surfaces:
    a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
    b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.
B. Install aluminum-framed storefront system and doors so that components are:
    1. Level, plumb, square, and true to line.
    2. Without distortion and do not impede thermal movement.
    3. Anchored securely in place to structural support, allowing for required movement, including expansion and contraction.
    4. In proper relation to wall flashing and other adjacent construction.
C. Install doors and hardware in accordance with manufacturer's printed instructions.
D. Erection Tolerances:
    1. Limit variations from plumb and level:
        a. 1/8 inch in 10'-0" vertically.
        b. 1/8 inch in 20'-0" horizontally.
    2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
    3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact, corrosion and electrolytic action.
F. Set sill members in bed of sealant to provide weather-tight construction. Set other members with internal sealants and baffles to provide weather-tight construction.
G. Dimensions indicated are based on an assumed design temperature of 70 degrees Fahrenheit. Take into account the ambient temperature range at the time of fabrication and erection.
H. Cut and trim component parts of the aluminum entrance and storefront during erection only with the approval of the manufacturer or fabricator and in accordance with his recommendations. Do not cut through reinforcing members. Restore finish completely to protect material and remove evidence of cutting and trimming. Remove and replace members where cutting or trimming has impaired strength or appearance.
I. Do not erect members which are warped, bowed, deformed, or otherwise damaged to such extent as to impair strength or appearance. Remove and replace members damaged in the process of erection.
J. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of the Joint Sealant Specification.

1. Seal joints in aluminum entrance and storefront in a concealed manner, unless exposed sealant is indicated.
2. Aluminum storefront and window installation at areas open between backer rods shall have sealant or foam to add insulation values.

K. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.
L. Glazing: Comply with the requirements in the Glazing Specification and Drawings, as well as the aluminum-framed system manufacturer’s printed installation instructions for glazing.

3.03 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturers’ instructions and the Door Hardware Specification to ensure smooth operation.

3.04 FIELD QUALITY CONTROL

A. Upon Architect or Owner’s written request, provide site visit by manufacturer’s field service representative.

3.05 CLEANING AND PROTECTION

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
B. Clean metal while exercising care to avoid damage to those materials and protective coatings and finishes.
C. Remove excess glazing and sealant compounds, dirt, and other substances.
D. Clean glazing surfaces in accordance with the Glazing Specification and the glazing manufacturer's written instructions.
E. Remove all construction waste from project site and dispose of waste in a legal manner.
F. Protect installed products and finish surfaces from damage during construction.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 56 53

BALLISTIC-RESISTANT WINDOW FRAME ASSEMBLIES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Ballistic-resistant aluminum window frame assembly – see Drawings for locations.

1.02 RELATED CSI NUMBERS

A. CSI Number 10 26 41 – Ballistic-Resistant Panels.

1.03 REFERENCES

A. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
C. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
D. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
E. UL 752 – Standard for Bullet Resisting Equipment.

1.04 SYSTEM DESCRIPTION

A. Design Requirements - comply with applicable recommendations of the following:
   1. AISC Manual of Steel Construction.
   2. AISI Cold Formed Steel Design Manual.
   3. TM5-855-1.
   4. TM5-1300.

B. Performance Requirements:
   1. Bullet resistance requirements; Withstand bullet resistance level as follows, in accordance with and tested by UL 752, and consistent with ASTM F1450, Section 7.1. “Bullet Penetration”: Level 4 - .30 caliber rifle lead core soft point.
   2. Bullet resistance ratings: Test assemblies in accordance with UL 752 for specified ratings, assemblies bearing labels of that agency.

1.05 SUBMITTALS

A. Quality assurance submittals:
   1. Design data: Bullet resistance for specific project conditions, certifying system conformance to specified performance requirements; bullet resistance system to bear the label of the recognized testing agency having a factory classification inspection services.
   2. Certificates: Contractor’s certification that:
      a. Products of this CSI Number, as provided, meet or exceed specified requirements.
      b. Manufacturer of products of this CSI Number meets specified qualifications.
      c. Installer of products of this CSI Number meets specified qualifications.
   3. Manufacturer’s instructions: Printed installation and adjusting instructions for systems.

B. Shop Drawings: Indicate capability of door and frame assemblies to meet requirements of design data; include the following:
   1. Door and frame elevations and sections.
   2. Location and details of all openings; include door hanging and latching hardware in a schedule.
   3. Material types, gages, locations, and fabrication details of system components; include all reinforcements.
C. Closeout submittals: Warranty documents, issued and executed by manufacturer of systems, countersigned by Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five (5) years documented experience producing products specified in this CSI Number.
B. Installer Qualifications: Minimum five (5) years documented experience installing products specified in this CSI Number.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations provided by manufacturer. Do not install products stored in conditions outside manufacturer's recommended limits.

1.08 FIELD CONDITIONS

A. Verify actual dimensions of existing wall openings in which hollow metal frames are to be installed by field measurements prior to fabrication. Indicate field measurements on shop drawings.

1.09 WARRANTY

A. Workmanship Warranty: All materials shall be warranted against defects for a period of 2 years from the date of Substantial Completion. Provide certificates of manufacturer's standard limited warranty with closeout documents.
B. Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for the period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: Total Security Solutions, www.tssbulletproof.com.**
   2. Krieger Specialty Products / Allegion, www.KriegerProducts.com.
   3. As approved by Architect and in compliance with substitution requirements.

2.02 DESIGN PERFORMANCE

A. Through the design, manufacturing techniques and material application the framing system shall be constructed of an extruded aluminum in 6061-T6 alloy/tempered.
B. Frame to have no exposed fasteners.

C. Corner joints shall consist of extruded and keyed aluminum spline.
D. All joints and connections shall be tight, providing hairline points and true alignment of adjacent members.
E. Panels shall not be removable from threat side.
F. Field alterations to the construction of the assembly fabricated under the acceptable standards are not allowed unless approved in writing by the manufacturer and the Architect.
G. Standard manufacturing tolerances +/- 1/16" shall be maintained.
H. Materials shall meet or exceed UL 752 requirements.

2.03 PERFORMANCE CRITERIA

A. Ballistic Resistant:
   1. Level 4 in accordance with UL 752 for the complete assembly including framing, glazing, and panels.

2.04 FABRICATION

A. Head, sill and jambs shall be two-piece extrusions with no integral weep system at the sill, extrusions to allow for re-glazing with the use of removable stops.
B. Mullions are three-piece extrusions with removable faces to allow for glazing and individual lite replacement.
C. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.
D. Glazing must not be removable from the threat side of the sash.
E. Provide to dimension heights and widths indicated on the Drawings.
F. System shall be designed to accept glazing from 3-4 inches to 2-1/2 inches thick.

2.05 FRAME FINISH

A. Factory-applied finish:
   1. Clear Anodic Finish - Satin: Architectural Class I, clear coating AA-M10C22A41 Mechanical Finish Chemical Finish: etched, medium matte; 0.70 mils minimum complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum”.
B. Cap the bottom of glazing with the corresponding finish material selected for frame.

2.06 GLAZING

A. Glazing shall be glass/polycarbonate.
B. Acrylic: All acrylic pieces shall meet or exceed UL 752 testing for ballistic integrity. All edges of acrylic shall be filed, sanded after cutting to remove rough edges and then polished until “water clear” transparent. All through holes for fasteners shall be 3/8” in diameter and be drilled clean. Chipped edges at through-hole exit points are not acceptable. All acrylic pieces shall be supported in the proper glazing channel designed for this purpose.
C. Glazing gaskets.
   1. Interior: Closed cell neoprene.
   2. Exterior: Solid neoprene.

2.07 ACCESSORIES

A. Anchors: Fully concealed and manufacturer recommended.
B. Transaction trays where shown on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation, verify that all supports have been installed as required by the Contract Documents and architectural drawings, and Shop Drawings have been approved.
B. Prior to beginning installation, verify that all supports have been installed as required by the Contract Documents and architectural drawings, and Shop Drawings have been approved.

3.02 PREPARATION

A. Clean and prepare all surfaces per manufacturers recommendations as required for achieving the best results for the substrate under the project conditions.
B. Verify field dimensions of openings prior to fabrication of framing.
C. Coordinate structural requirements to ensure proper attachment and support.
D. Do not begin installation of material until all unsatisfactory conditions have been resolved and approved by Architect.

3.03 INSTALLATION

A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings.
B. Install in accordance with manufacturer’s instructions and UL 752. Set all equipment plumb.
C. All products shall be installed per installation instructions provided by manufacturer.
D. Security window units shall arrive on site completely pre-fabricated to field dimensions approved by Shop Drawings.
E. Install framing and secure to structure in accordance with manufacturer's recommendations and approved shop drawings.
F. Provide required support and securely fasten and set windows plumb, square, and level without twist or bow.
G. Apply sealant in accordance with window and sealant manufacturer's recommendations as indicated in installation instructions.
H. Remove excess sealant and leave exposed surfaces clean and smooth.

3.04 CLEANING AND PROTECTION

A. Clean and protect windows from damage during ongoing construction operations. If damage occurs, remove and replace as required to provide windows in their original, undamaged condition.
B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer’s requirements.
C. Provide final cleaning of product and accessories, removing excess sealant, labels and protective covers.
D. Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Hardware and related items for interior and exterior doors.
B. Hardware for fire-rated doors.
C. Electrically operated and controlled hardware.
D. Weatherstripping and gasketing.
E. Thresholds.
F. Emergency Key Boxes (Knox Boxes).

1.02 RELATED CSI NUMBERS

A. CSI Number 07 92 00 – Joint Sealants.
B. CSI Number 08 11 13 – Hollow Metal Doors and Frames.
C. CSI Number 08 14 00 – Wood Doors.
D. CSI Number 08 41 13 – Aluminum-Framed Entrances and Storefronts.
E. CSI Division 26 – Electrical.
F. CSI Division 28 – Electronic Safety and Security.

1.03 REFERENCES

A. ADA Standards – 2010 ADA Standards for Accessible Design.
B. ICC A117.1 2017 – Standard for Accessible and Usable Buildings and Facilities.
C. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
D. BHMA A156.1 – Butts and Hinges.
E. BHMA A156.2 – Locks and Latches.
F. BHMA A156.3 – Exit Devices.
G. BHMA A156.4 – Door Closers and Pivots.
H. BHMA A156.5 – Cylinders and Input Devices for Locks.
I. BHMA A156.6 – Architectural Door Trim.
J. BHMA A156.7 – Template Hinge Dimensions.
K. BHMA A156.8 – Door Controls - Overhead Stops and Holders.
L. BHMA A156.10 – Power Operated Pedestrian Doors.
M. BHMA A156.12 – Interconnected Locks
N. BHMA A156.13 – Mortise Locks.
O. BHMA A156.14 – Sliding and Folding Door Hardware.
P. BHMA A156.16 – Auxiliary Hardware.
Q. BHMA A156.17 – Self Closing Hinges & Pivots.
R. BHMA A156.18 – Materials and Finishes.
S. BHMA A156.19 – Power Assist and Low Energy Power Operated Doors.
T. BHMA A156.21 – Thresholds.
U. BHMA A156.22 – Gasketing.
V. BHMA A156.24 – Delayed Egress Locking Systems.
W. BHMA A156.25 – Electrified Locking Systems.
X. BHMA A156.26 – Continuous Hinges.

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Y. BHMA A156.28 – Recommended Practices for Mechanical Keying Systems.
Z. BHMA A156.29 – Exit Locks, Exit Alarms, Alarms for Exit Devices.
AA. BHMA A156.31 – Electric Strikes and Frame Mounted Actuators.
BB. BHMA A156.115 – Hardware Preparation in Steel Doors and Frames.
CC. BHMA A156.115W – Hardware Preparation in Wood Doors and with Wood or Steel Frames.
DD. DHI Sequence and Format for the Hardware Schedule.
EE. DHI Keying Systems and Nomenclature.
FF. DHI Recommended Locations for Architectural Hardware for Doors installed in Custom Steel Frames.
GG. DHI Recommended Locations for Architectural Hardware for Doors installed in Standard Steel Frames.
HH. NFPA 70 – National Electrical Code.
II. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
JJ. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives.
KK. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.
LL. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies.
MM. UL 294 – Standard for Access Control System Units.
NN. UL 305 – Standard for Panic Hardware.
OO. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
PP. UL 437 – Standard for Key Locks.
QQ. UL 1784 – Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
B. Templates: Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
C. Shop Drawings - Door Hardware Schedule: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
    1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
    2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
    3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.
D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
E. Manufacturer's qualification statement.
F. Supplier's qualification statement.
G. Installer's qualification statement.
H. Keying Schedule:
    1. Submit Keying Schedule in compliance with requirements established by Owner.
I. Certification:
    1. At the completion of installation, certify that material is properly installed according to Manufacturers printed instructions.
    2. Submit certification that hardware for fire rated doors (including doors and frames as a unit) will comply with UL 10C (positive pressure testing) as required by IBC.

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J. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
K. Maintenance Materials and Tools Information for Owner’s use in maintenance of the project.
L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.05 QUALITY ASSURANCE

A. Coordinate the manufacturing, fabrication, and installation of products that door hardware is installed on or within.
B. Furnish hardware items of proper design for use in doors and frames of the thicknesses, profile, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information in the Contract Documents.
C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this CSI Number with a minimum of three years of documented experience.
D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this CSI Number.
E. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
F. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Package each item of hardware in original and individual containers, complete with all necessary fastenings, keys, instructions, and templates.
    1. Mark each container with its item number corresponding to the item number on the door hardware schedule.
    2. Containers holding locks shall show the following corresponding to that shown on the door hardware schedule:
        a. Heading number
        b. Door number
        c. Hand of door (when required)
        d. Keying symbol (when developed by Owner)
    3. Typewritten schedule conforming with the approved schedule shall accompany each shipment.
B. When hardware is to be installed at the factory, the hardware supplier shall send all such items needed to the respective supplier for their use in installation. The cost of this shipping requirement shall be borne by the hardware supplier.
C. Storage and Protection: Provide a secure area with sufficient space and shelving in which to store and inventory all materials under lock and key. Store all materials in accordance with manufacturer’s written instructions for storage. Protect hardware from damage at all times.

1.07 WARRANTY

A. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
    1. Locksets and Cylinders: 3 years minimum.
    2. Exit Devices: 3 years minimum.
    3. Closers: 30 years.

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PART 2 - PRODUCTS

2.01 MATERIALS – GENERAL

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide door hardware products that comply with the following performance requirements:
   1. Applicable provisions of federal, state, and local codes. Confirm requirements adopted by the Authority Having Jurisdiction (AHJ).
   2. Accessibility: ADA Standards and ICC A117.1 code requirements.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL, Intertek, a testing firm acceptable to the AHJ, or as suitable for application indicated.
   5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
   6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   8. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series as indicated in Hardware Sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      a. Finish: To match lock or latch.
      b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      c. Center Strike at Pairs of Doors: 7/8 inch (22.2 mm) lip.

D. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

E. Electrically Operated and/or Controlled Hardware: Coordinate with Owner to provide any necessary materials as required for proper operation.

2.02 HINGES

A. Manufacturers – Butt Hinges:
   1. **Basis of Design: McKinney; Assa Abloy, www.mckinneyhinge.com.**
   2. Hager Companies, www.hagerco.com.

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3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. Manufacturers – Continuous Hinges:
1. **Basis of Design: Pemko; Assa Abloy, www.pemko.com.**
2. Hager Companies, www.hagerco.com.
3. Select Hinges; Select Products Limited, www.select-hinges.com.
4. As approved by Architect and in compliance with substitution requirements.

C. Properties:
1. Butt Hinges: As applicable to each item specified.
   a. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
   b. Template screw hole locations.
   c. Bearing assembly installed after plating.
   d. Bearings: Concealed fully hardened bearings.
   e. Bearing Shells: Shapes consistent with barrels.
   f. Pins: Easily seated, non-rising pins
      i. Fully plate hinge pins.
      ii. Non-Removable Pins: Slotted stainless steel screws.
   g. UL 10C listed for fire-resistance-rated doors.
   h. Electrified Hardware Functions: Use hinges similar to conventional hinges used at the door leaf and designed to facilitate power transfer.
      i. Wiring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle. Provide wire quantity and sizes required for electric hardware be served and length sufficient for connection from locking hardware to power supply or junction box.
      ii. Connectors: Use Molex type.
      iii. Monitoring Switch: Concealed.
2. Continuous Hinges: As applicable to each item specified.
   a. Geared Continuous Hinges: As applicable to each item specified
      i. Non-handed.
      ii. Anti-spinning through-fastener.
      iii. UL 10C listed for fire-resistance-rated doors.
         A) Metal Door Installation: Rated up to 90 minutes.
         B) Wood Door Installation: Rated up to 60 minutes.
      iv. Sufficient size to permit door to swing 180 degrees.

D. Sizes: See Hardware Sets.
1. Hinge Widths: As required to clear surrounding trim.
2. Sufficient size to allow 180 degree swing of door.

E. Finishes: See Hardware Sets.
1. Fully polish hinges; front, back, and barrel.

F. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
2. Continuous Hinges: Comply with BHMA A156.26 and BHMA A156.7 for templated hinges.

G. Material: Base metal as indicated for each item by BHMA material and finish designation.

H. Types:
1. Butt Hinges: Include full mortise hinges.
2. Continuous Hinges.

I. Options: As applicable to each item specified.
1. Provide electric power transfer (EPT) as listed in hardware sets.
2. Provide concealed electric (CE) as listed in the hardware sets.

J. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
   a. Hinge weight and size unless otherwise indicated in Hardware Sets.

Public

i. For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
ii. For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
iii. For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
iv. For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

2. Continuous Hinges: One per door leaf.

K. Applications:
1. At swinging doors, provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

L. Products:
1. Butt Hinges:
a. Concealed bearing, five (5) knuckle.
i. **Basis of Design: McKinney TA/T4A Series.**
ii. Hager Companies BB Series.
iii. Ives 5BB Series.
2. Continuous Hinges:
a. Continuous gear hinges, full mortise. See Hardware Sets.

2.03 BOLTS

A. Manufacturers:
1. **Basis of Design: Rockwood; Assa Abloy, www.rockwoodmfg.com/en.**
2. Trimco, www.trimcohardware.com/#sle.
3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. Properties:
1. Flush Bolts:
a. Manual Flush Bolts: Manually latching upon closing of door leaf.
i. Bolt Throw: 3/4 inch (19 mm), minimum.
b. Automatic Flush Bolts: Automatically latching upon closing of door leaf.
i. Bolt Throw: 3/4 inch (19 mm), minimum.
2. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.

C. Options:
1. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.
2. Lever extensions: Provide for top bolt at oversized doors.

D. Products:
1. Manual flush bolts:
a. **Basis of Design: Rockwood 555 Series.**
b. Trimco 3917 Series.
c. Ives 262.
2. Dustproof Strikes:
a. **Basis of Design: Rockwood 570.**
b. Trimco 3910 Series.
c. Ives DP1 / DP2.

2.04 DOOR PULLS AND PUSH PLATES

A. Manufacturers:

Public

1. **Basis of Design: Rockwood; Assa Abloy, www.rockwoodmfg.com/en.**
2. Trimco, www.trimcohardware.com/#sle.
3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. Properties:
1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.

C. Finishes: See Hardware Sets.
D. Grades: Comply with BHMA A156.6.
E. Material: Stainless steel, unless otherwise indicated.
F. Products:
1. Pull Plates:
a. **Basis of Design: Rockwood 105 / 106 / 107 Series.**
b. Trimco 1017 Series.
c. Ives 8302 Series.
2. Push Plates:
a. **Basis of Design: Rockwood 71 Series.**
b. Trimco 1001 Series.
c. Ives 8200 Series.

2.05 CLOSERS

A. Manufacturers:
1. **Basis of Design: LCN; Allegion, www.lcnclosers.com.**
2. No substitutions; Owner's Standard.

B. Properties:
1. Surface Mounted Closers: Manufacturer's standard.
a. Construction Cast Iron.
b. Maximum Projection from Face of Door: 2-7/16 inches (62 mm).
c. Mechanism: Separate, tamper-resistant, self-regulating adjusting valves for closing and latching speeds, backcheck, advanced variable backcheck and optional delayed action feature.
i. Spring adjustment screw must be hex key.
ii. All valves must have mechanism to prevent oil leaks from over adjustment.
iii. All closer adjustments must be front facing and adjustable without removing closer from installed surface.
iv. Spring Size.
A) Adjustable spring sizes 1-6 with +50% power increase capability.
B) Spring size indicator shall be easy to read and adjustable without removal of housing from the installed surface.
d. Hydraulic: All-weather fluid.
e. Arm Assembly.
i. Construction: Stamped arms and forged hub.
ii. Material: Steel.
iii. Degree of Swing.
A) Parallel arm NHO mounting shall not limit opening angle and permit 180-degree door swing.
B) Regular arm NHO mounting shall not limit opening angle and permit 120-degree door swing.
C) Consult factory for non-standard templating.
iv. Include hold-open, integral stop, or spring-loaded stop feature, as specified in Hardware Sets.
f. Covers:
i. Type:

Public

A) Full.
ii. Material:
A) Plastic.
iii. Finish:
A) Painted.
iv. Attachment: Two-point flange mounting, dual-clamp friction fit closer cover.

C. Requirements:
1. Provide door closer on each exterior door, unless otherwise indicated.
2. Provide door closer on each fire-rated and smoke-rated door.
3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

D. Finishes: See Hardware Sets.

E. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
i. Product Listing: UL for use on fire-resistance-rated doors.
b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.

F. Code Compliance: As required by Authority Having Jurisdiction (AHJ).

G. Options:
1. Delayed action, adjustable with an independent valve.

H. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in Hardware Sets.
3. At out swinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

I. Basis of Design Products:
1. Surface Mounted Closers:
a. 4040XP Series.

2.06 COORDINATORS

A. Manufacturers:
1. **Basis of Design: Assa Abloy, www.assaabloydss.com.**
2. Trimco, www.trimcohardware.com/#sle.
3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. Properties:
1. General: Non-handed devices, with field-selectable active door leaf.
2. Active door to be field-selectable.
3. Coordinators: Devices on pairs of doors with closers and self-latching or automatic flush bolts installed.
a. Coordinator Operation: Only when inactive door is opened.

C. Finishes: See Hardware Sets.

D. Grades:
1. Closer and Coordinator Combinations: Comply with BHMA A156.4, Grade 1

E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
1. Meet UL 10C for Positive Pressure.

F. Types:
1. Coordinators: Bar.

G. Installation:

Public

1. Mounting: Provide necessary mounting brackets and filler bars to ensure proper installation of coordinator and related hardware.
2. Coordination: Properly sequence installation of other door hardware affected by placement of coordinators and carry bars.

H. Products: See Hardware Sets.

2.07 STOPS AND HOLDERS

A. Manufacturers – Wall Bumpers & Floor Stops:
1. **Basis of Design: Rockwood; Assa Abloy, www.rockwoodmfg.com.**
2. Trimco, www.trimcohardware.com/#sle.
3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. General:
1. Provide a stop for every swinging door, unless otherwise indicated.
2. Provide overhead stop/holder when wall or floor stop is not feasible.
3. Do not mount floor stops where they will impede traffic.

C. Grades:
1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
1. Wall Bumpers: Wall Bumpers: Bumper, concave, wall stop.
2. Floor Stops: Provide with bumper floor stop.

F. Installation:
1. Non-Masonry Walls: Provide adequate wall reinforcement to allow lasting installation of wall bumpers.

G. Basis of Design Products:
1. Wall Bumpers:
a. **Basis of Design: Rockwood 409.**
b. Trimco 1279CVSV.
c. Ives WS401/402CCV.
2. Floor Stops:
a. **Basis of Design: Rockwood 462.**
b. Trimco 1209HA.
c. Ives FS18S.

2.08 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
1. **Basis of Design: Norton-Rixson; Assa Abloy, www.nortonrixson.com.**
2. Architectural Builders Hardware (ABH) Manufacturing Inc., www.abhmfg.com.
3. Ives; Allegion, www.iveshardware.com.
4. As approved by Architect and in compliance with substitution requirements.

B. Properties:
1. Stop Settings: At 85 degrees opening.
a. Adjustable friction tension.
2. Provide non-handed design with mounting brackets as required for proper operation and function.

C. Requirements:
1. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
2. Overhead stop is not required if a floor or wall stop has been specified for the door.

Public

3. Overhead stops and holders to be surface or concealed types as indicated in Hardware Sets.

D. Sizes: Manufacturer's standard for the application.
E. Finishes:
   1. Arms and Brackets: Zinc-plated.
F. Grades: As applicable to item specified.
   1. Comply with BHMA A156.8, Grade 1.
   2. Listed in Certified Products Directory (CPD).
G. Material: Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel.
H. Products: See Hardware Sets.

2.09 PROTECTION PLATES

A. Manufacturers:
   1. **Basis of Design: Rockwood; Assa Abloy, www.rockwoodmfg.com.**
   2. Trimco, www.trimcohardware.com/#sle.
   3. Ives; Allegion, www.iveshardware.com.
   4. As approved by Architect and in compliance with substitution requirements.
B. Properties:
   1. Plates:
      a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
      b. Edges: Beveled, on four (4) unless otherwise indicated.
   2. Anti-Microbial Coating: Clear, silver ion-based.
   3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
C. Grades: Comply with BHMA A156.6.
D. Material: As indicated for each item by BHMA material and finish designation.
   1. Metal Properties: Stainless steel, 300 grade.
      a. Metal, Standard Duty: Thickness 0.050 inch minimum.
E. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
F. Installation:
   1. Fasteners: Countersunk screw holes and fasteners.
G. Products:
   1. Kickplates:
      a. **Basis of Design: Rockwood K1050.**
      b. Trimco K Series.
      c. Ives 8400/8402.

2.10 THRESHOLDS

A. Manufacturers – Wall Bumpers & Floor Stops:
   1. **Basis of Design: Pemko; Assa Abloy, www.pemko.com.**
   2. National Guard Products, Inc., www.ngp.com.
   3. Zero International; Allegion, https://us.allegion.com/en/products.html.
   4. As approved by Architect and in compliance with substitution requirements.
B. Properties:
   1. Threshold Surface: Fluted horizontal grooves across full width, unless indicated otherwise.

Public

C. Requirements:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.
D. Grades: Comply with BHMA A156.21.
E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
F. Products: See Hardware Sets.

2.11 WEATHERSTRIPPING AND GASKETING

A. Manufacturers – Wall Bumpers & Floor Stops:
   1. **Basis of Design: Pemko; Assa Abloy, www.pemko.com.**
   2. National Guard Products, Inc., www.ngp.com.
   3. Zero International; Allegion, https://us.allegion.com/en/products.html.
   4. As approved by Architect and in compliance with substitution requirements.
B. Properties:
   1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   2. Adhesive-Backed Perimeter Gasketing: Silicone gasket material applied to frame with self- adhesive.
   3. Rigid, Housed, Perimeter Gasketing: Sponge silicone gasket material held in place by aluminum housing; fastened to frame stop with screws.
   4. Overlapping Astragals for Meeting Stiles: Neoprene strip gasket material held in place by aluminum housing and overlapping when doors are closed; mounted to face of meeting stile with screws; surface mounted to door.
   5. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
   6. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
      a. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
   7. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
      a. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
C. Requirements:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
   3. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
   4. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
   5. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
D. Grades: Comply with BHMA A156.22.
   1. Weatherstripping: See Hardware Sets.
   2. Meeting Stile Seals: See Hardware Sets.
   3. Door Bottom Seals:
      a. Door Sweeps: See Hardware Sets.

Public

E. Products: See Hardware Sets.

2.12 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
   1. Manufacturers:
      a. Securitron DPS Series.

B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.
   1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   2. Manufacturers:
      a. Securitron AQL Series.

2.13 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Manufacturers:
   1. **Basis of Design: BEST; Dormakaba Group, www.bestaccess.com/#sle.**
   2. No substitutions; Owner’s Standard.

B. Properties:
   1. Mechanical Locks:
      a. Fitting modified ANSI A115.2 door preparation.
      b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.
      c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
         i. Through-bolted anti-rotational studs.
      d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
      e. Bored Hole: 2-1/8 inch (54 mm) diameter.
      f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
      g. Latch: Single piece tail-piece construction.
         i. Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
      h. Cylinders:
         i. Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
            A) Small format interchangeable.
      i. Lever Trim:
         i. Style: See Hardware Sets.
         ii. Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.

Public

iii. Strength: Locksets outside locked lever designed to withstand minimum1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
iv. Independent spring mechanism for each lever.
A) Contain lever springs in the main lock hub.
v. Outside Lever Sleeve: Seamless one-piece construction.

C. Finishes: See Hardware Sets.
1. Core Faces: Match finish of lockset
D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.
1. Durability: Passing 50 Million cycle tests verified by third party testing agency.
E. Material: Manufacturer's standard for specified lock.
1. Critical Latch and Chassis Components: Brass or corrosion-resistance treated steel.
2. Outside Lever Sleeve: Hardened steel alloy.
F. Basis of Design Products: Cylindrical locks, including mechanical and electrified types.
1. 9K (Grade 1).

2.14 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.15 LOCK CYLINDERS

A. Manufacturers:
1. **Basis of Design: BEST; Dormakaba Group, www.bestaccess.com/#sle.**
2. No substitutions; Owner’s Standard.
B. Properties:
1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
a. Provide cylinders from same manufacturer as locking device.
b. Provide cams and/or tailpieces as required for locking devices.
c. Provide cylinders with appropriate format interchangeable cores where indicated.
C. Grades:
1. Standard Security Cylinders: Comply with BHMA A156.5.
D. Types: As applicable to each item specified.
E. Applications: At locations indicated in hardware sets, and as follows:
F. Basis of Design Products:
1. Rim/mortise: 12E & 1E Series.

2.16 EXIT DEVICES

Public

A. Manufacturers:
   1. **Basis of Design: Von Duprin; Allegion, www.vonduprin.com.**
   2. No substitutions; Owner's Standard.
B. Properties:
   1. Actuation: Full-length touchpad.
   2. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
   3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
   4. Lever Design: Match project standard lockset trims.
   5. Cylinder: Include where cylinder dogging or locking trim is indicated.
   6. Strike as recommended by manufacturer for application indicated.
   7. Sound dampening on touch bar.
   8. Dogging:
      a. Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch (6 mm) hex key dogging.
      b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
   9. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
   10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
   11. Handing: Field-reversible.
   12. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
C. Grades: Complying with BHMA A156.3, Grade 1.
D. Standards Compliance:
   1. UL Listed for Panic and Fire for Class II Circuitry.
   2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
   3. Comply with UL 10C.
E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
F. Options:
   1. Electrified Devices:
      a. Latchbolt Retraction: Motorized latchbolt retraction.
   2. Internally mounted switch used to signal other components.
   3. QEL: Motorized latch retraction.
   4. Electrified Device Voltage: 24 VDC.
G. Basis of Design Products:
   1. 99 Series.
   2. 33A Series.

2.17 ELECTRIC STRIKES

A. Manufacturers:
   1. **Basis of Design: H.E.S.; Assa Abloy, www.hesinnovations.com.**
   2. No substitutions; Owner's Standard.
B. Requirements:
   1. Provide electric strikes designated for use with type of locks shown at each opening.
   2. Provide UL (DIR) listed burglary-resistant devices.
   3. Provide UL 1034 compliant devices.
   4. Provide UL 10C compliant devices.
   5. Non-handed devices suitable for door frame material and scheduled lock configuration.
   6. Field-selectable Fail Safe or Fail Secure modes, unless otherwise noted.
   7. Include transformer and rectifier as necessary for complete installation.
   8. Holding Force: 1,500 lbs (680.4 kg).

Public

9. Accommodating latch projections of 1/2 inch (13 mm), 5/8 inch (16 mm), or 3/4 inch (19 mm).

C. Grades: Complying with BHMA A156.31, Grade 1.

D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

E. Options: As applicable to each item specified.
   1. Voltage: 24 VDC.

F. Installation: Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

G. Products:
   1. 5300 Series.

2.18 ELECTRIFIED HARDWARE

A. Owner to provide low voltage wiring from a central location in the building to each electrified opening. Contractor to provide wiring pathways to electrified opening.

2.19 KEYS AND CORE CYLINDERS

A. Manufacturers:
   1. **Basis of Design: BEST; Dormakaba Group, www.bestaccess.com/#sle.**
   2. No substitutions; Owner's Standard.

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Provide small format interchangeable core.
   2. Provide Patented CORMAX keys and cores.
   3. Provide keying information in compliance with DHI (KSN) standards.
   4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
   5. Keying: Master keyed.
   6. Include construction keying and control keying with removable core cylinders.
   7. Supply keys in following quantities:
   8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   9. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
   10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate".
   11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Products:
   1. Patented: CORMAX.

2.20 EMERGENCY KEY BOXES (KNOX BOXES)

A. Manufacturers:
   1. **Basis of Design: Knox Company, www.knoxbox.com.**
   2. Kidde, www.kidde.com.
   3. As approved by Architect and Authority Having Jurisdiction (AHJ) and in compliance with substitution requirements.

B. Requirements:
   1. Provide quantity as shown on Drawings or as required by Authority Having Jurisdiction (AHJ); minimum quantity of (1) per building.

Public

2. Comply with UL 437.
3. Weather-resistant door gasket.
4. Hinged door.
5. Lock cylinder approved by the Authority Having Jurisdiction (AHJ).

C. Finishes:
1. Powder coat or equivalent finish, color as selected by Architect from manufacturer's full range of standard colors.

D. Installation:
1. Recess mounted, unless surface mounted is approved by Architect prior to bidding.
2. Rigidly anchored in place per manufacturer's written installation instructions.

E. Products:
1. **Basis of Design: Knoxbox 3200 Series – Recessed Mount.**
2. KiddeSafe 2HS Series – Recessed Mount.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify the following:
1. Doors and frames are ready to receive the work of this CSI Number.
2. Labeled, fire-rated doors and frames are properly installed.
3. Dimensions are as indicated on shop drawings.
4. Installed in compliance with requirements for installation tolerances.
5. Other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

C. Verify that electric power of the correct characteristics is available to power operated devices.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

C. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

D. Provide blocking in gypsum board walls where wall stops or other wall mounted hardware is located.

3.03 INSTALLATION

A. Install any and all hardware at the latest possible time frame.

B. Install hardware in accordance with manufacturer's instructions, applicable codes, and the following applicable reference standards using proper templates provided by hardware item manufacturer.
1. DHI Recommended Locations for Architectural Hardware for Doors installed in Standard Steel Frames.
2. DHI Installation Guide for Doors and Hardware (TDH-007-20).

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in CSI Division 9. Do not install surface-mounted items until finishes have been completed on substrates involved.

Public

D. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.
E. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
F. Install hardware for smoke and draft control doors in accordance with NFPA 105.
G. Do not install surface mounted items until application of finishes to substrate are fully completed.
H. Wash down masonry walls and complete painting or staining of doors and frames prior to installation of hardware.
I. Complete finish flooring prior to or in coordination with the installation of thresholds.
J. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. Install in compliance with DHI recommendations and ADA Standards, unless noted otherwise in Hardware Sets or on Drawings. Notify Architect if Authority Having Jurisdiction (AHJ) requests alternate mounting heights.
K. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws. See Joint Sealants specification for additional requirements.
L. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.
M. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
B. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
    1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
C. Fire Door Assembly Inspection: Reference CSI Division 01 "Closeout Procedures". Conduct an initial fire door assembly inspection, including documentation reporting, upon completion of door hardware installation according to NFPA 80 Standard for Fire Doors and Other Opening Protectives, paragraph 5.2.4, requirements.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
B. Adjust hardware for smooth operation.
C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.06 CLEANING AND PROTECTION

A. Protect exposed hardware installed on doors during the construction phase.

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B. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made to restore proper finish.
C. Clean adjacent surfaces soiled by hardware installation activities.
D. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.
E. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost to Owner.
F. Do not permit adjacent work to damage hardware or finish.
G. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner. Leave Work in clean, operable condition.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

PART 4 - HARDWARE SET LEGENDS

Manufacturer List:

Code	Name
AR	Adams Rite / Assa Abloy
BE	Best Access Systems / Dormakaba Group
HE	H.E.S. Innovations / Assa Abloy
IV	IVES / Allegion
LC	LCN / Allegion
PE	Pemko / Assa Abloy
RO	Rockwood / Assa Abloy
ST	BEST Access Systems / Dormakaba Group

Finish List:

Code	Description
26D	Satin Chrome
32D	Satin Stainless Steel
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
CL	Clear
US32D	Stainless Steel, Dull

PART 5 - HARDWARE SETS

5.01 GENERAL

A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in

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a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

Hardware Sets

Set: 1.0
Doors: A102, 101.1, 101.2, 102.1, 102.2

	Description	Catalog Number	Finish	Mfr
4	Hinge	T4A3386 NRP	US32D	MK
1	Lockset Storeroom	9K37D 15D	US26D	BE
1	Permanent Keyed Core	CORMAX SFIC	US26D	BE
1	Electric Strike	5300	US32D	HES
1	Latch Guard	LG14	US32D	IVES
1	Surface Closer	4040XP	689	LCN
1	Kick Plate	K1050 12” x 2” LDW	US32D	RO
1	Overhead Stop			
1	Threshold, Saddle	171A		PE
1	Perimeter Gasketing	S88BL		PE
1	Door Sweep	315CN		PE
1	Card Reader and Power	By Access Control Integrator		

Note: At door A102 provide 3ea Hinges.

Set: 2.0
Doors: 102.6

	Description	Catalog Number	Finish	Mfr
3	Hinge	T4A3786 NRP	US26D	MK
1	Lockset Storeroom	9K37D 15D	US26D	BE
1	Permanent Keyed Core	CORMAX SFIC	US26D	BE
1	Surface Closer	4040XP EDA	689	LCN
1	Floor Stop	466-RKW	BLK	RO
1	Silencers	608	Gry	RO
1	Kick Plate	K1050 12” X 2” LDW	US32D	RO

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Set: 3.0
Doors: A103

	Description	Catalog Number	Finish	Mfr
3	Hinge	TA2714	US26D	MK
1	Lockset Storeroom	9K37D 15D	US26D	BE
1	Permanent Keyed Core	CORMAX SFIC	—	BE
1	Electric Strike	5300	US32D	HES
1	Surface Closer	4040XP RA	689	LCN
1	Wall Stop	409	US32D	RO
3	Silencers	608	Gry	RO
1	Card Reader and Power	By Access Control Integrator		

Set: 4.0
Doors: A106.2

	Description	Catalog Number	Finish	Mfr
3	Hinge	TA2714 NRP	US26D	MK
1	Lockset Office	9K37AB 15D	US26D	BE
1	Permanent Keyed Core	CORMAX SFIC	—	BE
1	Wall Stop	409	US32D	RO
1	Silencers	608	Gry	RO

Set: 5.0
Doors: A100

	Description	Catalog Number	Finish	Mfr
1	Continuous Hinge	CFM SLF HD1	628	PE
1	Deadlatch	4900-3	628	AR
1	Push Bar	T47-3	US32D	RO
1	Cylinder	1E74	626	BE
1	Permanent Keyed Core	CORMAX SFIC	—	BE
1	Pull	BF162 12” 12HD	630	RO
1	Electric Strike	5300	US32D	HES
1	Surface Closer/Stop	4040XP CUSH	689	LCN
1	Threshold, Saddle	171A	CL	PE
1	Perimeter Gasketing	By frame mfg.		
1	Door Sweep	By door mfg.		
1	Card Reader and Power	By Access Control Integrator		

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Set: 6.0
Doors: 102.5

	Description	Catalog Number	Finish	Mfr
3	Hinge	T4A3786 NRP	US26D	MK
1	Mortise Privacy w/ ind	45HL 15H VIB	US26D	BE
1	Surface Closer	4040XP EDA	689	LCN
1	Floor Stop	466-RKW	BLK	RO
1	Silencers	608	Gry	RO
1	Kick Plate	K1050 12” X 2” LDW	US32D	RO

Set 7.0
Doors: 101.3, 101.4, 102.3,102.4

Note: Hardware by overhead coiling door manufacturer.

End of Hardware Sets.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 08 80 00

GLAZING

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Transparent and translucent glass and glazing products for interior and exterior applications, including the following types:
   1. Float glass.
   2. Heat-strengthened.
   3. Tempered glass.
   4. Laminated glass.
   5. Insulating glass.
   6. Spandrel glass.
   7. Fire-rated glass.
   8. Unframed Mirror glass.
   9. Glazing sealants & tapes.
   10. Miscellaneous glazing materials.

1.02 RELATED CSI NUMBERS

A. CSI Number 08 11 13 – Hollow Metal Doors and Frames.

B. CSI Number 08 14 00 – Wood Doors.

C. CSI Number 08 41 13 – Aluminum-Framed Entrances and Storefronts.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	FGIA	Fenestration & Glazing Industry Alliance
2.	GANA	Glass Association of North America
3.	HS	Heat-strengthened
4.	IGCC	Insulating Glass Certification Council
5.	Low-E	Low emissivity
6.	LSG	Light to Solar Gain
7.	NFRC	National Fenestration Rating Council
8.	NGA	National Glass Association
9.	SC	Shading Coefficient
10.	SHGC	Solar Heat Gain Coefficient
11.	T	Tempered
12.	VLT	Visible Light Transmittance

B. Reference Standards:
   1. ANSI Z97.1 – Safety Glazing Materials Used in Buildings

2. ASTM C 1036 – Standard Specification for Flat Glass.
3. ASTM C 1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
4. ASTM C 1172 – Standard Specification for Laminated Architectural Flat Glass.
5. ASTM C 1376 – Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
6. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E 2188 – Standard Test Method for Insulating Glass Unit Performance.
8. ASTM E 2189 – Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
9. ASTM E 2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
10. ASTM E 1300 – Standard Practice for Determining Load Resistance of Glass in Buildings
11. ASTM C 1349 – Standard Specification for Architectural Flat Glass Clad Polycarbonate
12. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
13. GANA'S - Glazing Manual and Laminated Glass Design Guide.

1.04 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or other specified gas.

D. Sealed Insulating Glass Unit Surface Designations:
1. Surface 1 – Exterior surface of the outer glass lite.
2. Surface 2 – Interspace surface of the outer glass lite.
3. Surface 3 – Interspace surface of the inner glass lite.
4. Surface 4 – Interior surface of the inner glass lite.

1.05 SUBMITTALS

A. Manufacturer’s Product Data: For each glass product and glazing material indicated. Include the following:
1. Structural, physical and environmental characteristics.
2. Size limitations.
3. Special handling or installation requirements.
4. Special application requirements for glazing materials.
5. All available colors of glass and glazing materials with color selections highlighted.
6. For Sealants:
a. Indicate VOC content, if applicable.
b. Laboratory Test Reports indicating compliance with low-emitting materials, if applicable.
c. Environmental Product Declaration (EPD), if applicable.

B. Test and Evaluation Reports: Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials, including insulating units.

C. Glass Samples:
   1. (2) 12-inch square samples of each glass and glazing product, except for clear monolithic glass, illustrating the various colorations. Includes:
      a. Tinted glass
      b. Coated glass
      c. Laminated glass
      d. Insulating glass units
      e. Spandrel glass
      f. Specialty glass
      g. Mirror glass

D. Glazing Sealant Samples (except for standard black): 12-inch long for each type of sealant or gasket exposed to view. Install sealant samples between two strips of material representative in color of adjoining framing system.

E. Color Spacer Samples (except for standard color): 12-inch long

F. Glass and Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations shown on Drawings.

G. Qualification Data: For installers.

H. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

I. Samples of warranties specified in this CSI Number.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with IBC Chapter 24 and all State and local requirements of authorities having jurisdiction.

B. Fabricator Qualifications: A manufacturer of fabricated glass units with a minimum of (5) years of fabrication experience who is acceptable to the primary glass manufacturer.

C. Installer Qualifications: An experienced installer who has successfully competed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance for a minimum of 10 years; and who employs glass installers for this project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited in accordance with the NFRC CAP Certification Agency Program.

E. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

F. Source Limitations: Obtain each type of glass, glazing material, and glazing accessory from a single manufacturer using the same type of glass lights and inner layers for each type of glass type or unit specified. Obtain glazing assemblies from one source for each product and/or installation specified and/or required.

G. Comply with recommendations in the following publications, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this CSI Number.
   1. NGA/GANA Glazing Manual
   2. NGA/GANA Engineering Standards Manual
   3. NGA/GANA Laminated Glazing Reference Manual

H. Insulating Glass Certification Program: Permanently mark either on spacers or on at least one component lit of units with appropriate certification label of the IGCC.

I. Safety Glazing Products. Comply with the following:
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

J. Coordinate glazing channel dimensions.
   1. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
   2. Achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.

B. Protect glazing materials in accordance with manufacturers' written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude changes.

D. Handling: Comply with manufacturer's instructions. Protect glass from edge damage.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees Fahrenheit.

1.09 WARRANTY

A. Provide a written 10-year warranty from date of Substantial Completion for coated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

B. Provide a written 10-year warranty from date of Substantial Completion for laminated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

C. Provide a written 10-year warranty from date of Substantial Completion for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

D. Provide a written 10-year warranty from date of Substantial Completion for fully tempered glass that has been Heat Soaked. Warrants that heat soaked tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions in more than three lites of glass (within an insulating or monolithic unit) per project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide glass products from one of the following manufacturers:
   1. Vitro Architectural Glass, www.vitroglazings.com.
   2. Guardian Glass, www.guardianglass.com/us/en
   3. Viracon, www.viracon.com.
   4. As approved by Architect and in compliance with substitution requirements.

B. Subject to compliance with the requirements of the Contract Documents**,** provide fire-rated glass products from one of the following manufacturers:
   1. Technical Glass Products, www.fireglass.com.
   2. Safti First, www.safti.com.
   3. Schott, www.schott.com.

C. Subject to compliance with the requirements of the Contract Documents**,** provide laminated glass products from one of the following manufacturers:
   1. Vanceva and Saflex from Eastman Chemical Company, https://saflex-vanceva.eastman.com/en.
   2. Kuraray America, Inc.,
   3. As approved by Architect and in compliance with substitution requirements.

D. Subject to compliance with the requirements of the Contract Documents**,** provide ceramic-coated spandrel glass products from one of the following manufacturers:
   1. Guardian Glass Deco HT: Black, Warm Gray, or White as indicated on the Drawings or selected by Architect.
   2. As approved by Architect and in compliance with substitution requirements.

2.02 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems to withstand each applicable condition including the following:
   1. Movements in all directions, temperature-related scenarios, and other load situations including design load cases and load case combinations without failure, which include the following:
      a. Loss or glass breakage attributable to defective manufacture, fabrication, or installation.
      b. Failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, or other defects in construction.

B. Glass and glazing materials shall provide continuity of the building enclosure air and vapor barrier.
   1. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant

C. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed IBC Chapter 24 requirements.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
   5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
   6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II

F. Acoustic Performance: As indicated on the Drawings.

G. Limit glass deflection to 1/175 or flexure limit of glass, with full recovery of glazing materials, whichever is less.

H. Strength: Do not substitute relative to designations of annealed, heat-strengthened, and fully tempered glass.

2.03 MATERIALS – GLASS AND GLAZING

A. Clear Float Glass: Per ASTM C1036, Type I, Class 1 (clear) or Class 2 (tinted, heat-absorbing and light reducing), Quality-Q3, ¼-inch thick minimum.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Fully Tempered Safety Float Glass: Per ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3, ¼-inch thick minimum. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided.
   2. Maximum bow and warp 1/32” per lineal foot (0.79mm).

C. Heat-Strengthened Float Glass: Per ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided.

D. Laminated Glass: Per ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201
   1. Construction: Laminate glass with interlayer as indicated on Drawings to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated on Drawings.
   4. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

E. Low-E-Coated Vision Glass: Per ASTM C1376, coated by vacuum deposition (sputter-coating) process, and complying with other specified requirements.

F. Reflective-Coated Vision Glass: Per ASTM C1376 and complying with other requirements specified.

G. Spandrel Glass, Ceramic-Coated: Per ASTM C1048, Type I, Condition B, Quality-Q3.
   1. Construction: Kind HS heat strengthened or Kind FT fully tempered.

H. Spandrel Glass, Reflective- and Low-E-Coated: Per ASTM C1376, Kind CS.

I. Fire-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction for fire protection ratings indicated on Drawings, based on testing according to NFPA 252.
   1. Basis of Design Product: 5/16” (8mm) FireLite Plus – Standard Grade by Technical Glass Products.

J. Restroom Lavatory Mirror Glass: Per ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q1 mirror select; ¼-inch thick, sizes shown on Drawings. Provide with polished edges. Restroom lavatory mirrors shall be unframed with a polished edge.

2.04 MATERIALS – INSULATING-GLASS UNITS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
   2. Perimeter Spacer: Manufacturer’s standard spacer material and construction:
      a. Aluminum with mill or clear anodic finish.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.
   4. Corner Construction: Manufacturer's standard corner construction.
   5. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge. The unit overall thickness tolerance shall be -1/16” (1.59mm) / +1/16” (1.59mm) from nominal thickness in decimal form.
   6. Comply with coatings and performance specifications indicated in Drawings.
   7. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.

2.05 FABRICATION – INSULATING-GLASS UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

B. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

C. Grind smooth and polish exposed glass edges and corners.

2.06 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer’s full range of standard colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Sika Corporation.
      b. Dow.
      c. Tremco Commercial Sealants and Waterproofing, part of Tremco Construction Products Group.
      d. Pecora Corporation.

e. GE Construction Sealants.

C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sika Corporation.
      b. Dow.
      c. Tremco Commercial Sealants and Waterproofing, part of Tremco Construction Products Group.
      d. Pecora Corporation.
      e. GE Construction Sealants.
      f. Polymeric Systems, Inc.
      g. Adfast Corp.

D. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Sika Corporation.
      b. Dow.
      c. Tremco Commercial Sealants and Waterproofing, part of Tremco Construction Products Group.
      d. Pecora Corporation
      e. GE Construction Sealants.
      f. Polymeric Systems, Inc.
      g. Bostik, Inc.

E. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Sika Corporation.
      b. Dow.
      c. Tremco Commercial Sealants and Waterproofing, part of Tremco Construction Products Group.
      d. Pecora Corporation.
      e. GE Construction Sealants.
      f. Polymeric Systems, Inc.
      g. Bostik, Inc.
      h. Adfast Corp.

2.07 GLAZING TAPES

A. If exposed, glazing tape shall be paintable, or colored to match frame.

B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

C. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 GLAZING ACCESSORIES & MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: EPDM or Silicone with Shore A durometer hardness of 85, plus or minus 5. Type recommended in writing by sealant or glass manufacturer. Minimum length of 4 inches.

D. Spacers: Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks: EPDM or Silicone with Shore A durometer hardness per manufacturer's written instructions.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance. Type recommended in writing by sealant or glass manufacturer.

G. Mirror Mastic: Polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint and approved by mirror manufacturer. The following manufacturers' products are acceptable:
1. Sikaflex®-124 Mirror Grip
2. As approved by Architect and in compliance with substitution requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

C. Demolition / Removal: Remove and replace glass that is broken, chipped, cracked or damaged in any way.

3.03 INSTALLATION – GENERAL

A. Comply with combined written instructions of manufacturers of frames, glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Prevent glass from contact with contaminating substances that result from construction operations such as weld splatter, fire-safing or plastering.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

D. Do not attempt to cut, seam, nip or abrade glass which is tempered or heat strengthened.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where length plus width is larger than 50 inches.
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

K. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

L. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

M. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.04 INSTALLATION – TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of opening.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 INSTALLATION – GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.06 INSTALLATION – SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 INSTALLATION – MIRRORS WITH ADHESIVE

A. Apply mirror mastic to cover not more than 25 percent of back of mirror.

B. Set mirror in support on setting blocks or continuous gasket, and press against substrate to ensure bond of adhesive.

C. Leave open ventilation space, 1/8-inch or more in thickness between mirror and substrate, over 75 percent of mirror area (wherever there is no adhesive).

3.08 INSTALLATION – WINDOW FILM

A. Apply window film in accordance with manufacturer’s instructions, free of bubbles and cut tight to frame at locations indicated on Drawings.

3.09 FIELD TESTING

A. Newly installed fenestration product(s) shall be field tested in accordance with AAMA 502, ASTM E1105, and E783.

B. Test a minimum of three of the fenestration products after they have been installed.

C. Water penetration resistance tests shall be conducted at a static test pressure equal to 20 percent of the positive design wind load times 0.667.

3.10 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers.

C. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal fashion. Leave Work in clean condition.

D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in any other way during the construction period, including natural causes, accidents and vandalism.

E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

F. Do not apply markers of any type to surfaces of glass.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.
   3. Grid suspension systems for gypsum board ceilings.

1.02 SUBMITTALS

A. Product Data: Submit data describing standard framing member materials and finish, product criteria, load charts, limitations, and installation instructions.

B. Certificates: Mill Certification shall be provided with shipment to verify chemical composition, yield strength, tensile strength, elongation, and coating thickness. Include listing of applicable ASTM standards specified in this CSI Number and comparison of ASTM requirements to actual materials provided to jobsite.

C. Manufacturer's letter: Manufacturer shall provide letter stating that the material supplied to the specific project meets or exceed the performance standards listed in these specifications.

1.03 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E4 13 by and independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lb./sq.ft.

2.02 FRAMING SYSTEMS

A. Studs, Runners, and Furring Channels:
   1. ASTM C 645, electro-galvanized to meet ASTM A 591, manufactured from steel supplied in accordance with ASTM A 653, Structural Quality Grade 33; G60 designation galvanized sheet steel.
   2. Thickness: In accordance with stud schedule provided herein.
   3. Deflection Track:
      a. Slotted Top Track (non-fire rated and fire-rated, as applicable): SLP- TRK® as manufactured by Sliptrack Systems (888) 475-7875 www.BradyInnovations.com, as distributed by Cemco *800) 775-2362 (western U.S) and Unimast Inc. (800) 654-7883 (eastern U.S.), gauge as per ICBO ER-5344, Table 2. Provide fire rated assemblies in accordance with manufacturer's literature, where applicable.

      b. Non-Fire Rated Slotted Top Track - Single Track Slip System for Interior Partitions: As manufactured by Metal Lite, Inc., 3070 E. Miraloma Avenue, Anaheim, CA 92806 (800) 886-6824. Provide for partitions that are not required to be fire rated.

B. Studs: C-shaped, non-load bearing rolled steel, punched for utility access, of size shown on Drawings.

C. Ceiling Runners: Cold or hot-rolled steel, meet ASTM C 754.

D. Hanger and Tie Wire: Meet ASTM C 754.

E. Furring and Bracing Members: Of same gauge, material and finish as studs, thickness to suit purpose.

F. Clips, Brackets: Galvanized wire or sheet metal designed for attachment of framing, furring, and bridging members.
   1. Deflection Clips: If acceptable to Building Official, VertiClip™ as manufactured by Signature Industries, LLC, P.O. Box 68005, Raleigh, NC 27613 (919) 844- 0789 may be provided for attachment of framing to roof and floor construction at head and slide conditions. Provide sizes as required for stud depth(s). Clips shall be manufactured of steel conforming to ASTM A 653 Prime Certified G60 galvanized material or better, 50 ksi yield strength and 65 ksi ultimate strength. Deflection clips to have positive attachment to structure and stud material while allowing for frictionless movement.
   2. Bridging Clips: If acceptable to Building Official, BridgeClip™ as manufactured by Signature Industries, LLC, P.O. Box 68005, Raleigh, NC 27613 (919) 844- 0789 may be provided for attachment of bridging to studs.

G. Fasteners: GA 203, self-drilling, self-tapping screws.

H. Anchorage Devices: Power driven, powder actuated, drilled expansion bolts or screws with sleeves as required for positive anchorage.

I. Partition Gap Closure System: Gordon Mullion Mate or equal.
   1. Finish: Match Window System
   2. STC: 35, minimum.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch in diameter.

D. Flat Hangers: Steel sheet 1 by 3/16 inch.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a bas steel thickness of 0.0538 inch and minimum ½ inch wide flanges.
   1. Depth: 2 inches or as indicated on Drawings.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum ½ inch wide flanges, ¾ inch deep.
   2. Steel Studs and Tracks: ASTM C645
   3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
   4. Resilient Furring Channels: ½ inch deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.

G. Grid Suspension System for gypsum board ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing; Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide [one of] the following:
   1. Asphalt-Saturated Organic Felt: ASTM D226/D226/M, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

C. Acoustic Sealant: As specified in CSI Number 09 29 00. ACOUSTICAL SEALANT IS REQUIRED ON ALL INTERIOR PARTITIONS.

D. Primer: FS TT-P-645, for touch-up of galvanized surfaces.

E. Backing: "Notch-Tite" and "Flush Mount" as manufactured by Metal Lite, Inc., 3070 E. Miraloma Avenue, Anaheim, CA 92806 (800) 886-6824.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with installer present, and including welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Verify field measurements are as shown on Drawings.

C. Verify that rough-in utilities are in proper location.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance rating indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

E. Install bracing at terminations in assemblies.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum ½ inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   6. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:
   1. Erect insulation specified in CSI Number 920-07 21 00 “Thermal Insulation” vertically and hold in place with Z-shaped furring members.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

G. Installation tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

H. Align and secure top and bottom runners at spacing indicated on Drawings. Place two beads of acoustic sealant between runners and substrate.

I. Backing and Blocking: Provide backing and blocking attached to studs. Bolt or screw steel channels to studs. Install backing and blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware. If proprietary system is used, install in accordance with manufacturer's printed instructions.

J. Construct corners using minimum three studs.

K. Coordinate erection of studs with requirements of door and window frame supports and attachments.

L. Refer to Drawings for indication of partitions extending to ceiling only and for partitions extending through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide nested extended leg ceiling runners, deflection clips or proprietary slip track.

M. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.

3.05 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Laterally brace entire suspension system.

F. At steel beams, joists or other steel construction wrap hangers around, inset through, or clip or bolt to the supports, so as to develop the full strength of the hangers.

G. At lights or other openings that interrupt the main runner or furring channels reinforce grillage with 3/4 inch cold-rolled channels, wire tied atop and parallel to the main runner channels.

H. Do not bridge control and expansion joints with metal furring. Provide separate supports on each side of joint.

I. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.06 STUD SCHEDULE

A. Stud Table: Maximum limits based upon 5 psf deflection limit, 33 ksi yield stress, and composite wall sheathed both sides full height with 1/2 inch thick gypsum wallboard attached with No. 6 screws at 12 inches on center minimum, from the SSMA "Product Technical Information" - "Wall Height Tables for Composite Allowable Wall Heights." Maximum allowable deflection as follows:
   1. Walls receiving gypsum wallboard finishes: L/240.
   2. Walls receiving plaster and brittle finishes, including stucco, stone masonry, and mirrors: L/360.
   3. Walls receiving ceramic and stone tile finishes: L/360.

STUD WIDTH	DESIGN THICKNESS (Gauge)	STUD SPACING	PARTITION HEIGHT		BRACING SPACING WHERE OCCURS
			L/240	L/360	
1 5/8”	18 mils .0188 in. (25)	16	8’ – 4”	---	4’ – 0” O.C.
		24	7’ – 11”	---	4’ – 0” O.C.
	33 mils .0346 in. (20)	16	9' – 8"	8’-5”	4’ – 0” O.C.
		24	8' – 9"	7’-8”	4’ – 0” O.C.

2-1/2”	18 mils .0188 in. (25)	16	11’ – 3”	9’-10”	6’ – 0” O.C
		24	10’ – 7”	9’-3”	6’ – 0” O.C
	33 mils .0346 in. (20)	16	12’ – 10”	11’-2”	6’ – 0” O.C
		24	11’ – 7”	10’-0”	6’ – 0” O.C
	18 mils .0188 in. (25)	16	14’ – 4”	12’-4”	8’ – 0” O.C
		24	13’ – 5”	11’-7”	8’ – 0” O.C
3-1/2”	33 mils .0346 in. (20)	16	16’ – 5”	14’-3”	8’ – 0” O.C
		24	14’ – 9”	12’-9”	8’ – 0” O.C
4”	18 mils .0188 in. (25)	16	15’ – 4”	13’-4”	8’ – 0” O.C
		24	14’ – 2”	12’-4”	8’ – 0” O.C
	33 mils .0346 in. (20)	16	18’ – 4”	15’-11”	8’ – 0” O.C
		24	16’ – 5”	14’-3”	8’ – 0” O.C
6”	18 mils .0188 in. (25)	16	19’ – 9”	17’-11”	10’ – 0” O.C
		24	16’ – 9”	16’-9”	10’ – 0” O.C
	33 mils .0346 in. (20)	16	24’ – 6”	21’-4”	10’ – 0” O.C
		24	21’ – 7”	18’-10”	10’ – 0” O.C

3.07 FIELD QUALITY CONTROL

A. Testing: At Owner's request, Contractor shall provide spot testing of actual properties of steel framing to verify compliance with specifications.

3.08 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes:
   1. Interior gypsum board.
   2. Exterior gypsum board for walls, ceilings and soffits.
   3. Tile backing panels.
   4. Texture finishes

1.02 SUBMITTALS

A. Product Data: Submit data on gypsum board, joint, finish and accessories.

B. Samples: Submit sample of textured finish prior to application.

C. Reports: Submit fire test report for fire rated assemblies, and acoustical performance test reports for acoustically-rated assemblies.

D. Samples for verification for the following products:
   1. Trim Accessories: Full-size Sample in 12-inch length for each trim accessory indicated.
   2. Textured finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in Gypsum Board Systems Work with 2 years documented experience and approved by Manufacturer.

B. Regulatory Requirements: Conform to applicable code for fire rated assemblies as shown on the Drawings.

C. Comply with applicable specification recommendations of GA-216 and GA-600 as published by the Gypsum Association.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by and independent testing agency.

B. STC-Rated Assemblies; For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:

   1. Georgia-Pacific Building Products. https://buildgp.com/gypsum/
   2. Gold Bond Building Products, National Gypsum Co. www.nationalgypsum.com
   3. United States Gypsum Co. www.usg.com
   4. Pabco Gypsum. www.pabcogypsum.com
   5. CertainTeed Gypsum, Saint-Gobain. www.certainteed.com

2.04 INTERIOR GYPSUM BOARD

A. Standard Gypsum Board: ASTM C1396/C1396M.
   1. ½ or 5/8 inch thick, or as noted on Drawings.
   2. Long Edges: Tapered.

B. Gypsum Board Type X: ASTM C1396/C1396M
   1. Thickness: 5/8 inch thick, or as noted on Drawings.

2. Long Edges: Tapered.

C. Moisture and Mold Resistant Gypsum Board: ASTM C1396-C1396M. With moisture and mold resistant core and paper surfaces.
1. Core: 5/8 inch thick, or as noted on Drawings.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.05 SPECIALTY GYPSUM BOARD

A. Acoustically Enhanced Gypsum Board: ASTM C1396/C1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound absorbing polymer core.

1. Products:
   a. Basis of Design: Pabco Gypsum QuietRock 530; 5/8".
   b. CertainTeed SilentFX.
   c. National Gypsum SoundBreak.

2.06 EXTERIOR GYPSUM BOARD SHEATHING FOR WALLS, CEILINGS AND SOFFITS

A. See CSI Number 06 16 43 for Exterior Gypsum Sheathing.

2.07 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
1. Core: 5/8 inch thick, or as noted on Drawings.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.08 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.
   g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C1047.
1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
   2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.09 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use [setting type-taping] [drying-type, all-purpose] compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use [setting-type, sandable topping] [drying-type, all- purpose] compound.
   4. Finish Coat: For third coat, use [setting-type, sandable topping] [drying-type, all- purpose] compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting type, sandable topping compound.

D. Joint Compound for Exterior Applications:

   1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.
   3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.10 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: (REQUIRED AT ALL INTERIOR PARTITIONS) Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
1. Install acoustical sealant in accordance with Manufacturer's instructions.
2. Install acoustical sealant at gypsum board perimeter at:
    a. Metal framing: Two beads.
    b. Base layer of double layer applications, if applicable.
    c. Face layer.
    d. Caulk partition penetrations by conduit, pipe, ductwork, and rough-in boxes.

F. Install acoustical sealant where gypsum board joins other walls or surfaces at sound control partitions.

G. Thermal Insulation: As specified in CSI Number 072100 "Building Insulation".

2.11 TEXTURE FINISHES

A. Primer: As recommended by texture finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E84.
1. Texture: [fine] [Medium] [Course]

C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
1. Texture: [Light Spatter] [Spatter knock-down]

D. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
1. Texture: [Orange Peel] [Spatter] [Spatter knock-down]

E. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
1. Application Thickness: ½ inch (12.7mm)
2. Surface-burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    a. Flame-Spread Index: [25] or less.
    b. Smoke-Developed Index: [50] or less.
3. NRC: [0.55] according to ASTM C423.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joins other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceiling, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow ¼-to 3/8-inch- (6.4 to 9.5mm) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide ¼-to ½-inch (6.4 to 12.7mm) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. ON Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers and face layers separately to supports with screws, or with screws; fasten face layers with adhesive and supplementary fasteners.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instruction and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch (300 mm) long straight sections at ends of curves and tangent to them.

2. For double layer construction, fasten base layer to studs with screws 16 inches (400mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300mm) o.c.

3.04 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4 -inch (6.4mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.05 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with ¼-inch (6.4mm) gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

C. Water-Resistant Backing Board: Install where indicated with ¼-inch (6.4mm) gap where panels abut other construction or penetrations.

D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.06 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use at outside corners where indicated.
3. LC-Bead: Use at exposed panel edges where indicated.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges where indicated.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.07 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere s required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: finish panels to levels indicated below and according to ASTM C840:
   1. Level 0 (Temporary Construction): No taping, finishing, or accessories required.
   2. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
      a. Joints and interior angles shall have tape embedded in joint compound.
      b. Surface shall be free of excess joint compound.
      c. Tool marks and ridges are acceptable.
   3. Level 2: Panels that are substrate for tile.
      a. Joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating joint compound over joints and interior angles.
      b. Fastener heads and accessories shall be covered with a coat of joint compound.
      c. Surface shall be free of excess joint compound.
      d. Tool marks and ridges are acceptable.
      e. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
   4. Level 3: Where indicated on Drawings
      a. Joints and interior angles shall have tape embedded in joint compound and one (1) additional coat of joint compound applied over joints and interior angles.
      b. Fastener heads and accessories shall be covered with two (2) separate coats of joint compound.
      c. Joint compound shall be smooth and free of tool marks and ridges.
      d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
      e. Un-textured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in CSI Number 09 91 00, as applicable.
   5. Level 4: Typical throughout at exposed gypsum board construction. Appearance areas to receive flat paints, light texture or where backed wall coverings are to be applied. This level of finish is not to be used where gloss, semi-gloss and enamel paints are to be applied.

      a. Joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over flat joints and one (1) separate coat of joint compound applied over interior angles.
      b. Fastener heads and accessories shall be covered with three (3) separate coats of joint compound.
      c. Joint compound shall be smooth and free of tool marks and ridges.
      d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
   6. Level 5: Where indicated on Drawings.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.08 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture (matching approved mock-up) free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces no indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.09 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are wet, or moisture damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.10 CLEANING

A. After completion of wallboard installation, taping and texturing, remove rubbish, excess material and equipment from building and job site, leaving floors and other surfaces clean.

B. Remove overspray from adjoining construction.

C. During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 30 00

TILING

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Ceramic Tiling.
B. Glass Tiling.
C. Metal Tiling.
D. Porcelain Stone Tiling.
E. Stone Tiling.
F. Tiling Accessories, including trim shapes.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 30 00 – Cast-in-Place Concrete.
B. CSI Number 07 92 00 – Joint Sealants.
C. CSI Number 09 29 00 – Gypsum Board.
D. CSI Number 10 28 00 – Toilet & Custodial Accessories.

1.03 REFERENCES

A. ANSI A108 Series Specifications.
B. ANSI A118 Series Specifications.
C. ANSI A136.1 – Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.
D. ANSI A137.1 – Standard Specifications for Ceramic Tile.
E. ANSI A326.3 – Dynamic Coefficient of Friction (DCOF) of Hard Surface Flooring Materials.
F. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
G. ASTM C150/C150M – Standard Specification for Portland Cement.
H. ASTM D226/D226M – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
I. ASTM D2103 – Standard Specification for Polyethylene Film.
J. ASTM E303 – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
K. Tile Council of North America, Inc. (TCNA) Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's current product literature, certified test reports, and installation instructions for each type of product, showing compliance with specified performance characteristics and physical properties. Indicate where each product is to be used. Include recommended procedures for mixing materials and setting tile.
B. Shop Drawings: Include tile layouts and patterns, edges, and details at columns, doorways, enclosing partitions, woodwork, and cutouts. Show details of special patterns.
C. Samples:
   1. Tile: Submit two (2) full-size units of each type, color, texture, and pattern shown on Drawings.
   2. Accessories: Submit two (2) 12-inch long units of each type, color, and material shown on Drawings.

3. Mark each sample with the Manufacturer’s name, style/color/pattern name, and correlating Architectural label from the Drawings.

D. Installer qualification statement and data, including photos of past projects (if requested).
E. Warranty: Sample of warranty to be issued for each product type.
F. Closeout Submittals:
   1. Maintenance and care information for each type of product. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to the finishes and performance of each product type.
   2. Furnish extra materials equal to one (1) square foot of tile for each 100 square feet of each product type, color, size, and pattern, including grout materials for that quantity of tile. If less than 100 square feet is installed, provide a minimum of four (4) square feet of extra stock. Extra materials shall match each product type installed and be from the same production run as the products installed. Extra materials shall be furnished in original packaging with protective covering for storage. Identify each package with labels describing contents. Comply with Owner’s requirements for delivery, storage and protection of extra materials.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in the techniques required by the Manufacturers and can demonstrate five (5) years minimum experience in work of similar scope and nature to that specified and shown on the Drawings.
B. Regulatory Requirements: Provide products in compliance with the following:
   1. Americans with Disabilities Act (ADA).
   2. Occupational Safety & Health Administration (OSHA).
C. Tile Blending: Manufacturer to blend tile at the factory. Provide additional blending at the project site as needed to obtain the Architect’s approval.
D. Tile shall bear the TCNA grade seal, unless otherwise approved by Architect.
E. Obtain each product from a single manufacturer.
F. Prepare substrates and install products in accordance with product manufacturer’s instructions.
G. Coefficient of Friction: Provide floor tile products and finished floor tile installation with a wet Dynamic Coefficient of Friction (DCOF) of 0.042 or greater when tested with the BOT-3000 using SLS solution per procedures in ASNI A137.1.
H. Mock-ups:
   1. Prior to the start of Work, construct an in-place mock-up of each type of tile (floor and wall). Floor tile mock-up shall be 6’-0” x 6’-0” minimum. Wall tile mock-up shall be 4’ wide minimum, from floor to ceiling, including cove transitions and other typical trims. This mockup section may be included as part of the finished building if approved by the Architect.
   2. Provide mockup(s) when requested by Architect for floor patten or aesthetic effects shown in Drawings.
   3. Mock-ups shall provide a standard of workmanship, and shall include flashings, joints, and sealant systems.
   4. Construct successive mock-ups as necessary until a mock-up is accepted by the Architect.
   5. When accepted, mock-up shall be the standard of comparison for the remainder of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Keep materials clean, dry, and protected against deterioration.

1.07 WARRANTY

A. Provide manufacturer's standard warranty for each type of product used.

PART 2 - PRODUCTS

2.01 MATERIALS – TILE

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturers as indicated on Drawings.**
   2. As approved by Architect and in compliance with substitution requirements.
B. Provide wall and floor tile in sizes and shapes as shown on Drawings.
C. Tile Trim Shapes: Provide Manufacturer's full selection of trim shapes as required.
   1. Provide all bases, caps, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
   2. Except as may be shown otherwise on Drawings, provide color and finish matching in the adjacent tile.

2.02 MATERIALS – SETTING AND GROUT

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. Ardex Americas, www.ardexamericas.com.
   2. Bostik, www.bostik.com.
   3. Custom Building Products, A Quickcrete Company, www.custombuildingproducts.com.
   4. Laticrete International, Inc., www.laticrete.com.
   5. MAPEI Corporation, www.mapei.com.
   6. TEC Specialty Products LLC, www.tecspecialty.com.
   7. As approved by Architect and in compliance with substitution requirements.
B. Mortar for thin-set installation: Latex-Portland cement mortar per ANSI A118.4 and applicable TCNA Handbook method. Acceptable products include:
   1. X 77 Microtec by Ardex Americas.
   2. Reflex by Bostik.
   3. Megalite by Custom Building Products.
   4. 254 Platinum by Laticrete.
   5. Kerabond/Keralastic System by MAPEI Corporation.
   6. Super Flex by TEC Specialty Products LLC.
   7. As approved by Architect and in compliance with substitution requirements.
C. Mortar for mud-set (mortar bed) installation: One part Portland cement to six (6) parts damp sand by volume:
   1. Portland Cement in accordance with ASTM C150, Type 1.
   2. Sand in accordance with ASTM C144.
D. Grout:
   1. Latex Grout: Conforming to ANSI A118.6 and the TCNA Handbook. Grout shall be sealed as recommended by manufacturer.
   2. Epoxy Grout: Chemical-resistant in accordance with ANSI A118.3 and water-cleanable during installation. Required at all walls and floors in Shower areas and where shown on Drawings.
E. Grout Sealer:
   1. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
      a. RainguardPro, Micro-Seal, www.rainguardpro.com.

b. As approved by Architect and in compliance with substitution requirements.

2.03 MATERIALS – TRIM

A. Subject to compliance with the requirements of the Contract Documents, provide products from one of the following manufacturers:
   1. Blanke Corporation, www.blankecorp.com.
   2. Schluter Systems, www.schluter.com.
   3. Laticrete International, Inc., www.laticrete.com.
   4. As approved by Architect and in compliance with substitution requirements.
B. Provide finishing and edge-protection at all tile installation areas, unless noted otherwise on Drawings. Trim shall be in profiles, materials, colors, and finishes as shown on Drawings or as selected by Architect. Coordinate sizes and shapes required with the tile.

2.04 MATERIALS – ACCESSORIES

A. Cleavage Membrane:
   1. Subject to compliance with the requirements of the Contract Documents, provide one of the following products:
      a. Noble Company, NobleSeal CIS, www.noblecompany.com.
      b. Daltile, Dal-Seal CIS, www.daltile.com.
      c. 0.004-inch thick polyethylene sheeting complying with ASTM D2103.
      d. 15 lb. asphalt-saturated felt complying with ASTM D226.
      e. As approved by Architect and in compliance with substitution requirements.
B. Waterproofing and Crack Isolation Membrane:
   1. Subject to compliance with the requirements of the Contract Documents, provide one of the following products:
      a. Laticrete, Hydro Ban 1, www.laticrete.com.
      b. Mapei, Mapelastic AquaDefense with Reinforcing Fabric, www.mapei.com.
      c. Ardex, Ardex 8+9 with SK Mesh Reinforcement Fabric, www.ardexamericas.com.
      d. As approved by Architect and in compliance with Plumbing Code and substitution requirements.
C. Expansion/Control Joint Backing Material: See Joint Sealants Specification.
D. Expansion/Control Joint Sealant: See Joint Sealants Specification.
E. Marble Thresholds: As shown on Drawings or as selected by Architect. Thresholds shall be Americans with Disabilities Act (ADA) compliant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine subsurface conditions to receive Work and report detrimental conditions in writing to the Architect. Commencement of Work will be construed as acceptance of subsurface conditions.
B. Coordinate with other Work that affects, connects with, or is concealed by the Work of this section. Before proceeding, ensure required inspections have been made.
C. Where tile will be thin-set directly to the substrata, do not commence installation of the tile until substrata are within the following tolerances:
   1. Horizontal surfaces: Level within 1/8-inch in ten feet in all directions.
   2. Vertical Surfaces: Level within 1/8-inch in eight feet in all directions.
   3. Deflection:
      a. Horizontal Surfaces: Less than 1/360 of the span.
      b. Vertical Surfaces: Verify that design of the wall or partition will not permit deflection exceeding 1/360 of the span for point and uniform loading. Space wood or metal studs not less than 16-inches O.C.

D. Conditions of Surfaces to Receive Tile:
   1. Verify that surfaces to receive tile are firm, dry, clean, and free from oily or waxy films and curing compounds.
   2. Verify that grounds, anchors, plugs, recess frames, bucks, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of tile.
   3. Scarify hard steel trowel finish concrete surfaces.
   4. Completely remove curing compounds on concrete surfaces by scarification or cleaning methods acceptable to tile setting materials manufacturer.

3.02 PREPARATION

A. Lay out Work so that no tile of less than half-size occurs.
   1. For heights stated in feet and inches, maintain full courses to produce nearest attainable heights without cutting tile.
   2. Align joints in wall tile vertically and horizontally except where other patterns are shown or specified. Align joints in walls to conform to patterns selected.
   3. Align joints in floor tile at right angles to each other and straight with walls and conform to patterns selected or indicated.
B. Obtain exact locations of expansion joints and accessories before installing tile.
C. Locate accessories in tile walls as indicated on Drawings or as directed by Architect. Where the size of an accessory does not line up with the jointing pattern of adjacent tile, the cutting of tile and arrangement of joints around the accessories shall be as directed by Architect.

3.03 INSTALLATION

A. Tile – General:
   1. Install tile in accordance with ANSI Specifications A108.1 through A118.1 and Manufacturer's recommendations. Masonry walls to receive tile shall have a leveling coat of mortar applied prior to installation of tile.
   2. Cut and drill neatly as required without marring tile. Rub smooth necessary cuts with a fine stone. Set cut edge against fixture, cabinet or other tile with joint at least 1/16-inch wide.
B. Waterproof Membrane (Adhesive): Utilize where membrane is required beneath tile. Waterproof coves at wet areas in accordance with Manufacturer's recommendations to a minimum height of 8-inches above floor. Allow adhesive type waterproof membrane to cure before applying bonding materials.
C. Thin-Set: Where indicated to be thin-set, install tile using TCNA Method for substrate condition and type for latex-Portland cement mortar.
D. Mud-Set (Mortar-Bed): Where indicated to be mud-set, install tile using TCNA Method for substrate condition and type for latex-Portland cement mortar.
E. Grout:
   1. Mix grout to a creamy consistency.
   2. Mix only as much grout as can be used in one (1) hour.
   3. Thoroughly force grout into joints and fill entire depth.
   4. Finished surface of joints shall be uniformly smooth, and continuously level with edges of tile.
   5. Seal grout in accordance with manufacturer's recommendations.
F. Expansion and Control Joint Sealant:
   1. Provide expansion/control joints where indicated on Drawings and:
      a. Interior: 24'-0" to 36'-0" in each direction.
   2. Joints in between tile and door frames and other metal accessories, tile and ceiling, wall tile and wall tile at inside corners, and wall tile and floor tile shall be sealed with silicone rubber sealant in accordance with Joint Sealants Specification.

3. Provide expansion joints at tile columns, curbs, and pipes, and fill with sealant. At building structural joints extend expansion joints through the tile. Seal with sealant in accordance with Joint Sealants Specification. In no case shall tile be carried over expansion joints without a joint in the tile.

G. Curing: Damp cure all tile installations, including Portland cement grouts, for 72 hours minimum.
   1. Cover with clean non-staining 40 lb. Kraft paper.
   2. Do not use polyethylene sheets directly over tile on horizontal surfaces.
   3. Keep all traffic off newly installed floors for at least 72 hours. Provide protection when necessary.

H. Tolerances:
   1. Tile: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes, and alignments shown:
      a. Horizontal Surfaces: 1/8-inch in 10'-0" in all directions.
      b. Vertical Surfaces: 1/8-inch in 8'-0" in all directions.
      c. Lippage: 1/8-inch maximum.
      d. Maximum Variation of Joint Width: 1/16-inch.

3.04 CLEANING AND PROTECTION

A. Wipe surfaces clean after grouting; remove traces of mortar and grout. Do not use acid solution for cleaning glazed tile.

B. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

C. Close spaces to traffic or other Work until tile is firmly set. Protect from damage until acceptance by the Owner. Repair damaged Work at no additional cost to Owner.

D. Prohibit foot and wheel traffic from using newly tiled floors for at least seven (7) days. Place large, flat boards in walkways and wheel-ways where use of newly tiled floor is unavoidable.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit Drawings showing complete layout of systems including attachments, intersections of members and edge conditions.

B. Product Data: Provide data on metal grid system components and acoustical units.

C. Samples:
1. Submit 2 samples of each type of unit specified, including color selection when applicable.
2. Submit samples of Manufacturer's full color options for selection by Architect.

1.02 QUALITY ASSURANCE

A. Qualifications: Installer shall be approved by Manufacturer of material or system.

B. Standards: Comply with the following:
1. ASTM C635, "Standard Specification for Acoustical Tile and Lay -In Panel Ceilings."
2. ASTM C636, "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay -In Panels."
3. Ceilings and Interior Systems Construction Association (CISCA) “Recommendations for Direct-Hung Acoustical tile and Lay -in Panel Ceilings."

1.03 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.

B. Storage: Adequately protect against damage while stored at the site.

C. Handling: Comply with Manufacturer's instructions.

1.04 MAINTENANCE

A. Extra Materials: Provide an additional 5 percent of each type of acoustical unit installed, in unopened labeled cartons, to the Owner at completion of Work, for his maintenance use, at no additional cost. Provide, at minimum, one full carton of each type of acoustical unit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Furnish products of the following Manufacturers, except as approved otherwise by the Architect, subject to compliance with Specification requirements.
   1. Basis-of-Design: USG Corporation. www.usg.com
   2. Armstrong World Industries. www.armstrongceilings.com/commercial
   3. As approved by Architect.

2.02 SUSPENSION SYSTEM

A. ACT System: Ceiling Suspension System.
   1. Main Runners: Minimum of 1-1/2 inch in height with an exposed dimensional capped face of 9/16 inch, equal to USG Donn Centricitee DXT suspension system, nominally 12 feet long.
   2. Cross-Tees: Minimum of 1-1/2 inch in height with an exposed dimensional capped face is a width to match main runners.
   3. Trim: 4 inch in height with an exposed dimensional capped face of 15/16 inch, equal to USG Compasso Trim.
   4. Finish: Exposed faces of main and cross runners shall be a baked enamel paint finish, white color.

B. Hanger Wire: Galvanized steel conforming to Federal Specification FF-QQ-W-461, Finish 5, Class 1 annealed, and not less than 12 gage).

C. Suspension system shall support the ceiling system specified with a maximum deflection of 1/360 of the span.

D. Wall and Penetration Moldings: 24 MSG painted steel with a minimum one inch wide lower flange, finish and configuration to match grid. For circular penetrations provide edge molding manufactured to exact diameter of circular penetration.

E. Blocking and angle at edges of suspended wood ceilings as shown on Drawings or required for finishing at the ceiling perimeter.

2.03 CEILING PANELS

A. Acoustical Ceiling Panels Type
   1. Model/Style: MARS as manufactured by USG
   2. Size: 24 inch x 24 inch
   3. Surface finish: Fine Texture
   4. Light reflectance: 0.90
   5. Surface Burning Characteristics: Flame Spread ASTM E84; Class A
   6. NRC: 0.70
   7. CAC: ASTM E1414/E1414M; Classified with UL label on product carton: 35
   8. Edge Detail: Fineline Bevel, square lay-in.

2.04 ACCESSORIES

A. Acoustic Batt Insulation: See Acoustic Insulation Specification.

B. Insulation Covers: See Thermal Insulation Specification.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing, with a copy to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Verify, before proceeding with this Work, that required inspections of existing conditions have been completed.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance the following:
   1. ASTM C636 and as supplemented in this CSI Number.
   2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical tile and Lay-in Panel Ceilings - Seismic Zones 1-2" as modified by IBC Section 1621.2.5.

B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

C. Locate system on room axis according to reflected ceiling plan.

D. Install after major above-ceiling Work is complete. Coordinate the location of hangers with other Work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

I. Do not eccentrically load system or produce rotation of runners.

J. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

K. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL LAY-IN UNITS

A. Install acoustical units in accordance with Manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling Work is complete.

E. Install acoustical units level in uniform plane, and free from twist, warp, and dents.

F. Cut panels to fit irregular grid and perimeter edge trim. Field rabbett panel edge. Double cut and field paint exposed edges of reveal edge units.

G. Where round obstructions occur, provide preformed closers to match edge molding.

H. Install hold-down clips to retain panels tight to grid system where required for fire-rated system.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/4 inch in 10 feet.

3.05 ADJUSTING

A. Remove damaged or soiled panels and replace with new units, as directed by Architect.

3.06 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. CSI Number Includes: Rubber base and resilient accessories.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's complete description of products with installation instructions.

B. Samples: 12-inch by full height or width of base and accessories, in colors as shown on drawings, or as selected by Architect from the manufacturer's full range of standard colors.

1.03 QUALITY ASSURANCE

A. Standards: Prepare substrate and install products in accordance with product manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wall Base and Flooring Accessories: Furnish products of one of the specified manufacturers, except as approved by the architect, subject to compliance with specification requirements.
   1. Type TP – Thermoplastic Rubber
      a. Flexco.
      b. Roppe.
      c. Tarkett Johnsonite.
      d. Equivalent as approved by Architect.

2.02 MATERIALS

A. Resilient Base: ASTM F1861
   1. Material: Type TP – Thermoplastic Rubber.
   2. Height: 2-1/2" or as scheduled on drawings.
   3. Thickness: 1/8" thick.
   4. Length: Coils in manufacturer's standard lengths. Cut lengths are not acceptable.
   5. Type: Top set, coved typical, toe-less at carpet unless otherwise indicated on drawings.
   6. Color: As selected by Architect from manufacturer's full range of styles & colors.

B. Subfloor Filler, Adhesives and Wax: Types recommended by resilient flooring manufacturer for material types and location.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Ensure substrate surfaces have solid backing, and are smooth and flat with maximum variation of 1/8-inch in 10-feet.

B. Ensure concrete substrates are dry (maximum 7% moisture content) and exhibit negative alkalinity, carbonization, or dusting.

3.02 PROTECTION

A. Maintain minimum 70ºF air temperature at flooring installation area for three (3) days prior to, during and for 24 hours after installation.

B. Store materials in area of application. Allow three (3) days for material to reach equal temperature as area.

C. Extra Stock: Deliver base equaling at least 2%, but not less than 48 lineal feet of base installed to Owner when and where directed.

3.03 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured.

3.04 INSTALLATION

A. Clean substrate. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation. Spread only enough adhesive to permit installation of products before initial set.

B. Fit base joints tight and vertical. Maintain minimum measurement of 18-inches between joints. Miter internal corners. Use pre-molded sections with minimum 2-inch returns for external corners and exposed ends. Adhere tightly to wall surfaces. Scribe and fit base to door frames and other obstructions. Install base straight and level to variation of ±1/8inch over 10-feet.

C. Install edge strips at unprotected or exposed edges where flooring terminates.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:
   1. Monolithic Quartz Resinous Flooring System

1.2 RELATED CSI NUMBERS

A. CSI Number 07 92 00 – Joint Sealants.

ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. System Application Guide: Manufacturer’s detailed installation instructions for system being installed

Samples for Initial Selection: For each type of exposed finish required.

Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

E. Product Schedule: For resinous flooring.

1.4 INFORMATIONAL SUBMITTALS

Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

Installer Qualifications: An installer that has demonstrated knowledge with installing resinous floors. Engage an installer who is experienced and has a portfolio of successful resinous flooring projects.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.

Include 48-inch (1200-mm) length of integral cove base with inside and outside corner.

   2. Simulate finished lighting conditions for Architect's review of mockups.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

Pre-installation Conference: Conduct conference prior to installation of resinous flooring.

DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PRODUCTS

2.1 MANUFACTURERS

Basis-of-Design Product: Subject to compliance with requirements, provide LATICRETE® SPARTACOTE™ product named or comparable product:

   1. Resinous flooring product to be manufactured under US Patents: 6,833,424 & 7,169,876
   2. Or approved equal in accordance with CSI Number 01 60 00.

2.2 HIGH-PERFORMANCE RESINOUS FLOORING

Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

   1. Basis-of-Design Product: LATICRETE, SPARTACOTE™ QUARTZ™ PURE Monolithic Quartz Industrial Flooring

B. System Characteristics:
   1. Color and Pattern: As selected by Architect from manufacturer's full range
   2. Wearing Surface: Textured for slip resistance.
   3. Overall System Thickness: 1/8” – 3/16”.

Cove Base:
   1. Name: SPARTACOTE Cove Gel
   2. Resin: Epoxy

Formulation Description: High Solids.

   4. Primer: SPARTACOTE General Primer
   5. Application Method: Trowel, Roller
      a. Thickness of Coats: 1/8” x 1” radius
      b. Cove Height: 4” or 6” as indicated on Drawings.

D. Base/Broadcast Coat:
   1. Name: SPARTACOTE™ FLEX PURE™ Pigmented
   2. Resin: Polyaspartic Aliphatic Polyurea

Formulation Description: High Solids.

   4. Type of Pigment: SPARTACOTE Polyaspartic Pigment
   5. Application Method: Roller, Squeegee or Broom.
      a. Thickness of Coats: 8-10 mil.
      b. Number of Coats: One.
      c. Color:

E. Quartz Broadcast:

   1. Name: Standard LATICRETE SPARTACOTE Blended Quartz Blends or as requested by Architect
   2. Application Method: Manual Broadcast
   3. Quartz Color: As noted in Finish Legend

F. Grout Coat:
   1. Name: SPARTACOTE FLEX PURE Clear
   2. Resin: Polyaspartic Aliphatic Polyurea
   3. Formulation Description: High Solids
   4. Application Method: Roller, Squeegee, Broom

      a. Thickness of Coats: 8-10 mils
      b. Number of Coats: One

G. Top Coat:
   1. Name: SPARTACOTE FLEX PURE Clear
   2. Resin: Polyaspartic Aliphatic Polyurea
   3. Formulation Description: High Solids
   4. Application Method: Roller, Squeegee, Broom

      a. Thickness of Coats: 8-10 mils
      b. Number of Coats: One

   5. Aggregates: Not required.
   6. DIAMOND TOPP™ Additive: For heavy-duty applications, incorporate DIAMOND TOPP wear coat additive to increase abrasion resistance. DIAMOND TOPP will leave a lightly textured matte finish.

System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated and no added traction additives:
Adhesion: 400+ concrete fracture per ASTM D 4541.

2. Tensile Strength: 4,500-5,000 per ASTM D 638.
3. Impact Direct/Reverse: ≤ 95 in.-lb per ASTM D 2794.
4. Abrasion Resistance: 22-28 maximum weight loss per ASTM D 4060.
5. Water Absorption: 0.87 as per ASTM D570
6. COF: 0.70 (DRY) 0.53 (WET) as per ANSI B101.3

System Chemical Resistance: As per manufacturer's chemical resistance chart.

2.3 ACCESSORIES

Vapor Membrane: LATICRETE® SPARTACOTE™ Moisture Vapor Barrier for concrete slabs exhibiting elevated moisture vapor emission rates (≥ 75% RH). For faster return to surface VAPOR BAN ER can be used.
Formulation Description: 100% Solids Chemically Enhanced Epoxy

Patching and Fill Material: SPARTACOTE™ FAST FIX™ or resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Filler Material: LATICRETE JOINT-TITE 750™ flexible polyuria joint filler or similar product.

D. Wear Coat Additive: DIAMOND TOPP™ additive from LATICRETE or similar material.

PART 3 - EXECUTION

3.1 PREPARATION

General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

Mechanically profile surfaces with an apparatus that abrades the concrete surface to a profile as specified by system application guide.

b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

Perform plastic sheet test, ASTM D4263. Proceed with application only after testing indicates absence of moisture in substrates.

b. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

Apply vapor reduction coating, where indicated, in manufacturer's recommended thickness.
Apply vapor reduction coating to substrates.

Integral Cove Base: Where indicated, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.
   1. Integral Cove Base: 4” high, minimum.
   2. Product to be SPARTACOTE Cove Gel or similar

Apply primer and body coats in thickness indicated for flooring system.

Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.

Material Sampling: Owner may at any time and any number of times during resinous flooring application require material samples for testing for compliance with requirements.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 81 00

ACOUSTIC INSULATION

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Acoustic Insulation within walls and on top of ceilings / soffits as shown in Drawings.

1.02 RELATED CSI NUMBERS

A. CSI Number 07 21 00 – Thermal Insulation
B. CSI Number 09 22 16 – Non-Structural Metal Framing
C. CSI Number 09 29 00 – Gypsum Board
D. CSI Number 09 51 00 – Acoustical Ceilings

1.03 REFERENCES

A. ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
B. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
C. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
D. ASTM E136 – Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data sheets, written installation instructions and limitations, and recommendations for each product/material to be used. Clearly indicate and label each product’s data sheets as to what application it will be used for. Include certification and test data substantiating combustibility of each type of insulation.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable code for fire resistance ratings and surface burning characteristics.
B. Provide certificate of compliance acceptable to authorities having jurisdiction indicating conformance to fire-resistance requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to jobsite in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
B. Storage & Handling: Comply with manufacturer's written instructions. Protect materials from damage while being stored at the jobsite.

1.07 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents and this specification, provide materials from a single manufacturer for each different product required:
   1. CertainTeed, LLC, www.certainteed.com.
   2. Johns-Manville, A Berkshire Hathaway Company, www.johnsmanville.com.
   3. Knauf Insulation, Inc., www.knaufnorthamerica.com.
   4. Owens Corning, www.owenscorning.com.
   5. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS

A. Sound Attenuation Blankets:
   1. Comply with ASTM C665, Type 1 (unfaced), glass or mineral fiber batts, with a Fire Hazard Classification of less than 50 when tested in accordance with ASTM E84.
   2. Combustion Characteristics: Passes ASTM E136 test.
   3. Fire Resistance Ratings: Passes ASTM E 119 test.
   4. Thickness: As shown on Drawings.
   5. Sound Transmission Class (STC) of assembly: As shown on Drawings.
   6. Comply with requirements of the tested assembly referenced on the Drawings.
   7. Color when Exposed to View: Provide black colored batts or scrim cover as directed by Architect where exposed to view in final work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive the Work of this CSI Number and report detrimental conditions in writing to Architect. Commencement of Work shall be construed as acceptance of subsurfaces. Verify, before proceeding with the Work of this CSI Number, that required inspections of existing conditions have been completed.

B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for specific conditions of installation in each case.

B. Batts may be friction-fit in place until the interior finish is applied. Install batts to fill entire stud cavity. If stud cavity is less than 96" in height, cut lengths to friction-fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities.

C. Where insulation must extend higher than 8 feet, supplementary support is to be provided to hold product in place until the interior finish is applied.

D. Butt ends of batts closely together and fill all voids.

3.03 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 91 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes: Painting as specified and as noted on Drawings. Surfaces requiring finishing and left unfinished by the requirements of other CSI Numbers shall be painted or finished as part of the Work of this CSI Number.

1.2 DEFINITIONS

A. Touch-Up: Painting of items missed by painter at no additional cost to Owner.

B. Re-Paint: Repairs to paint work for damages caused by other trades.

C. Block Resistance (Non-Blocking): The capability of a coating to resist sticking to itself when used on 2 surfaces that come in contact with each other (e.g. door and jamb, window sash and sill).

1.3 SUBMITTALS

A. Product Data: Submit schedule of manufacturers of products required for the Work, together with specifications recommended by each manufacturer.

B. Samples: Submit samples of each type of finish specified.
1. Architect will furnish Contractor a color schedule of colors selected either from manufacturer's stock colors or specially requested color mixes before Work is begun.
2. Submit two 8 inch by 10 inch samples of each color, including the correct sheen and texture, on heavy cardboard or masonry. Submit sealer and stain finishes on material of the same quality and species of wood on which that particular finish shall be used. Rejected samples shall be resubmitted until approved.
3. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered, until final color approval.

1.4 QUALITY ASSURANCE

A. Standards: Preparation, application, and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
1. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual" and "Standards".
    a. PDCA P1-09, "Touch-Up Painting and Damage Repair – Financial Responsibility and Definition of a Properly Painted Surface."

b. PDCA P2-09, "Third Party Inspections: Qualifications, Responsibilities and Procedures."
c. PDCA P3-09, "Designation of Paint Color."
d. PDCA P4-09, "Responsibility for Inspection and Acceptance of Surfaces Prior to Painting and Decorating."
e. PDCA P5-09, "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems."

2. Gypsum Association – GA210, “Gypsum Board for Walls and Ceilings.”

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging and Shipping: Deliver Materials to site in manufacturer’s sealed containers, legends and label, intact.

B. Storage:
1. Adequately protect against damage while stored at site
2. In no case shall the amount or method of materials stored exceed the amount permitted or the manner allowed by local ordinances, state laws, or fire underwriter regulations.

1.6 PROJECT/SITE CONDITIONS

A. Physical Requirements for Proper Installation or Application: Do not apply exterior paint in damp or rainy weather or until after the surface has dried thoroughly from the effects of such weather.
1. Do not apply varnish or paint when temperature is below 50 degrees F.. Avoid painting surfaces exposed to hot sunlight.
2. During interior application, maintain minimum temperature of 65 degrees F. unless otherwise directed by Architect or manufacturer's printed instructions. Hold temperature as constant as possible.
3. Provide adequate ventilation at all times so the humidity cannot rise above the dew point of the coldest surface to be painted.
4. Moisture-containing surfaces, such as concrete, stucco and cement plaster shall have a moisture content of less than 8 percent as measured by moisture meter. Remove surface salt deposits prior to painting. Verify that pH is neutral, or within acceptable limits of Paint Manufacturer. Paint after thoroughly cured.

1.7 MAINTENANCE

A. Extra Materials: Upon completion of the Work, furnish Owner with one fresh gallon of each type and color of paint and finish used on this Project. Label containers with manufacturer's name, batch, color, shelf life, instructions, and cautions.

1.8 WARRANTY

A. Manufacturer’s Warranty: Furnish 2 year warranty covering materials and labor required to maintain paint finishes in good condition from date of Substantial Completion of the Work.
1. Warranty shall cover repair or replacement of paint finishes (interior and exterior) that fail in materials or workmanship.
2. Warranty shall cover all materials and installation from the substrate up including, but not limited to, removal of defective finishes, surface preparation, primers and finish coats in accordance with original specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following manufacturers, except as otherwise approved by Architect, subject to compliance with specification requirements.
   1. Basis-of-Design: Dunn-Edwards Corporation www.dunnedwards.com
   2. Sherwin Williams www.sherwin-williams.com

2.2 MATERIALS

A. Provide materials in accordance with the Schedule of Paint Products at the end of this CSI Number as applicable to project and as follows:
   1. Block resistant (non-blocking) materials shall be used for doors, door jambs, railings and other locations subject to handling, or where surfaces will come into contact with other painted surfaces or belongings.
   2. Shall not be formulated or manufactured with formaldehyde, halogenated solvents, aromatic hydrocarbons, mercury, or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI, and their oxides.
   3. Shall not be formulated or manufactured with formaldehyde, mercury, or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI, and their oxides.
   4. Materials used shall comply with applicable Federal and local air pollution regulations, lead content laws, and current VOC requirements. If products listed in Schedule of Paint Products located at the end of this CSI Number are not in compliance with regulations, laws, or requirements, Contractor shall notify Architect and shall provide information regarding substitute products.

B. Basic painting materials such as linseed oil, shellac, turpentine, thinners, driers, and other similar products, shall be of highest quality, made by reputable, recognized manufacturers, and have identifying labels on containers. Paint materials shall be factory fresh.

C. Alternate materials submitted for prior approval shall have qualities and materials equal to the other listed manufacturer's scheduled products. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer, unless otherwise specified or scheduled.

D. Standard Gloss Range: Provide paints in accordance with the following ranges in accordance with ASTM D523 and in accordance with Finish Legends on drawings:

Sheen	Geometry	Gloss Range
Flat	85 degree	Below 15 (see also Paint Finishes herein)
Eggshell	60 degree	5-20
Lo Luster	60 degree	15-25
Satin	60 degree	15-35
Semi-Gloss	60 degree	30-650
Gloss	60 degree	Over 65

E. Paints shall be ready mixed except for filed catalyzed coatings.

F. In addition to other requirements specified herein, provide the following when deemed appropriate:

1. Low-biocide Paint: Interior use. Shall not contain formaldehyde. Shall not contain fungicides or bactericides that are classified as mercury acetates, phenol phenates, or phenol formaldehyde.
2. Natural Plant- and Mineral-Based Finishes: Contain extracts from plant sources and minimally processed earth minerals, such as chalk or iron oxides. Solvents include citrus oils and small amounts of low-odor petroleum solvents (dearomatized isoparaffinics).
3. Milk-Based Paint: Contains lime, milk protein, clay, and earth pigments; interior use only; not suitable for damp conditions
4. Clay-and Mineral-Based Pigments:
    a. Native earths: Ochre, raw umber, raw sienna
    b. Calcined earths: Burnt umber, burnt sienna
    c. Iron oxides: Mars black, Mars yellow, Mars violet
5. Biocides: Provide paint with levels below 0.025%

G. Transparent Finishes:
1. Urethane finishes: Water emulsion urethane
2. Penetrating oil-based, waterborne finishes: Shall not contain lead acetate or cobalt manganese (drying agents)
3. Stain: Vegetable oil-based, waterborne stain for exterior use with UV protection
4. Acrylic: Waterborne, urethane; VOC less than 100grams/liter
5. Plant-based oil finish: Low odor, water reducible; interior use
6. Polymerized linseed oil: Interior use
7. Polymerized tung oil: Interior use

H. Paint Strippers – Low-Emitting: Shall not contain methylene chloride. Avoid products containing methanol and trichloroethane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report in writing with a copy to Architect, conditions detrimental to Work. Commencement of Work will be construed as acceptance of subsurfaces.

3.2 PROTECTION

A. Before painting, remove hardware, accessories, electrical plates, lighting fixtures and similar items and protect.
1. Provide “Wet-Paint” signs and other barricades and protections as required to protect adjacent surfaces and work of other trades, whether being painted or not.
2. Mask permanent labels.
3. Provide, distribute, and maintain a sufficient supply of clean drop cloths and other protective coverings.
4. Protect foliage and other exterior finished surfaces from contact with cleaning materials and thoroughly flush with water after contact.
5. On completion of each space, replace above items.

3.3 SURFACE PREPARATION

A. General:
   1. Surfaces requiring painting or finishing shall be thoroughly dry and cured, free of dirt, dust, rust, stains, scale, mildew, wax, grease, oil, deteriorated substrates, bond-breakers, efflorescence and other foreign matter detrimental to the coating's adhesion and performance. Repair voids, cracks, nicks and other surface defects with appropriate patching material. Finish flush with surrounding surfaces and match adjacent finish texture.
   2. Spot prime marred or damaged shop coats on metal surfaces with appropriate metal primer.
   3. Determine moisture content of plaster, stucco, cementitious materials, wood and other moisture-holding materials by use of a reliable electronic moisture meter.
   4. Determine alkalinity of plaster, stucco and other cementitious materials by performing appropriate tests.
   5. Do not paint surfaces where moisture content or alkalinity exceeds that which is allowed by paint manufacturer.

B. Existing Surfaces:
   1. Clean, sand, patch, repair and prepare existing surfaces to be painted so that such existing finished surfaces are indistinguishable from new surfaces.
   2. Surfaces which cannot be prepared or painted as specified shall be immediately brought to the attention of the Architect in writing.
   3. Remove loose peeling and checked paint.
   4. Remove mildew by washing the surface with a commercially available mildew killer/remover.
   5. Remove efflorescence by wire brushing, power brushing or washing. Thoroughly rinse surfaces wire brushed. After removal of efflorescence, wash the surface with a commercially available cleaner acceptable to the manufacturer of the substrate.
   6. Remove existing wallcovering and wash the surface to remove paste residue. Seal surface before making any surface repairs.
   7. Dull and roughen glossy surfaces to obtain proper adhesion by either sanding, washing with a tri-sodium phosphate solution, or treating with a liquid deglossing compound.
   8. Overlap and feather edge spot-primed areas.

C. Wood:
   1. Sandpaper to smooth and even surface and then dust off. After primer or stain coat has been applied, thoroughly fill nail holes and other surface imperfections with putty tinted with primer or stain to match wood color. Sand woodwork between coats to a smooth surface. Cover knots and sap streaks with a thin coat of shellac, or seal with a suitable stain blocking sealer.
   2. Finish door and window edges after final fitting. Finish interior of cabinets in the same manner as the exterior unless otherwise specified. Seal interior of drawers unless otherwise specified.
   3. Backpriming:
      a. Backprime exterior woodwork, which is to receive paint finish, with exterior primer paint.
      b. Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoater paint.
      c. Backprime interior and exterior woodwork, which is to receive stain and/or varnish finish with VOC compliant varnish acceptable to the Architect.
      d. Back-prime wood trim before installation.
   4. Where existing stained surfaces are indicated to be coated with a transparent stain, test apply stain to small area where directed by Architect and obtain Architects approval of color.

D. Steel and Iron:
   1. Remove grease, oil, mill scale, rust and rust scale and touch-up chipped or abraded places on items that have been shop coated. Remove and reprime incompatible or damaged shop

applied primers. Comply with the Steel Structures Painting Council's (SSPC) recommendations for cleaning of uncoated steel and iron surfaces.
2. When area will be exposed to view, sandpaper the entire primed area smooth, feather the edge of surrounding undamaged prime coat and spot prime in a manner to eliminate evidence of repair.
3. Where steel or iron at existing Work have a heavy coating of scale, remove by sand blasting, sanding, descaling, grinding or wire brushing, as necessary, to produce a satisfactory surface for painting.

E. Galvanized Metal and Aluminum:
1. Thoroughly clean by wiping surfaces with a non-hydrocarbon solvent that will not leave an oily residue. Apply surface conditioner or vinyl-wash pretreatment as required for proper adhesion if required by paint manufacturer. Prime galvanized metal with galvanized iron primer as recommended by paint manufacturer. A test sample of the complete painting system should be applied and checked for adhesion before final painting begins.
2. Clean visible portions of throats of galvanized steel ductwork with solvent; wipe dry with clean rags and paint flat black.

F. Concrete:
1. Existing exposed concrete structure shall be patched smooth to the satisfaction of the Architect prior to painting.
2. The method of surface preparation shall be at Contractor's discretion, provided the results are satisfactory to the Architect, and the method is in compliance with applicable codes and requirements.
3. Repair surfaces to be painted prior to application of prime and finish coat(s). Apply a tinted primer to the substrate to help identify surface imperfections. After the primer has thoroughly dried, patch, fill and repair surface imperfections to match and flush-out with adjacent finish texture and profile.
4. Before first paint coat is applied, spot prime nails and other exposed metal occurring in the surfaces with a rust inhibitive primer as recommended by paint manufacturer.

G. Plaster and Gypsum Board Surfaces:
1. Fill cracks, holes or imperfections with compatible patching material and smooth off to match adjoining surfaces. Before painting, surfaces shall be first tested for dryness with a moisture testing device.
2. Apply no paint or sealer on gypsum board or plaster when the moisture content exceeds 8 percent. Test sufficient areas in each space and as often as necessary to determine if the surface has the proper moisture content for painting. If the moisture content is between 8 percent and 12 percent, prime with alkali resistant primer.
3. If 8 percent or less, prime with specified primer. Remove the dry salt deposits from plaster surfaces by brushing with a stiff brush before painting.

H. Acoustical Surfaces (Tetum Acoustical Ceiling Panels):
1. Thoroughly vacuum clean surfaces to remove dust and debris from acoustical surface pores. Use a soft brush attachment that will not damage or loosen acoustical surface.
2. Seal surface with a suitable stain blocking sealer that will not fill pores of acoustical surface.

3.4 WORKMANSHIP

A. Apply products to achieve paint manufacturer's printed specifications for dry mil thickness

B. Apply each coat of paint evenly and comply with manufacturer's drying time before applying subsequent coats.

C. Finished work shall be uniform, match approved color, texture and coverage, and free from runs, sags, clogging or excessive flooding. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping. Where varnishes or enamel is used, lightly sand, dust and clean undercoats to obtain a smooth finish coat. Sand carefully between each coat of finish on smooth surfaces for good adhesion of subsequent coats.

D. Where clear finishes are required, ensure tinted fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.

E. Where specific mil thicknesses are required, check thickness by the following methods:
1. Over ferrous metal - Elcometer Film Gauge.
2. Other surfaces - Tooke Dry Mil Inspection Gauge.

3.5 APPLICATION

A. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color and to produce satisfactory finish results.

B. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.

C. Priming will not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required to ensure an even primed surface before applying finish coat.

D. Block Fillers: Provide level of block fill as scheduled to conform with the following:
1. Level 1 – Regular Fill: Minimum block fill, reduces irregularity in masonry profile. One coat, spray applied.
2. Level 2 – Medium Full Fill: Masonry profile slightly reduced. One coat, spray applied and back-rolled.
3. Level 3 – Full Fill: Minimum block fill required for semi-gloss and gloss finishes. Use where conformance with health regulations is required. Number of coats as required to conceal most of masonry texture, spray applied and back-rolled.

E. Plumbing, Mechanical, and Electrical:
1. Exterior and interior exposed water, gas, waste piping, sprinkler piping, conduit, lighting and electrical panels, telephone terminal boxes, galvanized ducts and insulated ducts, shall be painted in areas other than mechanical rooms, unless otherwise scheduled.
2. Paint exposed unfinished fixtures, metal ducts, switch boxes, control panels, devices, starters, junction boxes, vents, drains, and other similar items, as directed by Architect.

F. Spray paint prime coated (not pre-finished) grilles and registers with enamel or lacquer to match walls and ceilings. Paint materials shall not sag, run or bind movable parts of grilles, registers, louvers, baffles and other similar items.
1. Throats of ducts shall be given one coat of flat black paint, wherever visibility of the interior of the duct is allowed through registers or other similar items. At fiber lined duct, use black latex paint.
2. Examine the Mechanical and Electrical Drawings and Specifications to determine the amount of exposed work to be painted.

G. Paint exposed surfaces of every member; paint items inaccessible after installation before installation, if required to be painted. Edges, tops and bottoms of wood doors shall be sealed

and finished with the same finish as the door faces, to meet door manufacturer's warranty requirements. Verify edge color with Architect as different colors may be selected for each face.

H. Edges, tops, and bottoms of wood doors shall be sealed and finished with the same finish as the door faces, to meet door manufacturer's warranty requirements. Verify edge color with Architect as different colors may be selected for each face.

I. Paint items fitted with finish hardware after hardware has been temporarily removed.

J. Heating and other equipment on or adjacent to walls or surfaces scheduled for painting, shall be disconnected, using workmen skilled in appropriate trades and moved temporarily to permit painting of surface. Following completion of painting, replace and reconnect items.

K. Each succeeding pigmented coat shall be distinguishably lighter than the previous coat. Tint prime and undercoats to a color similar to finish coat. Each coat of material applied must be inspected and approved by the Architect before the application of the succeeding specified coat; otherwise no credit for the concealed coat will be given, and the Contractor shall assume the responsibility to recoat work in question. Contractor shall notify the Architect when each coat is completed.

L. Brush, wipe or roll stain in 2 coat application. Avoid lap marks by maintaining "wet-edge" continually being merged with existing liquid coverage and stop only at natural edges, turns and breaking places.

M. Do not paint over Underwriters' Laboratory labels, fusible links, exposed sprinkler heads and other similar items.

N. Paint piping, electrical or other equipment, conduit, vents and other similar items, on roof or other exterior locations as directed by Architect.

O. Finish closets and the interior of cabinets with same color as adjoining rooms, unless otherwise specified. Finish other surfaces same as nearest or adjoining surfaces, unless otherwise shown or scheduled.

P. Paint surface of walls which will be concealed by cabinets, chalkboards and other items attached to wall.

3.6 ADJUSTING

A. At completion, do touch-up and re-paint work and leave finish surfaces in good condition.

3.7 CLEANING

A. During the course of the Work, remove misplaced paint and stain spots or spills. Leave Work in clean condition acceptable to Architect.

B. Remove oily rags and waste daily, taking precaution to prevent fire.

3.8 SCHEDULES

A. Color Schedule:

1. Architect will provide a complete schedule of colors. Colors may be selected from various manufacturer's color palettes. Manufacturer supplying paint shall match these colors. Contractor shall prepare duplicate set of samples of treatments for major surfaces. If a specific surface or item receiving a paint finish does not have a specific color indicated or selected by the Architect, obtain clarification from the Architect. Do not assume the confirmation of the same color on the adjacent surfaces.
2. Final coat of paint shall not be applied until colors have been approved by the Architect.

B. Schedule of Finishes: Refer to the “Finish Legend” on the Drawing for designated finishes of areas.

C. Finishing of the following listed items and materials will not be required and shall be protected:
1. Stainless Steel, brass, bronze, copper, monel, chromium, anodized aluminum; specially finished articles such as porcelain enamel, plastic coated fabrics, and baked enamel, unless otherwise indicated.
2. Finished products such as ceramic tile, glass, brick, resilient flooring and acoustical tiles, board and metal tees.
3. Pre-finished products such as wood folding partitions and doors, wood classroom and laboratory casework, bleachers and elevator cabs.

D. See CSI Number 09 96 00 for High Performance Coatings.

3.9 EXTERIOR PAINT FINISHES

A. This schedule uses the generic names listed in the Schedule pf Paint Products. See CSI Number 09 96 00 for High Performance Coatings.

B. System 101 (Ferrous Metals): Apply to exposed steel such as beams and column connectors, metal doors and frames, grilles, light fixture standards in parking areas, metal handrails, sectional and coiling doors, canopy overhangs and other exposed miscellaneous ferrous metals that are not pre-finished.
1. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
2. 2nd Coat: Same material as 3rd coat in accordance with manufacturer's recommendations.
3. 3rd Coat: Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).

C. System 102 (Galvanized Metals): Apply to exposed galvanized metal such as copings, and metal flashings.
1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer).
2. 1st Coat: Galvanized Metal Primer.
3. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
4. 3rd Coat: Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic – Non- Blocking).
    a. Gloss (if noted on Drawings): Enamel, Gloss – Waterborne (100% Acrylic – Non-Blocking).

D. System 103 (Aluminum): Apply to exterior louvers and other miscellaneous exposed exterior unfinished aluminum surfaces.
1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
2. 1st Coat: Aluminum Primer.
3. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.

4. 3rd Coat: Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss – Waterborne (100% Acrylic – Non-Blocking).

E. System 104 (Concrete Masonry Units): Apply to exterior concrete masonry unit construction indicated to be painted. (Refer to CSI Number 07 19 00 “Water Repellents and Masonry Stains” for use on concrete masonry units indicated to be stained.) Roller apply 2nd or 3rd coat.
1. 1st Coat: Concrete Masonry Block Filler. Provide Level 2 or 3 Fill as required by gloss.
2. 2nd Coat: Concrete and Masonry Primer.
3. 3rd Coat: Semi-Glos unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).

F. System 105 (Concrete and Stucco): Apply to exterior cementitious surfaces as indicated or noted. Precast concrete lintels, beams, caps, sills, etc. at exterior of buildings shall not be painted, unless specifically noted. Roller apply 2nd or 3rd coat.
1. 1st Coat: Concrete and Masonry Primer.
2. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
3. 3rd Coat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise.
4. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.

G. System 106 (Exterior Wood): Apply to wood facias, soffits, trim, wood posts, columns, beams and exposed trim and framing where indicated to be painted.
1. 1st coat: Exterior Wood Primer – Waterborne (100% Acrylic) unless noted otherwise.
2. 2nd and 3rd coats: Paint, Flat – Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to ^% per a 60 degree gloss meter.

H. System 107 (Exterior Gypsum Board): Apply to exterior grade gypsum board soffits.
1. 1st Coat: Exterior Gypsum Board Primer/Undercoater – Waterborne unless noted otherwise.
2. 2nd and 3rd Coats: Flat Paint - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.

3.10 INTERIOR PAINT FINISHES

A. This schedule uses the generic names listed in the Schedule of Paint Products.

B. System 201 (Ferrous Metals): Apply to exposed metals such as steel doors, hollow metal frames, metal beam saddles, columns, grilles and registers, stair and hand railings, ladders, and other exposed miscellaneous metals.
1. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
2. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
3. 3rd Coat: Enamel, Eggshell.

C. System 202 (Interior Wood Finishes - Enamel): Apply to wood wall base, wood wall cap, wood door frames, columns, exposed and concealed casework and millwork, wood- window wall construction, medium density plywood surfaces, shelving, roll-up wood doors, perforated and plain type hardboard, particleboard and other exposed miscellaneous wood and trim, except wood specified for a transparent or stain finish.
1. 1st Coat: Enamel Undercoater.
2. 2nd and 3rd Coat: Enamel, Semi-Gloss

D. System 203 (Interior Wood Finish - Flat): Apply to plywood telephone backing boards and other miscellaneous softwood as noted, specified or scheduled.
1. 1st Coat: Enamel Undercoater/Primer.
2. 2nd and 3rd Coat: Flat Paint, - Waterborne (Vinyl Acrylic)

E. System 204 (Galvanized Metals): Apply to exposed galvanized metal.
   1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer)
   2. 1st Coat: Galvanized Metal Primer
   3. 2nd and 3rd Coats: Enamel, Eggshell

F. System 205 (Aluminum): Apply to interior louvers and other miscellaneous exposed unfinished aluminum surfaces.
   1. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
   2. 1st Coat: Aluminum Primer
   3. 2nd and 3rd Coats: Eggshell: Enamel, Eggshell

G. System 206 (Gypsum Board, Plaster and Concrete - Wet Areas): Apply to gypsum board, plaster and concrete surfaces in toilet rooms, janitor rooms, kitchens, and other areas as scheduled.
   1. 1st Coat: Enamel Undercoater - Solventborne, unless noted otherwise.
   2. 2nd and 3rd Coats: Enamel, Semi-Gloss - Solventborne or Enamel - Solventborne (Epoxy-Polyester).

H. System 207 (Gypsum Board, Plaster and Concrete - Non-Wet Areas): Apply to gypsum board, plaster and concrete except for wet areas.
   1. 1st Coat: Waterborne Primer/Sealer. (Solventborne {Alkyd} shall be used at new untextured smooth gypsum board surfaces covered with powdery or unstable soft top joint cement)
   2. 2nd and 3rd Coat: Enamel, Eggshell

I. System 208 (Ferrous Metal - Chemical Resistant Finish): Not applicable.

J. System 209 (Interior Concrete Masonry - Wet Areas): Apply to concrete masonry block units in kitchen, toilet rooms, bathrooms, janitor rooms, vestibules and other walls noted for enamel finish. See System 401 for Central Plant.
   1. 1st Coat: Block Filler, w/o Aggregate. Provide Level 3 Full Fill.
   2. 2nd Coat: Primer/Sealer or same material as 3rd Coat as recommended by manufacturer.
   3. 3rd and 4th Coats: Enamel, Semi-Gloss - Solventborne or Enamel - Solventborne (Epoxy-Polyester).

K. System 210 (Interior Concrete Masonry or Plaster - Extremely Wet Areas): Apply to surfaces such as showers.
   1. 1st Coat: Block Filler, w/o Aggregate - Solventborne (Polyamide-Epoxy) Provide Level 3 Full Fill.
   2. 2nd and 3rd Coats: Enamel, Gloss - Solventborne (Polyamide-Epoxy).

L. System 211 (Interior Concrete Masonry - Non-Wet Areas): Apply to exposed interior concrete masonry block units except areas specified above for enamel finish. See System 401 for Central Plant.
   1. 1st Coat: Block Filler, w/o Aggregate. Provide Level 1, 2 or 3 Fill as required by gloss.
   2. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
   3. 3rd Coat: Enamel, Semi-Gloss - Waterborne.

M. System 212 (Acoustic Ceilings): Apply to acoustic panel or tile ceilings.
   1. 1st and 2nd Coat: Acoustic Paint.

3.11 CLEAR WOOD FINISHES

A. This schedule uses the generic names listed in the Schedule of Paint Products.

B. System 301 (Stained and Clear Finish): Apply to wood doors, handrails and chair rails. Fill open grain hardwood such as Oak.
   1. Stained and Finished with Clear Satin or Gloss Varnish - Solventborne:
      a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
      b. 2nd Coat: Varnish, Gloss – Polyurethane (Solventborne)
      c. 3rd Coat:
         1) Satin: Varnish, Satin – Polyurethane (Solventborne)
         2) Gloss: Varnish, Gloss – Polyurethane (Solventborne)
   2. Stained and Finished with Clear Satin or Gloss Varnish– Waterborne:
      a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
      b. 2nd Coat: Varnish, Gloss – Polyurethane (Waterborne)
      c. 3rd Coat:
         1) Satin: Varnish, Satin – Polyurethane (Waterborne)
         2) Gloss: Varnish, Gloss – Polyurethane (Waterborne)

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions of Division 01 Specification CSI Numbers, apply to this CSI Number.

1.02 SUMMARY

A. CSI Number includes surface preparation and the application of paint systems on the following substrates:

1. Exterior Substrates:

a. Concrete, vertical, and horizontal surfaces.
b. Fiber-Cement board.
c. Clay Masonry.
d. Concrete masonry units (CMU's).
e. Steel.
f. Galvanized metal.
g. Aluminum (not anodized or otherwise coated).
h. Copper.
i. Stainless steel.
j. Wood.
k. Fiberglass.
l. Portland cement plaster (stucco).

2. Interior Substrates:

a. Concrete, vertical, and horizontal surfaces.
b. Cement board.
c. Clay masonry
d. Concrete Masonry Units (CMU's).
e. Steel.
f. Galvanized metal.
g. Aluminum (not anodized or otherwise coated).
h. Wood.
i. Fiberglass
j. Gypsum Board.
k. Plaster

1.03 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.04 SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
   1. Submit samples on rigid backing, min. 8 inches square.
   2. Apply coats on samples in steps to show each coat required for system.
   3. Label each coat of each sample.
   4. Label each sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.05 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with a protective covering for storage and identified with labels describing contents.
   1. Coatings: 5 percent, but not less than 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect to select one surface to represent surfaces and conditions for application of each paint system.
      a. Wall and Ceiling Surfaces: Provide sample of at least 100 sq. ft.
      b. Other items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additions colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Sherwin Williams. 101 Prospect Ave. NW. Cleveland, OH 44115. www.sherwin-williams.com

B. Other: As approved by Architect.

C. Products: Subject to compliance with requirements, provide the products listed in the Exterior High-Performance Coating Schedule or the High-Performance Interior Coating Schedule for the coating category indicated.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:
   1. Materials for use within each coating system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
   3. Products shall be on same manufacturer for each coat in a coating system.

C. Colors: As selected by Architect from manufacturer's full range.

2.03 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If

coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMU's): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substance that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of [1500 to 4000 psi], [4000 to 10,000psi] at 6 to 12 inches.
   2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of [100 to 600 psi], [1500 to 4000 psi] at 6 to 12 inches.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC – S7/NACE No.4.
   2. SSPC – SP 11.
   3. SSPC – SP 6/NACE No.3.
   4. SSPC – SP 10/NACE No. 2.
   5. SSPC – SP 5/NACE No.1.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots. Before applying primer, apply coat of knot sealer that is recommended in writing by topcoat manufacturer for coating system indicated.
   2. Sand surfaces that will be exposed to view and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test for film thickness.
1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. Construction Waste: In accordance with CSI Number 01 74 19.

3.06 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. **Concrete Substrates, Vertical Surfaces:**
1. Epoxy System.
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
   c. Topcoat: Epoxy, gloss.

2. Epoxy-Modified Latex System
    a. Prime Coat: Epoxy-modified latex, matching topcoat.
    b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
    c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.
3. Pigmented Polyurethane over Epoxy System
    a. Prime Coat: Matching intermediate coat.
    b. Intermediate Coat: Epoxy, gloss.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

B. **Concrete Substrates, Horizontal Surfaces:**
1. Epoxy Non-slip Deck Coating System
    a. Prime Coat: As recommended in writing by topcoat manufacturer.
    b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    c. Topcoat: Epoxy deck coating (slip resistant).

C. **Cement Board Substrates:**
1. Epoxy System
    a. Prime Coat: Epoxy, matching topcoat.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Epoxy-Modified Latex System
    a. Prime Coat: Epoxy-modified latex, matching topcoat.
    b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
    c. Topcoat: Epoxy-modified latex, semi-gloss.
3. Pigmented Polyurethane over Epoxy System.
    a. Prime Coat: Epoxy, gloss.
    b. Intermediate Coat: Epoxy, matching prime coat.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

D. **Clay Masonry Substrates:**
1. Epoxy System
    a. Prime Coat: Epoxy, matching topcoat.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane over Epoxy System
    a. Prime Coat: Epoxy, matching intermediate coat.
    b. Intermediate Coat: Epoxy, gloss
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

E. **CMU Substrates:**
1. Epoxy System
    a. Block Filler: Block filler, epoxy.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane over High-Build Epoxy System
    a. Block Filler: Block filler, epoxy.
    b. Intermediate Coat: Epoxy, high build, low gloss.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

F. **Steel Substrates:**
1. Epoxy System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.

b. Intermediate Coat: Epoxy, high build, low gloss
c. Topcoat: Epoxy, gloss.

2. Epoxy over Self-Priming Epoxy System
   a. Prime Coat: Epoxy, high build, self-priming.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
3. Epoxy Deck Coating over Epoxy Primer and High-Build Epoxy System.
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   b. Intermediate Coat: Epoxy, high build, low gloss.
   c. Topcoat: Epoxy deck coating.
4. Epoxy Deck Coating over Self-Priming Epoxy System
   a. Prime Coat: Epoxy, high build, self-priming.
   b. Topcoat: Epoxy deck coating.
5. Pigmented Polyurethane over Epoxy System
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   b. Intermediate Coat: Epoxy, gloss.
   c. [First and Second] Topcoat: Polyurethane, two component, pigmented gloss.
6. Pigmented Polyurethane over High-Build Epoxy System.
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   b. Intermediate Coat: Epoxy, high build, low gloss.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.
7. Pigmented Polyurethane over Self-Priming Epoxy System
   a. Prime Coat: Epoxy, high build, self-priming.
   b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.
8. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System
   a. Prime Coat: Primer, zinc rich, epoxy.
   b. Intermediate Coat: Epoxy, gloss.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.
9. Pigmented Polyurethane over Epoxy Zinc-Rich Primer and High-Build Epoxy System.
   a. Prime Coat: Primer, zinc rich, epoxy.
   b. Intermediate Coat: Epoxy, high build, low gloss.
   c. [First and Second] Topcoat: Polyurethane, two component, pigmented, gloss.
10. Pigmented Polyurethane over Inorganic Zinc-Rich Primer and High-Build Epoxy System.
    a. Prime Coat: Primer, zinc rich, inorganic.
    b. Intermediate Coat: Epoxy, high build, low gloss.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

G. **Galvanized-Metal Substrates:**

1. Epoxy System
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane over Epoxy Primer System
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   b. Intermediate Coat: Polyurethane, two component, pigmented, gloss matching topcoat.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.
3. Pigmented Polyurethane over Vinyl Wash Primer and Epoxy Primer System
   a. Prime Coat: Primer, vinyl wash.
   b. Intermediate Coat: Primer, anti-corrosive, for metal.
   c. [First and Second] Topcoat: Polyurethane, two component, pigmented, gloss.

H. **Aluminum (Not Anodized or Otherwise Coated) Surfaces:**
1. Epoxy System
    a. Prime Coat: Primer, vinyl wash.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane over Epoxy System
    a. Prime Coat: Primer, vinyl wash.
    b. Intermediate Coat: Primer, anti-corrosive, for metal.
    c. [First and Second] Topcoat: Polyurethane, two component, pigmented gloss.

I. **Copper Substrates:**
1. Epoxy System
    a. Prime Coat: Primer, vinyl wash.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.

2. Pigmented Polyurethane over Epoxy System
    a. Prime Coat: Primer, vinyl wash.
    b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal.
    c. [First and Second] Topcoat: Polyurethane, two component, pigmented, gloss.

J. **Stainless Steel Substrates**
1. Epoxy System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane System
    a. Prime Coat: Primer, vinyl wash
    b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal.
    c. [First and Second] Topcoat: Polyurethane, two component, pigmented gloss.

K. **Wood Substrates: Glued-laminated construction.**
1. Pigmented Polyurethane System
    a. Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
    b. Intermediate Coat: Polyurethane, two component, pigmented, gloss matching topcoat.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

L. **Wood Substrates: Exposed Framing**
1. Pigmented Polyurethane System
    a. Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
    b. Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

M. **Wood Substrates: Wood trim, Architectural Woodwork, Doors, Windows, and Wood Board Siding and wood fences.**
1. Pigmented Polyurethane System
    a. Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
    b. Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.

c. Topcoat: Polyurethane, two component, pigmented, gloss.

N. **Fiberglass Substrates:**
1. Latex Floor Paint over Latex Primer System.
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Epoxy-Modified Latex System
   a. Prime Coat: Epoxy-modified latex, matching topcoat.
   b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
   c. Topcoat: Epoxy-modified latex, semi-gloss.
3. Pigmented Polyurethane over Epoxy System
   a. Prime Coat: Epoxy, matching intermediate coat.
   b. Intermediate Coat: Epoxy, gloss.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.

O. **Portland Cement Plaster Substrates**
1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss

3.07 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. **Concrete Substrates, Vertical Surfaces:**

1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Epoxy High-Build System
   a. Prime Coat: High-build epoxy, matching topcoat.
   b. Intermediate Coat: High-build epoxy, matching topcoat.
   c. Topcoat: High-build epoxy, low gloss, or gloss.
3. Epoxy-Modified Latex System
   a. Prime Coat: Epoxy-modified latex, matching topcoat.
   b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
   c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.

B. **Concrete Substrates, Horizontal Surfaces**
1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Epoxy, High-Build System
   a. Prime Coat: High-build epoxy, matching topcoat.
   b. Intermediate Coat: High-build epoxy, matching topcoat.
   c. Topcoat: High-build epoxy, low gloss, or gloss.
3. Pigmented Polyurethane System
   a. Prime Coat: Epoxy, gloss
   b. Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.

c. Topcoat: Polyurethane, two component, pigmented, gloss.

4. Clear (Two-Component) Polyurethane System
    a. Prime Coat: Two-component polyurethane matching topcoat.
    b. Intermediate Coat: Two-component polyurethane, matching topcoat.
    c. Topcoat: Varnish, aliphatic polyurethane, two component, gloss.

C. **Cement Board Substrates**

1. Epoxy System
    a. Prime Coat: Epoxy, matching topcoat.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss
2. Epoxy-Modified Latex System
    a. Prime Coat: Epoxy-modified latex, matching topcoat.
    b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
    c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.

D. **Clay Masonry Substrates:**

1. Epoxy System
    a. Prime Coat: Epoxy, matching topcoat.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Epoxy-Modified Latex System
    a. Prime Coat: Epoxy-modified latex, matching topcoat.
    b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
    c. Topcoat: Epoxy-modified latex, gloss.
3. Clear (Two-Component) Polyurethane System
    a. Prime Coat: Two-component polyurethane, matching topcoat.
    b. Intermediate Coat: Two-component polyurethane, matching topcoat
    c. Topcoat: Varnish, aliphatic polyurethane, two component.

E. **CMU Substrates:**

1. Epoxy System
    a. Block Filler: Block filler, latex, interior/exterior.
    b. Block Filler: Epoxy,
    c. Intermediate Coat: Epoxy, matching topcoat.
    d. Topcoat: Epoxy, gloss.
2. Epoxy, High-Build System
    a. Prime Coat: Epoxy block filler
    b. Intermediate Coat: High-build epoxy, matching topcoat.
    c. Topcoat: High-build epoxy, low gloss, or gloss.
3. Epoxy-Modified Latex System
    a. Block Filler: Block filler, latex, interior/exterior.
    b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
    c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.
4. Clear (Two Component) Polyurethane System
    a. Prime Coat: Two-component polyurethane, matching topcoat.
    b. Intermediate Coat: Two-component polyurethane, matching topcoat.
    c. Topcoat: Varnish, aliphatic polyurethane, two component, gloss.

F. **Steel Substrates:**

1. Epoxy System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.

2. High-Build Epoxy over Epoxy Zinc-Rich Primer System
    a. Prime Coat: Primer, zinc-rich, epoxy.
    b. Intermediate Coat: Epoxy, high build, low gloss.
    c. Topcoat: Epoxy, low gloss, or gloss.
3. Epoxy over Self-Priming Epoxy System
    a. Prime Coat: Epoxy, high build, self-priming
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss
4. Epoxy, High-Build System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    b. Intermediate Coat: High-build epoxy, matching topcoat.
    c. Topcoat: High-build epoxy, low gloss, or gloss.
5. Epoxy Deck Coating System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    b. Intermediate Coat: Epoxy, gloss
    c. Topcoat: Epoxy deck coating (slip resistant).
6. Epoxy-Modified Latex System
    a. Prime Coat: Primer, rust inhibitive, water based.
    b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
    c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.
7. Pigmented Polyurethane over Epoxy Primer System
    a. Prime Coat: Polyurethane, two component, pigmented, matching topcoat.
    b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
    c. Topcoat: Polyurethane, two component, pigmented, gloss
8. Pigmented Polyurethane over High-Build Epoxy System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    b. Intermediate Coat: Epoxy, high build.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.
9. Pigmented Polyurethane over Self-Priming Epoxy System
    a. Prime Coat: Epoxy, high build, self-priming
    b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
    c. Topcoat: Polyurethane, two component, pigmented, gloss
10. Pigmented Polyurethane over Inorganic Zinc and Epoxy System
    a. Prime Coat: Primer, zinc rich, inorganic.
    b. Intermediate Coat: Epoxy, gloss.
    c. Topcoat: Polyurethane, two component, pigmented, gloss
11. Pigmented Polyurethane over Epoxy Zinc-Rich and Epoxy System.
    a. Prime Coat: Primer, zinc rich, epoxy.
    b. Intermediate Coat: Epoxy, gloss.
    c. Topcoat: Polyurethane, two component, pigmented, gloss.

G. **Galvanized-Metal Substrates:**
1. Epoxy over Epoxy Primer System
    a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    b. Intermediate Coat: Epoxy, matching topcoat.
    c. Topcoat: Epoxy, gloss.
2. Epoxy over Vinyl Wash Primer and Epoxy Primer System
    a. Prime Coat: Primer, vinyl wash.
    b. Intermediate Coat: Primer, epoxy, anti-corrosive, form metal
    c. Topcoat: Epoxy, gloss.

H. **Aluminum (Not Anodized or Otherwise Coated) Substrates:**
1. Epoxy System

a. Prime Coat: Primer, vinyl, wash.
b. Intermediate Coat: Epoxy, matching topcoat
c. Topcoat: Epoxy, gloss.

2. Pigmented Polyurethane System
   a. Prime Coat: Primer, vinyl wash.
   b. Intermediate Coat: Epoxy, gloss
   c. Topcoat: Polyurethane, two-component, pigmented, gloss.

I. **Copper Substrates:**
1. Epoxy System
   a. Prime Coat: Primer, vinyl wash.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss
2. Pigmented Polyurethane System
   a. Prime Coat: Primer, vinyl wash
   b. Intermediate Coat: Epoxy, gloss
   c. Topcoat: Polyurethane, two component, pigmented, gloss.

J. Stainless-Steel Substrates:
1. Epoxy System
   a. Prime Coat: Primer, vinyl wash.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Pigmented Polyurethane System
   a. Prime Coat: Primer, vinyl wash,
   b. Intermediate Coat: Epoxy, gloss.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.

K. Wood Substrates: Glued-laminated construction.
1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss
2. Pigmented Polyurethane System
   a. Prime Coat: Polyurethane, two component, pigmented, matching topcoat.
   b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, two component, pigmented, gloss.

L. **Wood Substrates: Wood trim, Architectural woodwork, Doors, Windows, and wood board paneling.**
1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss

M. **Fiberglass Substrates:**
1. Epoxy System
   a. Prime Coat: Epoxy, matching topcoat.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss
2. Pigmented Polyurethane System

a. Prime Coat: Epoxy, gloss.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Polyurethane, two component, pigmented, gloss

3. Epoxy-Modified Latex System
   a. Block Filler: Block filler, latex, interior/exterior.
   b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
   c. Topcoat: Epoxy-modified latex, semi-gloss, or gloss.

N. **Gypsum Board and Plaster Substrates:**

1. Epoxy System
   a. Prime Coat: Primer, sealer, latex, interior.
   b. Intermediate Coat: Epoxy, matching topcoat.
   c. Topcoat: Epoxy, gloss.
2. Epoxy, High-Build System
   a. Prime Coat: Primer, sealer, latex, interior.
   b. Intermediate Coat: High-build epoxy, matching topcoat.
   c. Topcoat: High-build epoxy, gloss
3. Epoxy-Modified Latex System
   a. Prime Coat: Primer sealer, latex, interior.
   b. Intermediate Coat: Epoxy modified latex, matching topcoat.
   c. Topcoat: Epoxy-modified latex, gloss.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Exterior metal building characters.
B. Safety and code required signage.
C. Interior room identification signage.
D. Building Dedication Plaque.

1.02 RELATED CSI NUMBERS

A. CSI Number 06 10 53 – Miscellaneous Carpentry.
B. CSI Division 26 – Electrical.

1.03 REFERENCES

A. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
B. ASTM A653 / A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
C. ASTM A666 / A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
D. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
E. ICC ANSI A117.1 – Standard for Accessible and Usable Buildings and Facilities.
F. Public Law 101-36 – The Americans with Disabilities Act of 1990.
G. The Arizonans with Disabilities Act (Arizona Administrative Code 10-3-404).

1.04 SUBMITTALS

A. Product Data: Submit Manufacturer's literature indicating all materials and finishes.
B. Shop Drawings: Show sizes of all materials, method of construction, copy layout, and details for proper mounting.
C. Samples: Submit (1) representative metal number/letter and (1) room identification sign to confirm quality of craftsmanship, fonts, colors and finishes.
D. Furnish mounting templates to Installer for each type of signage.

1.05 QUALITY ASSURANCE

A. Comply with applicable Federal, State, and Local codes, including:
   1. ADAAG.
   2. ICC ANSI A117.1.
   3. Public Law 101-36.
   4. The Arizonans with Disabilities Act.
B. Provide all signage as required by applicable codes and the Authority Having Jurisdiction (AHJ).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
B. Storage and Protection: Store items in dry, protected areas. Adequately protect against damage while stored at the site. Keep free of corrosion or other damage.

1.07 FIELD CONDITIONS

A. Verify dimensions shown on Drawings by taking field measurements prior to fabrication and installation.

1.08 WARRANTY

A. Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents, provide products from one of the following manufacturers:
   1. Airpark Signs & Graphics, www.airparksigns.com.
   2. F & N Enterprises, Inc. DBA Smithcraft, www.smithcraftsigns.com.
   3. Image Craft LLC, www.imcraft.com.
   4. Ripps Enterprises Inc. DBA Epic Signs, https://epicsigns.com.
   5. Sierra Signs LLC, https://sierrasignsaz.com.
   6. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS – GENERAL

A. Materials shall be new stock, free from defects or imperfections in regard to strength, durability, and appearance. Provide materials as shown and detailed on drawings and as specified herein.
B. Metals – General:
   1. For fabrication of exposed metal work, use only materials which are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks, and trade names.
   2. Do not use materials which have stains and discolorations.
   3. For exposed items of work which include plain flat surfaces in width of more than 50 times the metal thickness, provide sheet stock from mill which has been stretcher leveled to highest standard of flatness commercially available.
   4. Aluminum Sheet: Provide aluminum sheet of allow and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B209 for 5005-H-15.
   5. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.
   6. Stainless Steel Sheet: ASTM A666, Type 304 or Type 316L, fully annealed stainless steel sheet.
   7. Cast Bronze: Copper Development Assoc. Alloy C92200; 88% copper, 6 percent tin, 4 percent zinc, 2 percent lead. Natural satin stroke sanded face, bead-blasted return, 2-part hardened acrylic polyurethane clear coat, NAVY G 88-8-0-4 lead and mercury free tin bronze alloy.
C. Vinyl Film: Opaque reflectorized vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior as well as interior applications.
D. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
E. Tape: VHB (very high bond) double-stick foam tape as manufactured by 3M.

F. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.03 MATERIALS – EXTERIOR METAL BUILDING CHARACTERS

A. Solid aluminum characters:
   1. Thickness: 1/4".
   2. Height: As shown on Drawings. 12” minimum.
   3. Finish: Clear anodized aluminum.
   4. Characters: Font as shown on Drawings or selected by Architect to comply with code requirements.
   5. Mounting: Threaded blind stud mounted to wall with projection spacers and drilled holes. Threaded studs fastened to building using silicone adhesive.

2.04 MATERIALS – INTERIOR ROOM IDENTIFICATION SIGNAGE

A. Base: 1/8” thick photopolymer panel painted in color as shown on Drawings or as selected by Architect. Rated non-static, fire retardant, and self-extinguishing.
   1. Finish: Matte.
   2. Characters: 1/32” raised tactile lettering painted in contrasting color as shown on Drawings or as selected by Architect to comply with code requirements.
      a. Characters shall contrast with background by at least 20 percent.
   3. Mounting: Screw or adhesive attach to wall, door, or door frame as approved by Architect. Minimum 2 screws per sign. Height as shown in Drawings.

2.05 MATERIALS – BUILDING DEDICATION PLAQUE

A. Solid cast aluminum plaque:
   1. Thickness: 3/4”.
   2. Dimensions: As Shown on Drawings.
   3. Background texture as selected by Architect.
   4. Standard background color: Black.
   5. Raised letter finish: brushed satin, natural patina, or polished as selected by Architect.
   6. Photo option – etched photo.
   7. Screw mounting for wall.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Verify solid backing materials have been provided for installation. Commencement of Work shall be construed as acceptance of subsurfaces.
B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 PREPARATION

A. Prepare/clean subsurfaces as recommended by manufacturer prior to installation.

3.03 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions, the Drawings, and approved Shop Drawings.
B. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.
C. Install signage plumb and level in accordance with Manufacturer's instructions.
D. Do not field cut any signage.
E. Install engraved signs after surfaces are finished, in locations indicated.
F. Securely fasten wall-mounted items to solid backing.
G. All exterior wall penetrations shown on Drawings or otherwise required for signage installation shall be located by using full-size installation templates furnished by the signage manufacturer/fabricator.
H. Seal, patch and paint all penetrations.
I. Self-Adhesive Vinyl Letters: Clean glass as recommended by manufacturer and apply letters level and at proper spacing at locations indicated.
J. Glass Mounted Panel Signs: Attach panel signs on glass with Silicone-Adhesive Mounting. Provide a back panel on interior side of glass with matching dimensions and color.
K. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
    1. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
    2. Double-Stick Tape Mounting: Clean surfaces to be joined and apply double stick tape to back of wall mounted signage in continuous strips at approximate 2-inch center to center spacing between strips. Apply sign to wall surface taking care to properly align and plumb signage before removing release paper.

3.04 CLEANING AND PROTECTION

A. Clean and polish all exposed surfaces of signage.
B. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 26 41

BALLISTIC-RESISTANT PANELS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Ballistic-resistant fiberglass panels – See Drawings for locations.

1.02 RELATED CSI NUMBERS

A. CSI Number 08 56 53 – Ballistic-Resistant Window Frames.
B. CSI Number 09 22 16 – Non-Structural Metal Framing.
C. CSI Number 09 29 00 – Gypsum Board.

1.03 REFERENCES

A. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
B. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
C. ASTM E413 – Classification for Rating Sound Insulation.
D. ASTM E1332 – Standard Classification for Rating Outdoor-Indoor Sound Attenuation.
E. ASTM E3112/E3112M – Standard Test Method for Ballistic-resistant Products and Shoot Packs.
F. ASTM F1233 – Standard Test Method for Security Glazing Materials and Systems.
G. Underwriters Laboratories (UL) 752 – Standard for Bullet Resisting Equipment.

1.04 DESIGN REQUIREMENTS

A. Through the design, manufacturing technique, and material application, the ballistic-resistant fiberglass panels shall be of the “non-ricochet type.” This design is intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

B. Performance Level: Level 4 per UL 752.

C. Ammunition Tested: 0.30 caliber rifle lead core – 180 grain, 11.7 grams, minimum 2,450 feet per second.

1.05 SUBMITTALS

A. Product Data & Test Reports: For each product indicated, submit manufacturer’s product data sheets, specifications, and installation instructions, along with any other printed data in sufficient detail to indicate compliance with the Contract Documents. Include the following:
   1. UL 752 listing verification.
   2. UL 752 current test results provided by Underwriters Laboratories (UL).
   3. Fire rating per ASTM E119.
B. Sample of warranty.
C. Physical Samples: (2) 12-inch square samples of each type of product used.
D. Installer qualification statement, including similar project references if requested by Architect.

E. Closeout documents.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A manufacturer of ballistics-resistant fiberglass panels with a minimum of (5) years of fabrication experience.
B. Installer Qualifications: An experienced installer who has successfully completed similar ballistics-resistant installations to the material, design, and extent indicated for this Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage and comply with manufacturer's written handling instructions.
B. Store materials inside and under cover, stack flat and off floor. Adequately protect against damage while stored at the site. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations provided by manufacturer. Do not install products stored in conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. Workmanship Warranty: All materials shall be warranted against defects for a period of two (2) years from the date of Substantial Completion. Provide certificates of manufacturer's standard limited warranty with Closeout Documents.
B. Finish Warranty: Provide manufacturer's warranty against deterioration of factory finishes for the period of two (2) years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. **Basis of Design Manufacturer: Waco Composites, www.ArmorCore.com.**
   2. North American Bullet Proof, www.nabulletproof.com.
   3. Total Security Solutions, www.tssbulletproof.com.
   4. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS

A. Ballistic-Resistant Fiberglass Panels – UL 752 Level 4.
   1. **Basis of Design Product: ArmorCore Bullet Resistant Fiberglass Panels, www.ArmorCore.com.**
   2. Panels shall be made of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. The production technique and materials used provide the controlled internal delamination to permit the capture of a penetrating projectile.
   3. Nominal Thickness: 1-3/8".
   4. Nominal Weight: 14 lbs. per square foot.
   5. Panel Sizes: As indicated on the Drawings or as necessary for installation of a complete assembly.

2.03 FABRICATION

A. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation, verify that areas have been prepared as required by the Contract Documents and that supports have been installed as required. Examine subsurfaces to receive Work of this CSI Number and notify Architect in writing of any unsatisfactory conditions. Commencement of Work will be construed as acceptance of subsurfaces.

3.02 PREPARATION

A. Clean and prepare all surfaces per manufacturer’s recommendations as required for achieving the best results for the substrate under the project conditions.

3.03 INSTALLATION

A. Do not begin installation until areas have been verified and surfaces properly prepared in accordance with the Contract Documents.
B. Install in accordance with manufacturer’s instructions and UL 752. Set all equipment plumb. Cut material with a diamond-grit blade, or as recommended by the manufacturer.
C. Panels shall be attached using self-tapping drywall screws or bolts, or construction adhesive when a screw/bolt attachment is not possible. Pre-drilling may be required. Method of attachment shall maintain the bullet resistive rating at junctures with the floor slab, roof structure above, ballistics-resistant door and window frames, and all required penetrations.
D. Joints shall be reinforced by a back-up layer (batten strip) of ballistics-resistant material. The ballistics resistance of the joint, as reinforced, shall be at least equal to that of the panel. Minimum width of reinforcing layer at joint shall be 4-inches, 2-inches on each panel with a 2-inch minimum overlap.
E. If construction adhesive is used, remove excess adhesive and leave exposed surfaces clean and smooth.
F. Apply sealant in accordance with manufacturer's recommendations as indicated in installation instructions. Remove excess sealant and leave exposed surfaces clean and smooth.

3.04 CLEANING AND PROTECTION

A. Clean and protect material from damage during ongoing construction operations. If damage occurs, remove and replace as required to provide materials in undamaged condition.
B. Inspection: Verify installation is complete and complies with manufacturer’s requirements.
C. Provide final cleaning of product and accessories, removing excess sealant, labels and protective covers.
D. Touch-up, repair, or replace damaged products prior to Substantial Completion.
E. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal fashion. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 28 00

TOILET & CUSTODIAL ACCESSORIES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Toilet Accessories.
B. Custodial Accessories.
C. Miscellaneous Accessories.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 30 00 – Cast-in-Place Concrete.
B. CSI Number 06 10 53 – Miscellaneous Rough Carpentry.
C. CSI Number 08 80 00 – Glazing.
D. CSI Number 09 22 16 – Non-Structural Metal Framing.
E. CSI Number 09 29 00 – Gypsum Board.
F. CSI Number 09 91 00 – Painting.
G. See Electrical Drawings for power to electrically-operated accessories.

1.03 REFERENCES

A. ADA Accessibility Guidelines (ADAAG).
B. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
C. Public Law 101-336 – The Americans with Disabilities Act of 1990.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's current product literature and installation instructions for each type of product specified herein, showing compliance with specified performance characteristics, physical properties such as dimensions, options, and finishes.
   1. Indicate backing requirements and any other requirements necessary for a proper installation per the manufacturer's recommendations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have a minimum of three (3) years of experience successfully completing projects similar in scope and size to this one.
B. Contractor is responsible for coordination and installation of products covered under this CSI Number and for any substrate conditions required for installation.
C. Verify substrate conditions, whether existing or installed under other CSI Numbers, are as detailed in the Drawings or required by the manufacturer of each product type. Consult with Architect for atypical conditions affecting installation.
D. Install products in locations and at heights shown in the Drawings and per applicable Federal, State, and Local Codes. If dimensions, locations, or heights shown in the Drawings are in conflict with applicable codes, consult with Architect prior to installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to project site in Manufacturer's original, unopened packaging, with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond to product or leave any residue when exposed to sunlight and/or heat.
B. Storage: Store product under cover in dry, enclosed spaces on site. Protect against water, damage, and theft while stored.
C. Handling: Comply with manufacturer’s instructions.

1.07 COORDINATION

A. See Drawings for items furnished by Owner and installed by Owner, and items furnished by Owner and installed by Contractor. Coordinate backing, substrate, and wall support materials as required by the manufacturer’s of the Owner furnished items.

1.08 FIELD CONDITIONS

A. Ambient Conditions:
   1. Maintain environmental conditions such as temperature, humidity, and ventilation within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.
   2. Maintain building temperature at minimum of 60 degrees Fahrenheit for 24 hours minimum before, during, and after installation of toilet compartments.
B. Existing Conditions: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.
C. Coordinate accessory locations with the Drawings and other Work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.09 WARRANTY

A. Provide Manufacturers’ standard warranty for each product type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
   1. American Specialties, Inc. – ASI Group; www.americanspecialties.com.
   2. Bobrick Washroom Equipment, Inc.; www.brobrick.com.
   3. Bradley Company, LLC – A Watts Brand; www.bradleycorp.com.
   4. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS

A. General:
   1. Locks shall be tumbler type, keyed alike, unless directed otherwise by Architect.
   2. Fasteners shall be theft-proof screws.
   3. No adhesive mountings, unless directed otherwise by Architect.
   4. See Drawings for locations and quantities of toilet & custodial accessories. Some accessories listed may not be applicable.
B. Grab Bars: 1-½ inch diameter 18-gauge (1.2mm) type 304 stainless steel tubing, with concealed type 304 stainless steel mounting flanges. Type 304 stainless steel snap flange covers. Satin finish on all surfaces. Furnish with concealed anchors and anchor plates suited to grab bar location. Grab bars shall be rated and installed in a manner to support at least

900 pounds. Provide in locations and lengths as shown on Drawings and where required for compliance with applicable codes.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 3800 Series.
    b. Bobrick, Model B-6806 Series.
    c. Bradley Company, Model 812 Series.
    d. As approved by Architect and in compliance with substitution requirements.

C. Framed Mirror (Surface-Mounted): 18-gauge type 304 stainless steel angle frame with beveled frame edge and satin finish. No. 1 quality ¼-inch glass warranted against silver spoilage for 15 years minimum. Theft-resistant concealed mounting with one-piece back plate. Provide in sizes and at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 0600 Series.
    b. Bobrick, Model B-290 Series.
    c. Bradley Company, Model 780 Series.
    d. As approved by Architect and in compliance with substitution requirements.

D. Unframed Mirror Glass: See Glazing Specification. Provide in sizes and at locations shown on Drawings.

E. Soap Dispenser (Surface-Mounted): 22-gauge minimum type 304 stainless steel with satin finish. Body is drawn, one-piece, seamless construction. Concealed, surface mounting. Minimum 40 ounce liquid soap capacity. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. Bobrick, Model B-2111.
    b. Bradley Company, Model 6563.
    c. As approved by Architect and in compliance with substitution requirements.

F. Toilet Seat Cover Dispenser (Surface-Mounted): 22-gauge minimum type 304 stainless steel with satin finish. All-welded construction with burr-free or beveled edges. Concealed, surface mounting. 250 seat cover capacity. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 0477-SM.
    b. Bobrick, Model B-221.
    c. Bradley Company, Model 5831.
    d. As approved by Architect and in compliance with substitution requirements.

G. Toilet Tissue Dispenser (Surface-Mounted): 22-gauge minimum type 304 stainless steel with satin finish. Concealed, surface mounting. Holds two (2) rolls up to 5-1/4” diameter. Top roll automatically drops in place when bottom roll is used up. Theft-resistant heavy-duty spindles. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 20030.
    b. Bobrick, Model B-2888.
    c. Bradley Company, Model 5402.
    d. As approved by Architect and in compliance with substitution requirements.

H. Sanitary Napkin Disposal (Surface-Mounted): 22-gauge minimum type 304 stainless steel with satin finish. Self-closing flap door. Removable waste container with tumbler lock. Minimum 1.3 gallon (4.8 liter) capacity. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 0473-1A.
    b. Bobrick, Model B-254.
    c. Bradley Company, Model 4722-15.
    d. As approved by Architect and in compliance with substitution requirements.

I. Folding Personal Device Utility Shelf (Surface-Mounted): 18-gauge minimum type 304 stainless steel with satin finish. Equipped with heavy duty internal spring. Shelf is manually lowered and retained in operating position by placing a weighted object upon it. Shelf automatically returns to upright position when object is removed. Provide at locations shown on Drawings.

1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 0698.
    b. Bobrick, Model B-287.
    c. As approved by Architect and in compliance with substitution requirements.

J. Hat & Coat Hook: Type 304 stainless steel with satin finish. Concealed, surface mounting. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 7382-S.
    b. Bobrick, Model B-6827.
    c. Bradley Company, Model 9134.
    d. As approved by Architect and in compliance with substitution requirements.

K. Waste Receptacle (Semi-Recessed): 22-gauge minimum type 304 stainless steel with satin finish. 11 gallon minimum capacity. All welded construction for cabinet and waste container. Waste container secured to cabinet with tumbler lock. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 20458.
    b. Bobrick, Model B-3644.
    c. Bradley Company, Model 346-10.
    d. As approved by Architect and in compliance with substitution requirements.

L. Combination Paper Towel Dispenser & Waste Receptacle (Semi-Recessed): 22-gauge minimum type 304 stainless steel with satin finish. 11 gallon minimum waste container capacity. 800 multi-fold or 600 C-fold towel capacity. Waste container secured to cabinet with tumbler lock. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 20469.
    b. Bobrick, Model B-3944.
    c. Bradley Company, Model 237-10.
    d. As approved by Architect and in compliance with substitution requirements.

M. Paper Towel Dispenser (Surface-Mounted): 22-gauge minimum type 304 stainless steel with satin finish. 525 multi-fold or 400 C-fold towel capacity. Concealed, surface mounting. Provide at locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 20210.
    b. Bobrick, Model B-4262.
    c. Bradley Company, Model 250-15.
    d. As approved by Architect and in compliance with substitution requirements.

N. Automatic Hand Dryer: Touch-free operation. Type 304 stainless steel with satin finish. Concealed, surface mounting. Provide at locations shown on Drawings. See Electrical Drawings for power.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 0199 Series.
    b. Bobrick, Model B-7125.
    c. Bradley Company, Model 2902 Series.
    d. Excel Dryer, ThinAir Model.
    e. As approved by Architect and in compliance with substitution requirements

O. Custodial Utility Shelf: Type 304 stainless steel one-piece construction with satin finish. 8” deep shelf with ¾” return for rigidity, four (4) mop holders, three (3) rag hooks, drying rod, and 36” length. Self-adjusting rubber cams for variable pole thickness. Provide at all mop sinks and additional locations shown on Drawings.
1. Acceptable products, subject to compliance with Specification requirements:
    a. ASI, Model 1315-4.
    b. Bobrick, Model B-224-36.
    c. Bradley Company, Model 9984.
    d. As approved by Architect and in compliance with substitution requirements.

P. Folding Shower Seat (ADA Compliant): One-piece rectangular, solid phenolic seat with integral slots for water drainage. Color: white or ivory. Seat secured to frame with stainless steel bolts and nuts. Type 304 stainless steel frame, support legs, flanges, and bracket. Guide bracket shall control seat lowering into operating position. Supports up to 500 lbs (227 kg). Provide at all ADA showers and additional locations shown on Drawings.
   1. Acceptable products, subject to compliance with Specification requirements:
      a. ASI, Model 8203-20.
      b. Bobrick, Model B-5193.
      c. Bradley Company, Model 9984.
      d. As approved by Architect and in compliance with substitution requirements.

Q. Shower Curtain Rod: Type 304 stainless steel seamless construction with satin finish. 18-gauge minimum tubing, 22-gauge minimum escutcheons. Concealed mounting. Provide at all single-user showers and additional locations shown on Drawings in lengths as shown or as necessary to span opening. Field verify dimensions prior to purchasing and installation.
   1. Acceptable products, subject to compliance with Specification requirements:
      a. ASI, Model 1204-2 Series.
      b. Bobrick, Model B-6047 Series.
      c. Bradley Company, Model 9539 Series.
      d. As approved by Architect and in compliance with substitution requirements.

R. Shower Curtain and Hooks: Anti-bacterial, 10-gauge minimum opaque white vinyl fabric with grommets every 6 inches along top. Curtain hemmed on bottom and sides. Standard 72” height. Curtain shall be 6” wider than opening up to 42” and 12” wider than opening exceeding 42”. Shower curtain shall be attached with hooks appropriately sized for diameter of shower curtain rod. Solid formed wire hooks made of type 304 stainless steel. Provide curtain and hooks at all single-user showers and additional locations shown on Drawings.
   1. Acceptable products, subject to compliance with Specification requirements:
      a. ASI, Model 1200-V Series and Model 1200-SHU.
      b. Bobrick, Model 204-2 / 204-3 Series and Model 204-1.
      c. Bradley Company, Model 9533 Series and Model 9536.
      d. As approved by Architect and in compliance with substitution requirements.

S. Baby Changing Station (Surface-Mounted, ADA Compliant): Horizontal 22-gauge minimum type 304 stainless steel exterior with satin finish. Changing surface shall be high-impact-resistant plastic for easy cleaning. Designed for infants and young children weighing up to 50 lbs. Tested to support a static load of 200 lbs. minimum. Provide at locations shown on Drawings.
   1. Acceptable products, subject to compliance with Specification requirements:
      a. ASI, Model 9013-9.
      b. Koala Kare by Bobrick, Model KB310-SSWM.
      c. Bradley Company, Model 962-11.
      d. As approved by Architect and in compliance with substitution requirements.

T. Adult Changing Table (Surface-Mounted, ADA Compliant): Table height adjustable using electronic control buttons. Plug-in electric-powered with backup battery system for emergency power outages. Tested to support a static load of 500 lbs. minimum. Provide at locations shown on Drawings. See Electrical Drawings for power.
   1. Acceptable products, subject to compliance with Specification requirements:
      a. Koala Kare by Bobrick, Model KB3000-AHL.
      b. Bradley Company, Model 9989.
      c. Max-Ability, Inc., Pressalit 3000.
      d. As approved by Architect and in compliance with substitution requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine substrates and subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work shall be construed as acceptance of substrates and subsurfaces.

3.02 PREPARATION

A. Coordinate with other Work that affects, connects with, or will be concealed by the Work of this CSI Number.

3.03 INSTALLATION

A. Install each item in locations as shown on Drawings and in accordance with Manufacturer's written instructions and approved installation drawings. Installation shall be in compliance with all applicable codes.
B. Secure toilet room accessories to adjacent walls and toilet partitions in accordance with the Manufacturer's instructions for each item and each type of substrate/subsurface construction, as well as the following:
   1. Attachment of Recessed Accessories: Place shims between framing and cabinet at screw attachment points.
   2. Attachment of Surface-Mounted Accessories: At stud walls, provide concealed blocking or backing at screw points to allow attachments with No. 18 x 1-1/2 inch sheet metal screws. At solid walls: wall plugs, expansion shields, or toggle bolts shall be provided.
   3. Mirrors shall be locked to wall hangers by tightening locking screws concealed in lower frame.
   4. Soap dispensers shall be mounted with 4-inch clearance from filler top to underside of any horizontal projection.
C. Grab Bar Installation:
   1. At Framed Wall Construction: Install concealed anchor plates to studs. Attachment to studs must be sufficient to withstand a horizontal pull of 300 pounds. Accurately position and fasten before wall finish is applied. After wall surface is finished, secure concealed mounting plate to anchor plate using stainless steel machine screws furnished by the Manufacturer.
   2. At Toilet Partitions: Through-bolted connection to anchors.
D. Seal wall penetrations with sealant as specified in Joint Sealant Specification to prevent moisture penetration through joints around accessories and fixtures.

3.04 CLEANING AND PROTECTION

A. Remove protective wraps or coatings from each product and clean surfaces in compliance with Manufacturers' recommendations.
B. During the course of the Work and upon completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean, operable condition.
C. Protect installed products and finish surfaces from damage during construction.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 43 13

DEFIBRILLATOR (AED) CABINETS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Automated External Defibrillator (AED) Cabinets.

1.02 REFERENCES

A. Reference Standards:
   1. American Heart Association (AHA):
      a. American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care - current Edition.
   2. ASTM International (ASTM):
      a. ASTM E814-11a, Standard Test Method for Fire Tests of Penetration Firestop Systems.
   3. International Code Council (ICC):
      a. International Building Code (IBC) – Applicable edition listed on drawings.
   4. National Fire Protection Association (NFPA):
      a. NFPA 70-2011, National Electrical Code.
   5. Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

A. Product Data:
   1. Cabinets: Materials description for defibrillator cabinets include roughing-in dimensions, details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
   2. Installation instructions for each product specified.

B. Shop Drawings:
   1. Small-scale plans showing locations of defibrillator cabinets.
   2. Schedules showing each type of cabinet to ensure proper fit and function.
   3. Indicate installation procedures and accessories required for a complete installation.

C. Samples:
   1. Defibrillator Cabinet Door and Trim Finishes: For each type of exposed finish required, prepare samples of size indicated below:
      a. Size: 6 inches (150 mm) square.

1.04 QUALITY ASSURANCE

A. Comply with the standards referenced.

B. Provide cabinets and accessories produced by a single manufacturer.

C. Fire-rated AED cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire resistance rating of walls where they are installed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect defibrillator cabinets, AED's and related materials using means and methods that will prevent damage, deterioration, or loss.
   1. Deliver components in manufacturer's original packaging, properly labeled for identification.

1.06 WARRANTY

A. Cabinets Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Acceptable manufacturers:
   1. Basis of design: JL Industries - Part of Activar Construction Products Group, Inc., 9702 Newton Ave. S., Bloomington, MN 55431, (800) 554-6077, website: https://www.activarcpg.com
   2. Substitutions as approved by Architect.

2.02 MATERIALS:

A. Cabinet with Steel Trim and Door: 1400 Lifestart™ Series, Model 1417
   1. Cabinet Style: Semi-recessed.
   2. Components:
      a. Tub: Cold-rolled steel.
         i. Finish: Factory-applied powder coat paint finish.
            A) Standard Color: White
      b. Door and Trim Construction: Cold-rolled steel; flush doors with 5/8 inch (15.88 mm) doorstop attached by continuous hinge and equipped with zinc-plated with roller catch.
         i. Trim Dimensions: 1-3/4 inch (44.45 mm) face trim on door and frame.
         ii. Finish: Factory-applied powder coat paint finish.
            A) Standard Color: White.
         iii. Door Style: Full Glazing
         iv. Trim Style and Depth:
            A) Semi-Recessed Cabinet:
               1) Rolled Edge: 3 inches (76.20 mm)
   3. Fire-Rating: 1-hour and 2-hour as indicated in the drawings.
   4. Cabinet Lettering: Silkscreen AED Graphics on door.
      a. Color: Red lettering with Heart logo

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed and blocking where surface mounted cabinets will be installed.
   1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
   1. Prepare recesses in walls for defibrillator cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
   2. Securely fasten cabinets to structure, square and plumb, to comply with manufacturer□s instructions.
   3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.

B. Cabinet Lettering:
   1. Location: Face of glass surface.
   2. Apply lettering on factory-finished cabinets either at the factory or just prior to Substantial Completion.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.

E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Submit Manufacturer's data and installation instructions for each item, including dimensions and anchorage details.

1.02 QUALITY ASSURANCE

A. Standards: Comply with ANSI/UL 92 and 711.

B. Regulatory Requirements: Conform to ANSI/NFPA 10 and the following:
1. ANSI A117.1, 1998 "Accessible and Usable Buildings and Facilities."
2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
3. ADA Accessibility Guidelines (ADAAG).
4. The Arizonans with Disabilities Act of 1992 Administrative Rules (AzDAAG).

1.2 Warranty

A. Special Warranty: Manufacturers standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
   c. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
1. Fire Extinguishers:
   a. Amerex.
   b. Ansul.
   c. Buckeye.
   d. General.
   e. Kidde.
   f. Any manufacturer that can meet all requirements in this CSI Number.

2. Fire Extinguisher Cabinet:
    a. Basis of Design: Larsen's Manufacturing Co. www.larsensmfg.com
        1) Standard: Full Panel, Steel, Semi-Recessed, Model No. 2409 6R.
        2) Fire-Rated: Full Panel, Steel, Semi-Recessed, Model No. FS 2409-R4.
    b. Other acceptable manufacturers:
        1) J.L. Industries www.jlindustries.com
        2) General.
        3) Knox.
        4) Supra Products Co.

2.02 MATERIALS AND ACCESSORIES - GENERAL

A. Fire suppression equipment shall not contain HCFC's or Halons.

2.03 EQUIPMENT

A. Extinguishers and Cabinets:
1. Mechanical rooms, electrical rooms, and commercial kitchens:
    a. Minimum rating: 20-B:C.
    b. Extinguishing agent: Sodium bicarbonate base or potassium bicarbonate base. Carbon dioxide or halon agents are not acceptable.
    c. No cabinet required.
2. Corridors and other areas requiring fire extinguishers (or are considered light hazard to ordinary hazard areas):
    a. Provide fire extinguisher cabinet
    b. Minimum rating of 4-A:20-B:C.
    c. Extinguishing agent: Ammonium phosphate.
3. Fire extinguishers must be UL approved and bear an individual identification on the fire extinguisher.
4. The cylinder head and internal parts must be constructed of steel or aluminum.
5. Stainless steel cylinders or any other cylinders requiring normal hydrostatic testing less than every twelve years are not acceptable.
6. Fire extinguisher cabinets, provide with locks, must be key operated by the standard Larsen LL24 key.

B. Wall Bracket: Manufacturer's standard J-type for wall hung extinguishers.

C. Fire Extinguisher Cabinets:
1. Standard: As manufactured by Larsen Manufacturing Co., model "Architectural Series, full panel, clear acrylic door glazing, steel trim and door material, 2 ½" rolled edge semi-recessed".
2. Fire-Rated: As manufactured by Larsen Manufacturing Co., model "Architectural Series, full panel, clear acrylic door glazing, steel trim and door material, 3 ½" rolled edge semi-recessed".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.02 INSTALLATION

A. Install items in accordance with Manufacturer's directions. Install cabinets plumb and level at heights shown on Drawings.

B. Comply with regulatory requirements and anchor securely.

C. Travel distance:
1. Mechanical rooms, electrical rooms, and commercial kitchens: Not to exceed 50 feet. Fire extinguishers outside the room/area of protection cannot be included in the travel distance requirements.
2. Corridors and other areas requiring fire extinguishers (or are considered light hazard to ordinary hazard areas): Not to exceed 75 feet.

D. Verify that extinguishers are charged and tagged.

E. Place extinguishers in cabinets and on wall brackets.

3.03 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment, and debris away from premises in a legal manner. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 10 75 00

FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes: Internal halyard ground set flagpole, including baseplate and foundation sleeve.

B. Related CSI Numbers:
   1. CSI Number 03 05 14 – Fly Ash.
   2. CSI Number 03 10 00 – Concrete Forming and Accessories.
   3. CSI Number 03 20 00 – Concrete Reinforcing.
   4. CSI Number 03 30 00 – Cast-in-Place Concrete.
   5. CSI Division 26 – Electrical.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: comply with National Association of Architectural Metal Manufacturer's "Guide Specifications for the Design of Metal Flagpoles," Standard FP-1.

1.3 SUBMITTALS

A. Shop Drawings: Submit Drawings showing sizes, finishes, methods of installation and accessories.

B. Samples: Submit samples showing material and finish.

C. Manufacturer's calculated engineering data for base.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.

B. Storage: Adequately protect against damage while stored at the site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Furnish products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
   1. American Flagpole Division, Kearney-National www.americanflagpole.com
   2. Baartol www.baartol.com
   3. Concord Industries www.flagpoles.com.
   4. Eder Flag Manufacturing Co., Inc. www.ederflag.com
   5. Ewing Group ww.ewinggroup.com
   6. Morgan-Francis Div. www.morgan-francis.com
   7. The Flag Company, Inc.: Flag Pole Warehouse www.flagwarehouse.com
   8. Pole-Tech Col, Inc. www.poletech.com.

2.2 FLAGPOLES

A. Poles: Cone tapered aluminum ground set of seamless cold drawn ASTM B241, 6063-T6 aluminum tubing with 0.188-inch wall thickness, with base and top diameter as required for height(s) of poles specified.
   1. Height(s):
      a. As shown on Drawings.

B. Accessories: Equip pole with the following:
   1. Internal Halyard Fittings: Manufacturer's standard cable based internal halyard and winch mount system with locking door and reinforced door frame assembly.
   2. Truck Assembly: Single sheave, revolving truck assembly.
   3. Ball: 14 gauge clear anodized spun aluminum flag pole ball ornament of diameter to be compatible with height of pole and no larger than butt (bottom) diameter of pole.
   4. Provide upgraded 1/4 inch thick clear anodized aluminum casting base.

C. Pole and Hardware Finishes: Clear Anodized.

D. Foundation: 16 gauge corrugated galvanized foundation tube with self-centering bottom plate and hardwood or resilient wedges and lighting protector ground

E. Concrete: 3,000 psi minimum, unless noted otherwise on Drawings, and meeting the requirements of the Cast-in-Place Concrete specification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with heavy coat of bituminous paint or manufacturer's standard protective bituminous tape.

3.3 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with Manufacturer's instructions.

B. Electrically ground flagpole installation.

C. Install foundation plate and centering wedges for flagpole base set in concrete and fasten. Fill foundation tube sleeve with sand and compact.

D. Allow concrete to cure at least 14 days before erecting pole.

3.4 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 12 24 13

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Roller shades.
B. Shade fabric.
C. Accessories.

1.02 RELATED CSI NUMBERS

A. CSI Number 06 10 53 – Miscellaneous Rough Carpentry.
B. CSI Number 09 22 16 – Non-Structural Metal Framing.
C. CSI Number 09 29 00 – Gypsum Board.
D. CSI Number 09 91 00 – Painting.

1.03 REFERENCES

A. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
B. ASTM E2180 – Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) in Polymeric or Hydrophobic Materials.
C. NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
D. ANSI / WCMA A100.1 – Safety of Window Covering Products.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog pages and data sheets for products specified including materials, finishes, dimensions, profiles, mountings, and accessories.
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, accessories, and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.
   5. Manufacturer's Instructions: Include storage, handling, protection, examination, preparation, and installation.
   6. Project Record (Closeout) Documents: Record actual locations of control system components and show interconnecting wiring.
B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
   1. Provide location plan showing all manual shade control locations. Cross-reference furniture plans for optimal positioning of chains.
   2. Provide elevation drawings showing shade band layout. Indicate any necessary seam or batten locations, and align with horizontal mullions where possible. Consult with Architect as necessary for atypical conditions.
C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
D. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.

1. Shade Fabric Samples: Mark face of material to indicate interior faces.
    a. Submit test reports indicating compliance with specified fabric properties.
    b. Samples shall be 6 inches square minimum, representing actual materials, color and pattern.

E. Warranty: Provide manufacturer's warranty documents as specified in this CSI Number.
F. Mock-Up: Provide a mock-up of one of each type of roller shade assembly for evaluation of mounting, appearance and accessories.
    1. Locate mock-up in window designated by Architect.
    2. Mockup Size: Full size. 3 feet x 3 feet minimum.
    3. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
    4. If mock-up is not acceptable to Architect, rebuild mock-up until satisfactory results are achieved.
    5. Do not proceed with remaining work until, mock-up is accepted by Architect.
    6. Retain mock-up during construction as a standard for comparison with completed work.
    7. Do not alter or remove mock-up until work is completed or removal is authorized by Architect.
    8. Full-sized mock-up may become part of the final installation.
    9. Full-sized mock-up will become the property of the Owner to be used for spare parts.

1.05 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this CSI Number.
C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this CSI Number.
    1. Requirements for Roller Shade Installer/Contractor:
        a. Roller Shade Hardware, shade fabric and all related controls shall be furnished and installed as a complete assembly.
D. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
E. Shade Fabric Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC9644 and ATCC9645, and ASTM E2180.
F. Shade Fabric Cleanability and Disinfecting: Shade fabric must meet cleanability and disinfecting requirements via 3rd party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19.
G. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified. Initial submittals, which do not include the Environmental Certification will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
H. Third Party Evaluation: Provide documentation stating the shade fabric has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
I. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
2. Do not install shades until final surface finishes and painting are complete.

J. Preinstallation Meeting: At least one (1) week prior to commencing work related to this CSI Number, schedule a preinstallation meeting with the Architect and the Owner. Require attendance of all affected installers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in Window Treatment Schedule.
B. Store and handle products per manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating, transferrable warranty for interior shading.
1. Shade Hardware – 10 years.
2. Shade Fabric: Manufacturer's standard 25-year warranty.
3. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed Owner’s responsibility.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
1. **Basis of Design Manufacturer: MechoShade Systems, www.MechoShade.com.**
2. Hunter Douglas, www.HunterDouglas.com.
3. Lutron, www.Lutron.com.
4. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS - GENERAL

A. Shade System General Requirements:
1. Components capable of being removed or adjusted without removing mounted shade brackets, or cassette support channel.
2. Smoothly operation raising or lowering shades.

2.03 MATERIALS – MANUAL OPERATING, SUNSCREEN SINGLE ROLLER SHADES

A. Manual operating, chain drive, sunscreen single roller shades and related mounting systems and accessories as indicated on Drawings.
B. **Basis of Design Product: Mecho/5 System as manufactured by MechoShade Systems.**
C. Description: Manually operated fabric window shades.
1. Shade Type: Single Roller.

2. Universal drive capability to offset drive chain for reverse or regular roll shades.
3. Mounting: As shown in Drawings or as directed by Architect.
4. Size: As indicated in Drawings.
5. Fabric: As indicated in Shade Fabric below.

D. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
1. Material: Steel, 1/8 inch (3 mm) thick.
2. Radiused Center Support Brackets: Provide brackets and connectors for radiused window applications.
a. Maximum Offset: Eight degrees on each side for a 16 degree total offset.

E. Roller Tubes:
1. Material: Extruded aluminum.
2. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
3. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
4. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.

F. Hembars: Designed to maintain bottom of shade straight and flat.
1. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

G. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
1. Heavy-duty, 1/8” steel mounting bracket and integrated steel brake, clutch and sprocket assembly rigidly affix the shade support and user control to the building structure fully independent of the roller tube components.
2. Permanently lubricated maintenance-free brake assembly employs an oil-impregnated steel hub with wrapped spring clutch.
3. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
4. Direct drive clutch requires no interstitial gear stages or plastic parts between the building structure and clutch ensuring reliable operation across the full range of shade sizes.
5. Maximum shade hanging weight of 18 pounds (8.2 kg).

H. Drive Chain: Continuous loop stainless steel beaded ball chain, 100 pound (45 kg) minimum breaking strength. Provide upper and lower limit stops.
1. Chain Tensioner: Chain tensioning device complying with ANSI/WCMA A100.1.
2. Limit stops: Bead stops affixed to the chain maintain consistent shadeband alignment at the top and bottom of shade travel across multiple shades, and help prevent shade damage resulting from unmanaged user control.

I. Accessories:
1. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
a. Finish: Clear anodized or as shown on Drawings.
b. Can be installed across two or more shade bands in one piece.
c. Profile: As selected by Architect.
d. Configuration: As shown on Drawings or as selected by Architect from the manufacturer’s available options.

2.04 MATERIALS – SHADE FABRIC

A. **Basis of Design Products: Shade fabric(s) as manufactured by MechoShade Systems.**
1. Sunscreen (Solar) Shade Fabric:
a. Fabric: SoHo 1600 Series. 3 percent open.
i. 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend.
ii. NRC Rating: 0.25.
iii. SAA Rating: 0.29.

iv. Minimum width: 126 inches.
v. Color: As shown on Drawings or as selected by Architect from the manufacturer's full line of available colors.

B. Performance Requirements:
1. Flammability per NFPA 701: Pass. Large- or small-scale test.
2. Fungal Resistance: No growth when tested per ASTM G21.
3. Cleanability and Disinfecting: Shade fabric must meet cleanability and disinfecting requirements via 3rd party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19.

C. Fabrication:
1. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
2. Battens: Manufacturer's standard material, full width of shade, and enclosed in welded shade fabric pocket; locate as indicated on Drawings.
3. Seams for Railroaded Fabric: Manufacturer's standard seam; locate as indicated on Drawings.
4. Welded Zipper Edge: Full height on both sides of fabric ensuring smooth operation within ShadeLoc channels.

2.05 FABRICATION

A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill Opening from Head to Sill: 1/2 inch (13 mm) space between bottom bar and window sill or finished floor, as applicable.
2. Horizontal Dimensions: Inside Mounting.
a. Fill openings from jamb to jamb. No light gap or as acceptable to the Architect.
3. Horizontal Dimensions: Outside mounting.
a. Extend shades beyond jambs on each side: 1 inch or as acceptable to the Architect.
C. Openings Requiring Continuous Multiple Shade Units with Separate Rollers: Locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
C. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Contractor Furnish and Install Responsibilities.
1. Window Covering Contractor (WCC) shall provide an on-site Project Manager, and shall be present for all related jobsite scheduling meetings.
2. WCC shall supervise the roller shade installation, and setting of intermediate stops of all shades.

3. WCC shall be responsible for field inspection on an area-by-area and floor-by-floor basis during construction to confirm proper mounting conditions per shop drawings.
4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor, Architect, and Owner of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
5. WCC shall provide accuracy to 0.0625” inch (1.5875mm); field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
6. WCC shall install roller shades level, plumb, square, and true according to manufacturer’s written instructions, and as specified here in. Blocking for roller shades shall be installed plumb, level, and fitted to window mullion in accordance with industry standard tolerances and the Contract Documents. The horizontal surface of the shade pocket shall not be out-of-level more than 0.625” (15.875mm) over 20 linear feet (6.096 meters).
7. Shades shall be located so the shade band is not closer than 2 inches (50 mm) to the interior face of the glass. Allow proper clearances for window operation hardware.
8. Adjust, align and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
9. Installer shall set Upper and Lower limits of all manual shade bands, and assure alignment in accordance with the above requirements.
10. Clean roller shade surfaces after installation, according to manufacturer’s written instructions.
11. WCC shall train Owner’s maintenance personnel to adjust, operate and maintain roller shade systems.
    a. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.

3.04 CLEANING AND PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.
    1. Clean soiled shades and exposed components as recommended by manufacturer.
    2. Replace shades that cannot be cleaned to "like new" condition. Architect shall be the final judge for acceptance of shade conditions.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 14 95 00

HYDRAULIC SLIDING PIT COVER OPERATORS

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Sliding Pit Cover Operators and Accessories as necessary for the complete installation and operation of hydraulic sliding pit cover operators for the inspection pits as shown on the Drawings and specified herein.

1.02 RELATED CSI NUMBERS

A. CSI Number 05 50 00 – Metal Fabrications.
B. CSI Division 26 – Electrical.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM).
B. Illuminating Engineering Society (IES).
C. Institute of Electrical and Electronic Engineers (IEEE).
D. National Electric Code (NEC).
E. National Electrical Manufacturers Association (NEMA).
F. Occupational Safety and Health Administration (OSHA).
G. United States of America Standards Institute (USASI).
H. Underwriters' Laboratories, Inc. (UL).

1.04 DESIGN AND REGULATORY REQUIREMENTS

A. Prior to submitting a proposal, the Contractor shall become familiar with the rules of the governing boards having jurisdiction and shall notify the Owner before submitting a proposal, if in the Contractors opinion, any work or material specified is contrary to such rules. Otherwise, the Contractor is responsible for the approval of all work or material at no extra cost to the Owner, and in case the use of any material specified is not permitted, a substitute shall be approved by the Owner and shall be provided at no extra cost.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including:
   1. Descriptive brochures or detail drawings of all product features.
   2. Power Information: Horsepower, starting current, running current, and all electrical requirements.
B. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, details, and schematics indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finishes, options, accessories, and other information to render a complete and functional system.
   1. Include all high and low voltage conduit runs.
   2. Include operator mounting pad dimensions and locations.
   3. Include details of electronic equipment, electrical equipment, or any other apparatus deemed necessary by the Owner.
C. Samples: Submit manufacturer's samples of colors and finishes.

D. Operation and Maintenance Manual: Submit manufacturer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; and trouble shooting guide.
E. Manufacturer's Affidavit: Submit affidavit from the manufacturer demonstrating the operator mechanism and controller have been tested in excess of 200,000 cycles without component failure.
F. Installer qualification statement and project references.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A company specializing in the manufacturing of the type of hydraulic pit cover operators specified herein with a minimum of ten (10) years experience.
B. Installer Qualifications: A company with a minimum of three (3) years installation experience of similar equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
C. Handling: Protect materials during handling and installation to prevent damage.

1.08 FIELD CONDITIONS

A. Contractor to provide temporary electrical power as necessary.

1.09 INSPECTIONS

A. Contractor shall procure all necessary and usual inspections and certificates for all work to be installed. Deliver same to Owner prior to final acceptance.

1.10 WARRANTY

A. Operators shall carry a five (5) year limited warranty against all defects in materials and workmanship. Defective components shall be replaced by the manufacturer, at no cost to the owner. Freight, labor, and other incidental costs are not considered part of the factory warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents and substitution requirements, provide products from a manufacturer as approved by Architect.

2.02 MATERIALS

A. All materials shall be new and shall bear the manufacturer's name, trade name, and the UL/ ETL label in every case where a standard has been established. The equipment to be furnished shall be the standard product of a manufacturer regularly engaged in the production of the required type of equipment. Furnish all accessories, connections and incidental items necessary to fully complete the Work and provide a complete system.

B. Hydraulic Sliding Pit Cover Operator:
   1. The operator/controller shall be of rugged, solid-state design, approved for use by a nationally recognized testing laboratory (NRTL) in accordance with the requirements of UL 325 and UL 991.
   2. Specific Requirements to meet UL325:
      a. The operator shall include inherent entrapment sensing as its primary safety device. The use of infrared beams or reversing edges shall only be required as secondary safety devices.
      b. The manufacturer shall supply an external audible alarm as part of the control circuitry.
   3. Features:
      a. Operators shall be designed and manufactured for continuous duty. Operators shall be capable of actuating individual grate panels up to 50 feet in length and weighing up to 1,250 pounds with a drive rail draw force requirement of no less than 300 pounds at a preset speed of 1.2 feet per second, except where limited by UL325 Class I and II, then travel speed shall be 1 foot per second.
      b. AC motor shall be continuous duty rated, totally enclosed, and fan cooled.
      c. Limit switches shall be NEMA 4 capacitive proximity limit switches rated for harsh duty. Switch housing shall be one-piece and shall be of corrosion resistant stainless steel.
      d. There shall be a flexible coupling between the motor and the hydraulic pump.
      e. Hydraulic pump and drive motors shall be equipped with JIC connectors. No quick disconnect fittings shall be allowed.
      f. One (1) disconnect means shall be provided.
         i. Primary drive wheel separator.
      g. Entire operator shall be UL 325 and UL 991 listed.
   4. Functionality:
      a. Power System:
         i. The standard power unit shall be capable of producing a minimum of 1.5 peak horsepower.
         ii. The unit shall be made available as 115/208/230 single phase or 208/230/460 three-phase AC voltage. The motor shall be of the high starting torque, continuous duty, and industrial type, protected against overload by either a thermal or current sensing overload device.
      b. Hydraulic System:
         i. The hydraulic system shall be self-contained and shall consist of the electric motor, pump, reservoir, 2-position 4-way control valve, hydraulic “plumbing”, and two (2) hydraulic drive motors.
         ii. Pump shall have full roller bearing construction.
         iii. The hydraulic motors shall be “plumbed” in a series configuration to accomplish a minimum draw force of 300 pounds, applied to the drive rail by the clamping force of the upper and lower hydraulic motor support arm spring assemblies.
         iv. Hydraulic motors shall be self-adjusting for wear compensation.
         v. The hydraulic motors shall withstand an operating pressure of 1800 psi, and continuous torque of 900 inch-pounds.
      c. Actuation:
         i. The pit cover shall have a drive rail rigidly attached. The drive rail shall be constructed of high strength 6061-T6 aluminum extrusion. Alternative drive rail shall be 3” x 4” x 1/4” hot-dipped galvanized steel.
         ii. The “rail” shall be friction fed through the spring-loaded, hydraulically driven wheels.

iii. The pit cover travel shall be controlled by proximity type limit switches. Remote sensing devices shall not be required to limit the travel of the cover.
iv. The circuit design shall provide for a delay reversal of the grate panel of no greater than two (2) seconds without the reversal of the electric motor rotation.
v. Change of left or right hand directional operation of the operator shall be accomplished via software selection, and shall not be accomplished by reversing switches, limit switch connectors or hydraulic hose assemblies.

d. Drive Design:
i. The drive mechanism shall be designed and tested so as to equalize the vertical forces imposed on the drive rail during operations of the pit cover.
ii. The drive mechanism shall be designed and tested so each drive motor shaft centerline and the corresponding hydraulic motor mounting arm pivot centerline shall be in the same horizontal plane and shall be parallel to the drive rail, so that the vertical forces generated on the drive rail shall be negated.
iii. Hydraulic motor arms shall be constructed from cast aluminum.
iv. The drive motor wheels shall be a 1.5" wide x 6" o.d. polyurethane tread and shall have a durometer hardness of 88.

e. Electrical:
i. Pit cover operator motors shall be available as 115/208/230 VAC single phase or 208/230/460 VAC three phase power.
ii. A line voltage disconnect shall be standard.
iii. A main transformer shall supply the control and safety circuits.
iv. A transformer rated at a minimum of 100VA, with secondary output at 24VAC shall supply the control circuit power. The transformer shall supply low-voltage compensation for applications where long wire runs limit available voltage.
v. Individual electrical components shall be tested by a nationally recognized testing laboratory (NRTL) and bear the UL / ETL label.
vi. 24VAC and 24VDC accessory power shall be available for connection of secondary safety devices, loop detectors, etc.
vii. All wiring shall terminate using removable terminal strips, and shall include a color-coded wiring diagram.

f. Microprocessor/Controller Interface:
i. The pit cover controller interface shall be of rugged design and approved for use by an independent testing laboratory in accordance with the requirements of UL325 and UL991.
ii. The Controller interface shall include a 4 line x 12 character backlit LCD display, and integrated 3 button control station.
iii. The controller shall not utilize plug-in type timers and/or relays to accomplish control of the grate system. The controller shall be designed as a two-board set so that installation and maintenance routines may be centralized at one location for ease of use. All setup and maintenance operations shall be performed on the Controller and all input /output terminations shall be made on the I/O Board.
iv. The Controller shall include a minimum of 12 inputs and 8 outputs. An additional 4 input / 4 output expansion module shall be available as accessory equipment.
v. The pit cover controller shall provide the following standard features in a user-selectable programmable format:
A) Auto-close timer, 0-600 seconds.
B) Maximum run timer, 0-600 seconds.
C) Intermediate-open operation.
D) Right-hand or left-hand operation.
E) Single, master/slave or interlocking operation.

vi. An external reset input terminal shall be provided to allow restart of the control via a remote link with the grate operator in accordance with UL325.
vii. Output relays shall be rated at 12 amps at 120VAC, minimum.
viii. The Controller shall be capable of programmable left-hand or right-hand grate operation without the swapping of limit switches or hydraulic hoses.
ix. The Controller shall have non-volatile memory to retain time, date, and program data should power be interrupted.
x. The pit cover controller shall be capable of accepting input from a wide range of additional accessories, including but not limited to: obstruction detectors, tape switches, radio controls, PLC's or other "intelligent" pit cover system controllers.

g. Operator Chassis / Housing:
   i. The chassis shall be fabricated from 10 gauge carbon steel. Formed, channel-shaped side plates shall be used to produce a strong configuration without welded corners.
   ii. The housing shall be fabricated from 18 gauge steel, and when removed, shall allow unrestricted access to hydraulic and electrical components from any side of the operator.
      A) The cover shall be pad lockable. Key and paracentric locking covers shall be available as options.
   iii. All drilling and welding shall be completed prior to painting.
      A) The finish shall be a high-gloss powder coat finish, color as selected by Architect from the manufacturer's full range of available colors.
h. Emergency Operation:
   i. Operator shall have a one-piece manual toggle-style disconnect to instantly disengage the drive wheels for manual operation. The operator shall function properly when returned to normal operating conditions without regard to the grate position.
i. Testing:
   i. Each operator shall be subjected to complete factory testing of all functions after assembly.
j. Warranty:
   i. The specified grate operator shall be warranted against manufacturing defects in materials and workmanship for five (5) years.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of the Work under this CSI Number.
B. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the manufacturer/installer.
C. Commencement of Work shall be construed as acceptance of substrates and subsurfaces.

3.02 INSTALLATION

A. Installation shall be performed according to the manufacturer's instructions. Verify all operator locations with Drawings and Shop Drawings.
B. Any disagreement between the Drawings, Specifications, Ordinances, and Regulatory Requirements shall be brought to the attention of the Owner prior to signing the Contract. After the Contract has been signed, the Contractor is responsible for having all Work meet the requirements of the authorities having jurisdiction.

3.03 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by installation activities.
B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner. Leave Work in clean, operable condition.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 31 03 00

EARTHWORK FOR BUILDINGS

PART 1 - GENERAL

1. SUMMARY

   a. CSI Number Includes:
      i. Site clearing, preparation and grading.
      ii. Building excavating and backfilling.
      iii. Trenching, backfilling and compacting for building and site utilities.
      iv. Excavation and grading for site paving, curbs and sidewalks.
      v. Finish grading.

   b. Related CSI Numbers:
      i. CSI Number 03 30 00 – Cast-in-Place Concrete: Sub-slab vapor retarder membrane.

2. DEFINITIONS

   a. Native or natural soils: Undisturbed soils present at site in their site in their natural state or conditions. Materials which are essentially free of vegetation or organic matter and do not include trash or other deleterious materials.

   b. Existing fill soils: Materials present at site that have been disturbed, possibly transported, and are not in their natural undisturbed state.

   c. Imported fill soils: Materials transported onto site.

   d. Granular material: A sandy type of soil whose particles are coarser than cohesive material and which do not stick to each other.

   e. Finished Grade: floor level for interior footings, and the lowest adjacent grade (either floor level or outside grade) within 5’-0” of foundations for perimeter wall or exterior column footings.

   f. Building Perimeter: The extreme outer edge of footing. This location of the building perimeter is to be used in determining the required lateral extent of engineered fill.

   g. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within the building lines.

3. SUBMITTALS

   a. Test Reports:
      i. Test results shall clearly indicate:

a. Types of materials and composition.
b. Hardness.
c. Compactibility.
d. Presence of organic contaminants, whether or not below EPA action levels.
e. Presence of hazardous and/or regulated wastes and contaminants, whether or not below EPA action levels.
f. Suitability for proposed usage.

ii. Testing laboratory shall notify Architect of non-conforming fill material submittals.

b. As-Built Drawings:
   i. Maintain previously recorded utilities and accurately record location of:
      A) Newly encountered utilities remaining.
      B) Rerouted utilities.
      C) New utilities by horizontal dimensions, elevations or inverts, and slope gradients.

4. QUALITY ASSURANCE

a. Regulatory Requirements: Comply with applicable Federal, State and local ordinances, including Arizona Highway Department Standard Specifications, Town of Wickenburg, and MAG Specifications. Where geotechnical report, General Structural Notes, or notes on drawings state more restrictive requirements, the requirements of the geotechnical report, General Structural Notes, or notes on drawings shall govern.

b. Staking: Staking shall be performed by a Civil Engineer or Land Surveyor currently registered in the state where the Project is located. One person only shall be responsible for staking the Project, however, additional staff may be used (under direct supervision of responsible person) for larger projects.

c. Observation of Geotechnical Engineer: Every phase of the earthwork shall be performed under observation and testing directed by the Geotechnical Engineer.

5. SITE CONDITIONS

a. Soil Report: See Report provided in Project Specifications.

b. Existing Conditions:
   i. Bidders are expected to visit the site to form their own conclusions as to the character of the Work under this CSI Number.

c. Environmental Requirements: Place, spread or roll fill materials during favorable weather conditions. When the Work is interrupted by rain, do not resume fill operations until evidence is furnished which establishes that moisture content and density of the previously placed fill are as specified.
   i. Surface drainage: Provide and maintain positive surface drainage during excavation. Prevent infiltration of water into utility or foundation excavations from whatever sources as may exist.
   ii. Dust control: Comply with requirements of governing authorities. Use whatever means necessary to control dust on and near the Work and on and near off-site borrow, storage and spoil areas, if such dust is caused by the Contractor's operations during performance of the Work, or if resulting from the conditions in

which the Contractor leaves the site. Thoroughly moisten surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other Work on the site.

PART 2 - PRODUCTS

1. MATERIALS

   a. Fill Materials:
      i. Native clayey soils are considered suitable for use in general grading fills and engineered fills below foundations but shall not be used in the top 12 inches pf pad fill or as retaining wall backfill.
      ii. The top 12 inches of pad fill shall be completed with an approved low- or non-expansive soil, either native silty sand, approved common borrow or select granular soil.
      iii. If select granular soils are used, the 4 inches of under-slab aggregate base may be included as part of the top 12 inches. Otherwise, 12 inches of approved common borrow shall be used in addition to the normal 4 inches of aggregate base.
      iv. Imported common fill for use in site grading shall be examined by the Geotechnical Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. Fill gradation and properties shall be in accordance with recommendations of the Report on Geotechnical Investigation.

   b. Under-Slab Fill: Aggregate Base (ABC) conforming with material requirements of MAG Section 702.

   c. Pipe Bedding Fill: Material used for pipe bedding shall comply with MAG Section 601.4.1.

   d. Warning Tape:
      i. Acid- and Alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.
      ii. Provide detectable warning tape with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2’06” deep for non-metallic utility pipes, conduit or other underground services outside of building line.
      iii. Tape Colors: Provide taped colors to utilities as follows:
         A) Red: Electric.
         B) Yellow: Gas, oil, steam, and dangerous materials.
         C) Orange: Telephone and other communications.
         D) Blue: Water systems.
         E) Green: Sewer systems.

PART 3 - EXECUTION

1. PREPARATION

   a. Verify survey data. Stake out work and verify as to location and elevation. Carefully maintain bench marks, monuments, and other reference points; if disturbed or destroyed, replace as directed.

   b. Irrigation operations shall cease as far ahead of construction start-up as possible. We soils shall be allowed to dry in accordance with recommendations of the Report on Geotechnical Investigation.

   c. Site Clearing: Strip and remove all vegetation, debris, rubble, obviously loose surface soils from the entire area to be occupied by proposed construction in accordance with recommendations of the Report on Geotechnical Investigation.
      i. Oversize material such as concrete irrigation lining (if present) may be broken up into small pieces and placed in landscape fill areas.
      ii. Any existing plant stalks shall be brushed from the site. Do not turn into the surface soil.
      iii. Root system may be incorporated into the fill.
      iv. Enough additional soil shall be removed to provide space for the 12 inches of non-expansive fill if this option is selected.

   d. Due to the disturbance of the existing surface soils, at least the upper 18 inches of native soils shall be pre-compacted within the entire building footprint prior to placing fills in accordance with recommendations of the Report on Geotechnical Investigation.

   e. Buried hazards (i.e. undocumented fills, concrete lined irrigation canal, silage pits, trash pits, septic systems, etc.) if encountered, shall be removed, and the resulting excavation deepened and widened as necessary to remove unsuitable materials and provide access for compaction equipment.

   f. Fills made on slopes shall be placed in accordance with recommendations of the Report on Geotechnical Investigation.

   g. Subsoils under building foundations shall be further over-excavated at least 2 feet below proposed footing bottom elevation, or existing grade, whichever is deeper, extending at least 5 feet beyond footing edges. It may be more efficient to over-excavate the entire building footprint.

   h. The Geotechnical Engineer shall examine subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials.

   i. Prior to placing engineered fill below foundations and slabs on grade, exposed grade shall be scarified, moisture conditioned, and properly compacted in accordance with recommendations of the Report on Geotechnical Investigation.

   j. Pavement areas shall be scarified, moisture-conditioned, and properly compacted in a similar manner.

   k. All cut areas and areas above footing bottom elevation that are to receive floor slab only fill shall be scarified, moisture conditioned, and properly compacted in accordance with recommendations of the Report on Geotechnical Investigation.

   l. Existing Utilities:

i. Identify known below grade utilities. Stake and flag locations.
ii. Identify and flag above grade utilities.
iii. Maintain, re-route, extend and protect as required existing utilities remaining which pass through Work area as indicated.
iv. Notify utility company to remove and relocate utilities obstructing the Work.
v. Pay costs for this Work, except that covered by utility company.

m. Unknown Utilities and Concealed Conditions:
i. Upon discovery of unknown utility of concealed conditions which are unrecorded on the Contract Documents, discontinue affected Work and notify Architect in writing.
ii. Should additional work be required to remove, maintain, re-route, extend or protect unknown utilities or other conditions, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.

2. SUBGRADE

a. Prepare subgrade at building areas to proper elevation to receive under-slab fill.

b. Prepare subgrade at paved areas to proper elevation to receive base course materials.

c. Grade as required to bring entire remainder of site to finished grade as indicated on drawings.

3. EXCAVATION – GENERAL

a. Excavate for foundations and footings to provide vertical walls and corners square. Keep entire excavation free from loose material. Conform to dimensions and elevations indicated with allowances for erection of forms, shoring, waterproofing, and inspection of footings.

b. Material to be excavated shall be non-classified and shall include earth or other materials encountered in excavating.

c. The use of explosives will not be permitted.

d. Drawings show predetermined elevations or depths for bottoms of footings. Should additional depth of excavation by necessary, the Contractor will be paid for the Work in accordance with the provisions of the General Conditions.

e. Shore and brace excavations if necessary to prevent cave-ins. Remove shoring before backfilling is completed, but not until permanent supports are in place.

f. If excavation is carried below depth indicated, backfill with properly placed and compacted fill material (material as specified) over properly prepared subgrade, or increase foundation depth as required without extra compensation.

g. Remove excess excavated material from the grounds and legally dispose of same.

h. Protect utility services uncovered by excavation.

i. Remove abandoned utility service lines from areas of excavation; cap, plus or seal such lines and identify at grade.
ii. Accurately locate and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

4. EXCAVATION - UTILITES

a. Trenching:
i. General:
A) Perform trenching required for the installation of items where the trenching is not specifically described in other areas of these Specifications.
B) Excavate for underground utilities, including water, steam, condensate, natural gas pipe lines, fire protection lines, sewers, electrical lines, cables, ducts and other electrical items.
ii. Width:
A) Make trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.
B) Provide for a minimum net clearance of 6 inches and a maximum net clearance of 12 inches on each side of the barrel of the pipe and to allow the backfill to be placed and properly compacted. Exceptions to these clearances will occur at encasement or special construction.
iii. Depth:
A) Trench as required to provide the elevations shown on the Drawings.
B) Where elevations are not shown on the Drawings or specified in other areas of the specifications, trench to sufficient depth to give a minimum of 18” of fill above the top of the pipe, measured from the adjacent finished grade.
C) Where the bottom of excavation is found to be soft and cannot support the pipe, the depth shall be extended until solid bearing is reached. Backfill to pipe foundation grade with granular material or earthfill and thoroughly compact to assure a firm foundation for the pipe.
D) Where excavation is in rock, or caliche, cut to depth of at least 8 inches below pipe invert elevations.
iv. Trench Bottoms:
A) Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit.
B) Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C) Remove stones and sharp objects to avoid point loading
D) For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
E) For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

v. Do not disturb any portion of or remove support from a piping system that has thrust blocks or other constraints against movement while the system is in service.
vi. Correction of faulty grades: Where trench excavation is inadvertently carried below proper elevations, backfill with pipe bedding material and compact to provide a firm and unyielding subgrade or foundation without additional compensation.

vii. Trench bracing:
    A) Properly brace and support trenches in accordance with requirements of governing authorities.
    B) Brace, sheet, and support trench walls in such a manner that the ground alongside the excavation will not slide or settle, and that existing improvements of every kind, whether on public or private property, will be protected from damage.
    C) Arrange bracing, sheeting, and shoring so as not to place stress on portions of the completed Work until the general construction thereof has proceeded fare enough to provide sufficient strength.
viii. Repairs and replacement: In the event of damage to such improvements, immediately make repairs and replacements necessary to the approval of the Architect without additional compensation.
ix. Removal of trench bracing: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.
x. Grading and stockpiling trenched material: Control the stockpiling of trenched material in a manner to prevent water running into the excavations. Do not obstruct surface drainage, but provide means whereby storm water is diverted into existing gutters, other surface drains, or temporary drains.

b. Crossing Protection
    i. Provide adequate temporary crossover for pedestrian and vehicular traffic including guard rails, lamps and flags, as required by agencies having jurisdiction and as directed.
    ii. Remove provisions for crossing protection when they are no longer needed.

c. Underpinning: Where excavation work is required under or adjacent to existing footings, under-pin as required to prevent damaging existing construction.

5. FOUNDATION FOR PIPES

a. General: Grade trench bottoms to provide a smooth, firm, and stable foundation free from rockpoints throughout the length of the pipe.

b. Foundation material: Place a minimum of 6” of the specified pipe bedding fill material in the bottom of the trench.

c. Subsurface conditions: In areas where soft, unstable materials are encountered at the surface upon which cohesionless material is to be placed, remove the unstable material and replace it with material approved by the Architect. Make sufficient depth to develop a firm foundation for the item being installed.

d. Overexcavation: If the need for such overexcavation has been occasioned by an act of failure to act on the part of the Contractor, make the overexcavation and replacement without additional compensation.

e. Bearing: At each joint in pipe, recess the bottom of the trench as required into the firm foundation in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing of the pipe barrel on the firm foundation.

f. Shaping: Accurately shape pipe subgrade and fit the bottom of the trench to the pipe shape. Use a drag template shaped to conform to the outer surface of the pipe if other methods do not produce satisfactory results.

6. BEDDING FOR PIPES

a. General: Place the specified pipe bedding fill material in the trench, simultaneously on each side of the pipe for the full width of the trench, to a maximum depth of 3 feet and a minimum depth of one foot above the outside diameter of the pipe barrel. Water consolidation shall not be allowed.

b. Densification: Take special care to provide firm bedding support on the underside of the pipe and fittings for the full length of the pipe.

c. Alternate bedding: Other bedding procedures and materials may be used if prior written approval has been obtained from the Civil Engineer through the Architect.

7. UNDER-SLAB FILL

a. Place under-slab fill to the thickness and grade indicated, smooth and even, free of voids. Compact to specified density. Grade to a tolerance of 1/4 inch in 10 feet.

8. BACKFILLING – GENERAL

a. After completion of the foundations, walls and other construction, and removal of forms, clean the excavations of trash and debris.

b. Place the backfill symmetrically against each side of the walls to prevent eccentric loading. Place backfill in horizontal 6 inch (150mm) layers with the proper moisture content for the required degree of compaction.

9. BACKFILLING – UTILITIES

a. Backfill pipe and conduit trenches in a manner to prevent disturbance to the pipes or conduits. Fill under and around pipes thoroughly to a point approximately 12 inches above the top of the pipe and compact. Backfill remainder of trench in 6 inch layers and compact.

b. Backfill utility trenches I accordance with MAG Section 601.

c. Backfilling prior to approvals: Do not allow or cause portions of the work performed or installed to be covered up or enclosed by work of this CSI Number prior to required inspections. Should any of the work be so enclosed or covered up before it has been inspected, uncover such work at no additional compensation.

d. Backfill simultaneously on both sides of utility to prevent displacement.

e. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

f. Provide 4-inch thick concrete base slab support for piping or conduit less that 2'-6" below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

g. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

10. COMPACTION

a. Place and compact fills in accordance with recommendations of the Report on Geotechnical Investigation.

b. Utilize mechanical compaction equipment in grading operations. In no case shall water settling or "jetting" be employed. Vibratory compaction equipment employed shall be subject to the approval of the Architect to ensure that vibrations will not be created that will affect existing construction or slopes.

11. FINISH GRADING

a. After construction and final clean-up of exterior, and removal of debris, grade building site to slopes and elevations directed.

b. Leave graded areas raked smooth.

c. Remove excess material from the site.

12. FIELD QUALITY CONTROL

a. Earthwork, footings depths, and excavations for foundations shall be inspected by the Geotechnical Engineer to verify allowable soil bearing and low settlement and swell potential, and to make any additional recommendations.

b. Tests: Inspection and testing of earthwork shall be performed by a testing laboratory.
   i. Provide free access to Work and cooperate with appointed firm.
   ii. Tests of materials may be performed to ensure conformance with specified requirements.
   iii. Provide one field density test of under-slab fill for every 2,000 square feet of building area.
   iv. Provide two field density tests of backfill at locations and elevations directed.
   v. Provide one field density test of prepared subgrade for every 2.000 square feet of site and building compaction.
   vi. Soil compaction which does not meet the specified requirements shall be recompacted and reworked as directed by the Geotechnical Engineer through the Architect.

13. PROTECTION

a. Protect newly graded area from traffic and erosion, keep areas free of trash and debris. Repair and establish grades in any areas settled, rutted or eroded.

END OF CSI NUMBER

SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 31 31 00

SOIL TREATMENT

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Pretreatment to provide chemical barrier to protect buildings and contents against attack by subterranean termites.

1.02 SUBMITTALS

A. Product Data: Submit label indicating manufacturer's chemical analysis of treatment materials prior to application. Submit evidence of EPA approval and State registration.

B. Test Reports: Submit reports of field tests for termite treatment.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Registered applicator with a minimum of 5 years of experience and licensed by the applicable agency in the State where the project is located.

B. Regulatory Requirements: Chemicals shall be approved for use and registered by the Environmental Protection Agency (EPA) and the applicable agency in the State where the project is located.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Conform to manufacturer's instructions and Governmental Agencies' requirements.

B. Deliver materials in original sealed and labeled manufacturer’s containers.

1.05 FIELD CONDITIONS

A. Do not apply chemicals in inclement weather or when there is a possibility of rain.

1.06 WARRANTY

A. Upon completion of soil treatment, and as a condition of final acceptance, provide Owner with written unlimited warranty including:
   1. Statement that application was made at concentration, rate, and method in compliance with the Specifications contained herein.
   2. Warrant effectiveness of the soil treatment against subterranean termite infestation for a period of not less than 5 years from the date of Substantial Completion.

B. Upon evidence of subterranean termite activity within warranty period, re-treat area to stop infestation of affected areas and repair termite caused damage to building at no cost to Owner.

1. Re-treatment under warranty sufficient to prevent termites from attacking building or its contents during remainder of initial warranty period, plus one additional year for each time re-treatment under warranty is required.
2. Complete re-treatment of the building shall be as specified herein and shall be rendered upon the third recurrence of subterranean termites in the same structure within 5-year period from the date of project acceptance.
3. Damage caused by infestations and by re-treatment shall be repaired at no cost to the Owner.

C. Draft warranty in favor of Owner, successors or assigns.
1. Pre-printed FHA or VA guarantee forms shall not be accepted.
2. The Owner and the applicator reserve the option to renew termite protection on an annual basis after the expiration of the warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Termite Treatment: Apply one of the following chemicals as a water emulsion (no oil solutions permitted):
1. Dragnet FSR (Permethrin); FMC Corporation, www.fmc.com.
2. Biflex TC (3rd generation synthetic pyrethroid); FMC Corporation, www.fmc.com.
3. Prevail FT (Cypermethrin); FMC Corporation, www.fmc.com.
4. Talstar (Bifenthrin); FMC Corporation, www.fmc.com.
5. Termidor (Fipronil); Termidor Termite Control, www.termidorhome.com.
6. Torpedo (Permethrin); ICI Americas, Inc.
7. Prelude (Permethrin); AMGUARD Environmental Technologies
8. Premise (Imidacloprid)
9. Demon TC (Cypermethrin)

B. Mix solutions in accordance with Manufacturer’s written directions to highest allowable concentration by label.

PART 3 - EXECUTION

3.01 APPLICATION

A. Time of Application:
1. Notify Architect and Owner at least 48 hours prior to application of materials, should the Architect or Owner want to be present during application.
2. Apply chemical treatment during normal working hours in order to be subject to observation.
3. Do not treat soil and fill areas that are excessively wet or after heavy rains to avoid surface flow of toxicants.

B. Application: In accordance with Manufacturer's recommendations, and local codes and regulations.
1. Provide applicator trucks with approved measuring flow meters.
2. Apply chemicals on soils and compacted ABC fill materials under entire subsurfaces of concrete floor slabs and slabs abutting building walls in quantities and locations stated on label.

C. Do not disturb aggregate base course and treated soil between application of poison and pouring of concrete.

1. Re-treat soil or compacted fill which has been disturbed after soil poisoning, due to plumbing and electrical changes or omissions.
2. Should rainy weather occur prior to pouring concrete slab over treated ABC, re- treat the complete area at the discretion of Architect, and at no additional cost to Owner.

3.02 FIELD QUALITY CONTROL

A. Tests: Chemical analysis tests shall be made of materials used on the basis of one test for each 10,000 square feet of treated area. Samples and test may be taken of both concentrates and the dilute materials while being applied.

3.03 PROTECTION

A. Adjacent property, trees and plants shall be protected from injury and damage as result of operations in this CSI Number.

B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner.

END OF CSI NUMBER

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SECTION 920-1 – ARCHITECTURAL & STRUCTURAL

CSI NUMBER 41 14 36

TRUCK WEIGH SCALES

PART 1 - GENERAL

1.01 CSI NUMBER INCLUDES

A. Fully operational multi-platform static truck weigh scale within a scale pit.
B. Controls, cabling, and conduits from the weigh scale to the countertops of the Weighmaster Booth and to the remote display.
C. Associated electronic equipment for the scale including digital weight indicators, scale ticket printers, and remote weight displays to be mounted on a steel pole.

1.02 RELATED CSI NUMBERS

A. CSI Number 03 05 14 – Fly Ash.
B. CSI Number 03 10 00 – Concrete Forming and Accessories.
C. CSI Number 03 20 00 – Concrete Reinforcing.
D. CSI Number 03 30 00 – Cast-in-Place Concrete.
E. CSI Number 03 80 00 – Concrete Cutting and Boring.
F. CSI Number 50 00 – Metal Fabrications.
G. CSI Number 10 00 – Dampproofing and Waterproofing.
H. CSI Number 92 00 – Joint Sealants.
I. CSI Division 22 – Plumbing.
J. CSI Division 26 – Electrical.

1.03 REFERENCES

A. National Institute of Standards and Technology – Handbook 44.
B. National Type Evaluation Program (NTEP).
C. State of Arizona Department of Weights and Measures.

1.04 DESIGN REQUIREMENTS

A. Scales shall be NTEP certified and shall meet the requirements as set forth by the National Institute of Standards and Technology Handbook 44, current edition for class III L devices. The scale manufacturer shall provide a Certificate of Conformance to these standards. Provisional certification shall not be acceptable.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, including descriptive brochures or detail drawings of all product features.
B. Shop Drawings: Submit manufacturer’s shop drawings, including plans, elevations, sections, details, and schematics indicating dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finishes, options, accessories, and other information to render a complete and functional system.
C. Operation and Maintenance Manuals: Submit manufacturer’s operation and maintenance manual(s); including operation, maintenance, adjustment, and cleaning instructions; and trouble shooting guide.
D. Installer qualification statement and project references.

E. List of major spare parts and pricing including (but not limited to) the following:
    1. Replacement load cells.
    2. Digital indicator.
    3. Printer.
    4. Junction box circuit boards.
    5. Accessory parts.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A company specializing in the manufacturing of the type of hydraulic pit cover operators specified herein with a minimum of ten (10) years experience.
B. Installer Qualifications: A company with a minimum of three (3) years installation experience of similar equipment.
C. Pre-installation Meeting:
    1. Convene pre-installation meeting before start of installation of scales.
    2. Require attendance of parties directly affecting the work of this CSI Number, including Contractor, Architect, Owner, and scale manufacturer/installer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
C. Handling: Protect materials during handling and installation to prevent damage.

1.08 FIELD CONDITIONS

A. Contractor to provide temporary electrical power as necessary.

1.09 WARRANTY

A. Weigh scales shall carry a five (5) year limited warranty against all defects in materials and workmanship. Defective components shall be replaced by the manufacturer, at no cost to the owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents**,** provide products from one of the following manufacturers:
    1. **Basis of Design Manufacturer: Cardinal Scale Manufacturing Co., www.CardinalScale.com.**
    2. As approved by Architect and in compliance with substitution requirements.

2.02 MATERIALS

A. General:
    1. Source Limitations: The design and manufacture of the scale weighbridge, load cells, digital weigh indicator, remote weight displays, and associated accessories shall be from a single manufacturer to maximize compatibility and availability of components and design.
    2. Scale shall be of a fully digital load cell design and shall not incorporate any mechanical weighing elements, check rods, or check stays.

B. Weighbridge:
C. Load Cells:
D. Digital Weight Indicator:
E. Printer:
F. Remote Weight Display:
G. Junction Boxes and Cabling Conduit:
H. Surge Voltage Protection:
I. Sump Pump:
J. Cleanout with Frame and Cover:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of the Work under this CSI Number.
B. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the manufacturer/installer.
C. Commencement of Work shall be construed as acceptance of substrates and subsurfaces.

3.02 PREPARATION

A. Coordinate with the necessary Trades as required to provide items to be built-in.

3.03 INSTALLATION

A. Erect Work to the proper lines and levels, plumb and true, and in correct relation to other Work. Maintain this condition through completion.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by installation activities.
B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises in a legal manner. Leave Work in clean, operable condition.

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 00

COMMON WORK REQUIREMENTS FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. See General Conditions and Supplementary Conditions.

B. The requirements listed under General Conditions and Supplementary Conditions and the General Requirements are applicable to this section and all subsequent Sections of CSI Division 22 and form a part of the contract.

C. See CSI Division 2, for Trenching, Backfilling and Compaction requirements.

D. See CSI Division 2 for requirements of site utility systems including sanitary sewer, storm sewer and domestic water distribution system.

E. See CSI Division 23 for Heating, Ventilating & Air Conditioning (HVAC) Systems

F. See CSI Division 26 for Electrical Systems.

G. All electrical work, regardless of voltage which is provided under CSI Division 22 shall comply with the requirements of the National Electric Code (NEC) and CSI Division 26.

1.2 PLUMBING CSI DIVISION INDEX

CSI Number 22 05 00	Common Work Requirements for Plumbing
CSI Number 22 05 03	Trenching & Backfilling for Plumbing
CSI Number 22 05 04	Pipe & Pipe Fittings for Plumbing
CSI Number 22 05 05	Piping Specialties for Plumbing
CSI Number 22 05 23	Valves for Plumbing
CSI Number 22 05 48	Vibration & Seismic Controls for Plumbing
CSI Number 22 05 49	Plumbing & Electrical Installation Coordination
CSI Number 22 07 00	Plumbing Insulation
CSI Number 22 11 00	Facility Water Distribution
CSI Number 22 13 00	Facility Sanitary Sewage
CSI Number 22 15 00	General Service Compressed Air
CSI Number 22 40 00	Plumbing Fixtures & Trim

1.3 CODES AND PERMITS

A. The plumbing work shall be performed in strict accordance with the applicable provisions of the International Building Code, 2018 Edition; the International Plumbing Code, 2018 Edition; the International Mechanical Code, 2018 Edition as adopted and interpreted by the State of Arizona, Town of San Simon, and the National Fire Protection Association (NFPA Regulations), current adopted edition, regarding plumbing systems and electrical

systems. All materials and labor necessary to comply with rules, regulations and ordinances shall be provided. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern. The Contractor shall hold and save the Architect free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.

B. Permits necessary for performance of the work shall be secured and paid for by the Contractor. See Division 2 for all requirements associated with utility permits and fees, connections, extensions, meter pits, and meter sets.

C. The following lists some applicable codes and standards that shall be followed.

Applicable county and state mechanical, electrical, gas, plumbing, health and sanitary codes, laws and ordinances.

National Electrical Manufacturer's Association

Standards. National Electrical Code.

Underwriters Laboratories, Inc.

Standards. American National

Standards Institute.

American Society for Testing Materials Standards.

Standards and requirements of local utility companies.

American Society of Mechanical Engineers Boiler and Pressure Vessel

Codes. Occupational Safety and Health Act.

Commercial and Industrial Insulation Standards

(MICA). American Gas Association.

The American Society of Sanitary Engineering

1.4 RECORD DRAWINGS

A. See CSI Division 1, for requirements associated with Project Record Drawings.

B. The Contractor shall be responsible to maintain a complete and accurate set of marked up AS-BUILT prints showing information on the installed location and arrangement of all plumbing work, and in particular, where changes were made during construction. The Contractor shall be responsible for keeping record drawings accurate and up-to-date throughout the construction period. Record drawings may be reviewed and checked by the Architect during the construction and in conjunction with review and approval of monthly pay requests. Contractor shall include copies of all addenda, RFI's, bulletins, and change orders neatly taped or attached to record drawing set.

1.5 QUALIFICATIONS

A. All mechanics shall be skilled in their respective trade.

B. All welders shall be certified in accordance with the ASME Boiler Test Code, Section IX, latest issue.

1.6 QUALIFICATION PROCEDURES

A. The storage, handling, and transportation of all refrigerants, oils, lubricants, etc. shall be accomplished in strict compliance with all State, local, and Federal Regulations including all requirements set forth by the Environmental Protection Agency (EPA) for the safe handling of regulated refrigerants and materials. The Contractor shall utilize qualified and/or certified personnel and equipment as prescribed by these requirements.

1.7 HAZARDOUS CONDITIONS

A. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operation personnel, shall be cut back and/or protected to reduce the risk of injury.

1.8 SUBMITTALS

A. The Contractor shall submit submittal brochures of all equipment, fixtures and materials to be fire-rated under CSI Division 22, including but not limited to the following:

1. Piping materials, valves, insulation materials and installation methods, vibration isolation devices, pipe penetration installation methods and products for fire rated assemblies, and all plumbing equipment listed on equipment schedules, and in related construction documents.

2. Materials, certification, shop drawings, and other information as specified in the individual CSI Division 22 Specification Sections within this Specification.

B. Unauthorized Substitutions: If substitute materials, equipment or systems are installed without prior review or are installed in a manner which is not in conformance with the requirement of this Specification and for which the Contractor has not received a written review, removal of all the unauthorized materials and installation of those indicated or specified shall be provided at no change in contract amount.

C. All equipment shall be installed in accordance with the manufacturer's recommendations.
Provide all accessories and components for optimum operation as recommended by the manufacturer.

D. Expense: All costs for the preparation, correction, delivery, and return of the submittals shall be borne by the Contractor.

E. See CSI Division 1 for additional submission requirements.

F. Complete data must be furnished showing performance, quality and dimensions. No equipment or materials shall be purchased prior to receiving written notification that submittals have been reviewed and marked either "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED". Submittals returned marked "EXCEPTIONS AS NOTED" do not require resubmittal provided that the Contractor agrees to comply with all exceptions noted in the submittal, and so states in a letter.

G. Review of Submittals: Submittals will be reviewed with reasonable promptness, but

only for conformance with the design concept of the Project and for conformance with the information indicated on the Drawings and stated in the Specifications. Review of a separate item as such will not indicate review of the assembly in which the item functions. Review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents, nor for errors or omissions in the submittals; or for the accuracy of dimensions and quantities, the adequacy of connections, and the proper and acceptable fitting, execution, functioning and completion of the work. Review shall not relieve the Contractor of responsibility for the equipment fitting within the allotted space shown on the drawings with all clearances required for equipment operation, service and maintenance including minimum clearances required by applicable codes, manufacturer's installation instructions and as necessary for proper clearance in front of all electrical panels as defined by the National Electric Code (NEC). Any relocation of plumbing and/or electrical equipment, materials and systems required to comply with minimum clearances shall be provided by the Contractor without additional cost under the Contract.

H. Shop drawings will be returned unchecked unless the following information is included: cover sheet shall be provided for each submittal of equipment, products and material proposed for use on the project. A common cover sheet for similar equipment (example: all air handling units or all fire protection products) is acceptable. The cover sheet shall list equipment by symbol number; reference all pertinent data in the Specifications or on the drawings; provide size and characteristics of the equipment, name of the project and a space large enough to accept a review stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. Cover sheet shall clearly identify any deviations from the specifications for submitted equipment, products, and materials.

I. Use of substitutions reviewed and checked by the Engineer does not relieve the Contractor from compliance with the Contract Documents. Contractor shall bear all extra expense resulting from the use of any substitutions where substitutions affect adjoining or related work required in this Division or other Divisions of this Specification.

J. If Contractor substitutes equipment for that drawn to scale on the drawings, he shall prepare a 1/4" = 1'-0" installation drawing for each equipment room where a substitution is made, using dimensions of substituted equipment, and including piping, and electrical equipment requirements, to verify that equipment will fit space with adequate clearances for maintenance. This 1/4" = 1'-0" fabrication drawing shall be submitted for review with the shop drawing submittals of the substitution. Failure to comply with this requirement will result in the shop drawings being returned unchecked.

1.9 USE OF CADD FILES

A. Under certain conditions, the Contractor will be permitted the use of the Engineer's CADDfiles for documentation of as-builts, submittals, or coordination drawings.

B. The Engineer shall be compensated for the time required to format the CADD files for delivery to the Contractor. Such work may include removal of title blocks, professional seals, calculations, proprietary information, etc.

C. The Contractor shall complete the enclosed License, Indemnity and Warranty Agreement, complete with contractor's name, address, and Contractor's Representative signature prior to request for CAD file usage.

1.10 PRIOR REVIEW

A. Prior Review of plumbing equipment submittals is required.

B. See CSI Division 1 for additional substitutions and product options requirements.

1.11 GUARANTEE-WARRANTY

A. See CSI Division 1 for warranties.

B. The following guarantee is a part of the specifications and shall be binding on the Contractor:

> "The Contractor guarantees that this installation is free from defects. He agrees to replace or repair any part of the installation which may fail within a period of one year after date established below, provided that such failure is due to defects in the materials or workmanship or to failure to follow the specifications and drawings. Warranty of the Contractor-furnished equipment or systems shall begin on the date the system or equipment is placed in operation for beneficial use of the Owner or occupancy by the Owner, whichever occurs first; such date will be determined in writing, by means of issuing a 'Certificate of Substantial Completion', AIA Form G704", or equivalent.

C. The extent of guarantees or warranties by Equipment and/or Materials Manufacturers shall not diminish the requirements of the Contractor's guarantee-warranty to the Owner.

PART 2 - PRODUCTS

2.1 QUALITY OF MATERIALS

A. All equipment and materials shall be new, and shall be the standard product of manufacturers regularly engaged in the production of plumbing equipment and shall be the manufacturer's latest design. Specific equipment, shown in schedules on drawings and specified herein, is to set forth a standard of quality and operation.

2.2 ALTITUDE RATINGS

A. Unless otherwise noted, all specified equipment capacities are for an altitude of 207 feet above sea level and adjustments to manufacturer's ratings must be made accordingly.

2.3 ELECTRICAL SERVICES – MOTORS

A. Each motor, unless otherwise specified of 3/4 HP and greater, shall be designed for operation with 3 phase, 60 Hz, see electrical drawings for voltage requirements. Unless otherwise specified, motors of 1/2 hp and less shall be designed for operation with single phase, 60 Hz, 120 volt electrical service. Motors shall be 1750 RPM, squirrel cage, normal starting torque and normal starting current, in accordance with NEMA standards unless otherwise specified.

B. All T-frame, ODP motors 5 HP and above shall be premium efficiency motors with a minimum power factor of 0.85 on 1800 RPM motors and a minimum efficiency rating in accordance with IEEE Standard 112, Test Method ‘B’ as scheduled below. In addition, all motors used in conjunction with variable frequency drives shall be premium efficiency.

NEMA EFFICIENCY	
Motor Horsepower	**Efficiency, Minimum**
5	90.2
7-1/2	91.0
10	91.7

C. Motors, including premium efficiency motors shall be manufactured by General Electric Baldor, Reliance Electric, Westinghouse.

Special motors as may be necessary by the application and as specified herein and on the drawings include C-FACE, totally enclosed fan cooled (TEFC),explosion-proof, etc., shall be provided as required and shall be furnished manufacturer's premium efficiency rating for 5HP and larger.

D. Each motor shall be of the horsepower as specified and suitable for use at an altitude of 207 feet. All motors shall have grease lubricated sealed ball bearings. Motors larger than 1 HP shall have a standard grease fitting "Zerk" and a separate grease relief tapping. Motors shall be factory lubricated. Motors shall be commercially dynamically balanced and tested at the factory before shipment and shall be selected for quiet operation. The Contractor shall line up motors and drives and place motors and equipment on foundations ready for operation.

E. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40^0C. rise and total temperature rise of 65^0C. ambient and when powered from the system voltage feeding the motor. TEFC motors shall have a service factor of 1.00 with total temperature rise of 65^0C in the above conditions. Motors located in areas exceeding 40^0C. in the ambient shall be factory rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Unless otherwise specified for a particular application use electric motors with the following requirements.

1. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

2. Polyphase Motors: NEMA Design B, Squirrel cage, induction type. Each two speed motor shall have two separate windings.

3. Rating: Continuous duty at 100% capacity in an ambient temperature of 40^0C.

F. If the CSI Division 22 Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first submit his request for the change and shall then coordinate the change with CSI Division 26 and shall pay all additional charges in connection with the change.

2.4 ELECTRICAL WIRING AND CONTROL EQUIPMENT

A. All wiring and conduit shall be furnished and installed as scheduled in Section 22 05

49 unless otherwise noted or directed.

B. The Contractor shall coordinate completely with all trades and Sub-Contractors as required to ensure that all necessary components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

C. The piping system may be bonded to the electrical ground bus at the electrical service equipment, but shall not under any circumstances be used as the main grounding electrode for the electrical service.

2.5 PAINTING

A. All finish painting of plumbing systems and equipment will be under "Painting", unless equipment is hereinafter specified to be provided with factory applied finish coats.

B. All equipment shall be provided with factory applied prime finish, unless otherwise specified.

C. Touch-Up: If the factory finish on any equipment is damaged in shipment or during construction of the building, the equipment shall be refinished.

2.6 IDENTIFICATION OF VALVES

A. Each valve shall be provided with a stamped metal tag secured to the valve. Tag shall indicate the valve number, the service and function of each valve. The Contractor shall provide a valve chart, typed neatly on 8-1/2" X 11" sheets, listing the number, size, location, function, normal operating position, on each valve installed under CSI Division 22. Valves shall be listed by system, i.e. domestic cold water, hot water, chilled water etc. Tags shall be stamped brass 1-1/2" diameter, and secured to valves by heavy copper figure eight hooks, braided stainless steel wire anchor, or other approved means.

B. CSI Division 22 valve tags shall be coordinated with CSI Division 21 and CSI Division 23 valve tags for coordinated format between each Division.

C. Valve tags shall be coordinated with existing facility valve tags and Contractor shall obtain a copy of existing facility valve chart and provide updated valve chart to the Owner's Representative.

2.7 PIPING SYSTEM IDENTIFICATION

A. Means of Identification: All piping shall be identified by each of the means described below.

The Contractor shall provide shop drawing submittal data for proposed labeling system materials and manufacturer's recommended installation procedures.

B. Piping Systems shall be identified by means of an identifying legend on color coded background appropriately worded to indicate the "service" name of the pipe as shown on the drawings. Color coded banding shall also be provided. Additionally, an arrow shall be included to indicate the direction of flow through the pipe.

C. Locations of Piping System Identification: The identifying legends and directional arrows described in the paragraphs preceding shall be located at the following points on each piping system:

Adjacent to each valve in piping system.

At every point of entry and exit where piping passes through a

wall. On each pipe riser and junction.

At a maximum interval of 20 feet on pipe lines exposed and concealed above accessible ceilings.

Adjacent to all special fittings (regulating valves, etc.) in piping

systems. At every access door.

D. Piping identification shall meet the standards of the Federal Occupational Safety Health Act (OSHA) which refers to the ANSI Standard A13.1. The following standardized color code scheme shall be used:

Yellow - Hazardous Materials
Green - Liquid Materials of Inherently Low Hazard
Blue - Gaseous Materials of Inherently Low
Hazard Red - Fire Protection Materials

E. The size of letter and length of color field shall conform to the ANSI standard and shall be as follows:

Outside Diameter of Pipe or Covering	**Length of Color Field**	**Size of Letters**
------ to 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

F. All pipe labels shall be semi-rigid plastic identification markers. Each label shall have appropriately color-coded background with printed legend. Directional flow arrows shall be included on label. Labels shall "snap-on" around pipe without the requirement for adhesive or bonding of piping sizes 3/4" through 5". Labels for piping 6" and larger shall be furnished with spring attachment at each end of label.

G. Attach pipe markers to lower quarter of the pipe on horizontal runs and on the centerline of vertical piping where view is not obstructed. Flow indicator arrow shall point away from pipe marker.

H. Provide the following labels, with ANSI/OSHA color for all piping systems as shown on the drawings and as listed below:

Service/Legend	**Letter Color**	**Background Color**
Domestic Cold Water	White	Green
Domestic Hot Water	Black	Yellow
Domestic Hot Water Return	Black	Yellow
Sanitary Sewer	White	Green

2.8 UNDERGROUND PIPING SYSTEM IDENTIFICATION

A. Bury a continuous, preprinted, bright colored, plastic ribbon cable marker with each underground pipe regardless of whether encased. Locate directly over buried pipe, 6" to 8" below finished grade. Marker tape used in conjunction with buried plastic piping systems shall be special detector type. Marker tape used in conjunction with buried plastic piping systems shall be special detection type.

2.9 EQUIPMENT TAGS

A. Furnish and install equipment identification tags for all items of PLUMBING equipment furnished and installed under CSI Division 22. Equipment tags shall be minimum of 3/32" thick laminated phenolic plastic.

2.10 ACCESS DOORS

A. Provide all access doors required for access to valves, controls, or other items for which access is required for either operation or servicing. All costs incurred through failure to perform this function as the proper sequence of this work shall be borne by the Contractor. The type of access door shall be as required by the room finish schedule. Acoustical tile access doors shall be 16 gauge steel, 12 gauge frame and shall accommodate acoustical tile, or acoustical plaster for sidewall drywall or plaster construction. Access door shall be 16 gauge steel frame with 14 gauge door panel.

B. Access doors shall be not less than 24" X 24" in size except that larger panels shall be furnished where required, and panels in tile or other similar patterned ceilings shall have dimensions corresponding to the tile or pattern module.

C. Where access doors are installed in walls required to have a specific fire rating, the access door installed shall be a fire rated access door with U.L. label. Access door in 1-hour construction shall be Class C and access doors in 2-hour construction shall be Class B.

PART 3 - EXECUTION

3.1 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other parts of these specifications covering the work of other trades which must be carried on in conjunction with the plumbing work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination. The Contractor shall be responsible for the size and accuracy of all openings.

3.2 DRAWINGS

A. The plumbing drawings show the general arrangement of all piping, fixtures, equipment, etc., and shall be followed as closely as actual building construction and work of other trades will permit. Whenever discrepancies occur between plans and specifications, the most stringent shall govern. All Contract Documents, including but not limited to CSI Division 21 Fire Suppression, CSI Division 23 HVAC, and CSI Division 26 Electrical shall be considered as part of the work insofar as this information furnishes the Contractor with details relating to design and construction of the building. Architectural and Structural drawings shall take precedence over the plumbing, HVAC and fire suppression drawings. Because of the small scale of the plumbing, HVAC and fire suppression

drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves, and accessories as may be required to meet such conditions. Should conditions necessitate a rearrangement of piping, such departures and the reasons therefore shall be submitted by the Contractor for review in the form of detailed drawings showing the proposed changes. No such changes shall be made without the prior written review. All changes shall be marked on the set of record drawings by the Contractor.

B. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, the question shall be submitted in writing.

C. Installation of all plumbing equipment and piping systems shall be arranged to provide all clearances required for equipment operation, service, and maintenance, including minimum clearances required by applicable codes, manufacturer's installation instructions and as necessary for proper clearance in front of all electrical panels as defined by the National Electric Code (NEC). Piping systems shall not be routed through or above electrical equipment room or electrical equipment space designed within equipment rooms.

D. The installation of all concealed plumbing systems shall be carefully arranged to fit within the available space without interference with adjacent structural and electrical systems. The Contractor shall make all necessary provisions for penetrations of piping, including sleeves and blockouts in structural systems. The exact location of all exposed plumbing systems; access doors; piping exposed within finished areas; and other equipment and devices as applicable, shall be coordinated with the Architect, who shall have final authority for the acceptance of the work as it specifically relates to the architectural aesthetic design requirements for the facility.

3.3 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions and conditions governing his work at the building.

No extra compensation shall be claimed or allowed on account of differences between actual dimensions, including dimensions of equipment, fixtures and materials furnished, and those indicated on the drawings. Contractor shall examine adjoining work, on which his work is dependent for perfect efficiency, and shall report any work which must be corrected.

Coordination of all plumbing work within the building will be the direct responsibility of the Contractor. Review of submittal data in accordance with paragraph "Submittals" shall in no manner relieve the Contractor of responsibility for the proper installation of the plumbing work within the available space. Installation of equipment and systems within the building space shall be carefully coordinated by the Contractor with all building trades. Each contractor shall so harmonize his work with that of the several other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Sewer lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork. Installation of plumbing, HVAC and fire suppression equipment within the ceiling cavity shall be in the following order of priority: plumbing waste lines; supply, return, outside air, makeup, and exhaust ductwork; fire sprinkler mains; fire sprinkler branch piping and sprinkler runouts; refrigerant piping; domestic hot and cold water; control piping, wiring and conduit.

3.4 CONCRETE BASES AND HOUSEKEEPING PADS

A. Concrete bases and housekeeping pads shall be installed under all pieces of plumbing equipment unless specifically deleted by the specifications or drawings.

B. Contractor shall be responsible for the accurate dimensions of all pads and bases and shall furnish and install all vibration isolators, anchor bolts, etc.

C. Contractor shall provide concrete housekeeping pad foundations for all floor mounted equipment installed under this section unless otherwise shown on the drawings. All concrete bases and housekeeping pads shall conform to the requirements specified under CSI Division 3, Concrete, portions of these specifications. Pad foundations shall be 4" high minimum, unless otherwise indicated on the drawings. Chamfer edges shall be 1". Faces shall be free of voids and rubbed smooth with carborundum block after stripping forms. Tops shall be level. Provide dowel rods in floor for lateral stability and anchorage.

D. Equipment anchor bolts shall be set in a galvanized pipe or sheet metal sleeves 1" larger than bolt diameter. Anchor bolts shall be high strength steel J shape. Anchor bolt design shall be arranged and paid for by the Contractor.

E. Machinery bases, bed plates, sole plates, or vibration isolation units shall be carefully aligned, shimmed, leveled, then grouted in place with commercial non-shrink grout. When a flexible coupling is employed as a part of the drive train, the coupling shall be aligned before the machinery base is grouted. See Section 22 05 48 for requirements for seismic supporting of equipment and systems.

3.6 PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be responsible for the protection of all work, materials and equipment furnished and installed under this section of the specifications, whether incorporated in the building or not.

B. Plumbing equipment and materials, including piping, valves and fittings, etc., shall be protected from damage and contamination. Equipment and materials shall not be stored outside and exposed to weather and ambient conditions without appropriate protection measures and without the review by the Architect. Equipment and materials shall be delivered to the jobsite and maintained while on the jobsite with all openings, controls and control panels covered with caps, with heavy duty polyethylene wrap or other proper means. Equipment and materials where stored within the building shall be protected at all times from construction damage and contamination from dust, dirt, debris, and especially during fireproofing, painting and gypboard sanding and finishing. Unprotected equipment and piping will require special field cleaning by the Contractor prior to acceptance by the Architect.

C. The Contractor shall provide protection for all work where necessary and shall be responsible for all damage done to property, equipment and materials. Storage of materials within the building shall be reviewed by the Architect prior to such storage.

D. Pipe openings shall be closed with caps or plugs, or covered to prevent lodgment of dirt or trash during the course of installation. At the completion of the plumbing work, fixtures and materials shall be cleaned and polished thoroughly and delivered in a condition satisfactory to the Architect.

3.7 MANUFACTURER'S INSTRUCTIONS

A. All equipment shall be installed in strict accordance with recommendations of the manufacturer. If such recommendations conflict with plans and specifications, the Contractor shall report such conflicts to the Architect**,** who shall make such compromises as he deems necessary and desirable.

3.8 PRESSURE RELIEF DEVICES

A. Pressure relief devices and fusible plugs shall be installed with piping to a safe location in accordance with Code requirements.

3.9 TESTS

A. Tests shall be conducted in the presence of the designated and authorized Owner's Representative. The Contractor shall notify the Architect a minimum of one week in advance of scheduled tests. Requirements for testing are specified under the sections covering the various systems. The Contractor shall furnish all necessary equipment, materials, and labor to perform the required tests.

3.10 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall furnish complete operating and maintenance instructions covering all units of plumbing equipment fixtures, faucets, etc., herein specified together with parts lists. Equipment spare parts shall include all components requiring service, including motors, bearings, shafts, etc.

B. See CSI Division 1 for additional requirements concerning manuals, manual distribution, and maintenance materials.

C. Operating and maintenance manuals as required herein shall be submitted for review and distribution to the Owner not less than two (2) weeks prior to the date scheduled for the Contractor to provide Operating and Maintenance Instructions to the Owner as specified herein.

D. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the plumbing systems and equipment for a period of one (1) day of four (4) hours. During this period, the Contractor shall instruct the Owner or his representative fully in the operations, adjustment and maintenance of all equipment furnished. Contractor shall provide at least two weeks notice in advance of this period, with a written schedule of each training session, the subject of the session, the Contractors' representatives who plan to attend the session, and the time for each session.

E. Operational test shall be conducted by the Contractor with the assistance of the equipment manufacturer's representative or service technician. Test shall be conducted in the presence of the designated and authorized Owner's Representative.

3.11 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify in writing that all equipment furnished and all work done is in compliance with the contract documents and all applicable codes. Submit certifications and acceptance certificates, including proof of delivery of O&M manuals, spare parts required, and equipment warranties which shall be bound with

O&M manuals.

3.12 SITE VISITS AND OBSERVATION OF CONSTRUCTION

A. The design professional shall make periodic visits to the project site at various stages of construction in order to observe the progress and quality of various aspects of the Contractor's work, in order to determine in general if such work is proceeding in accordance with the Contract Documents. This observation, however, shall in no way release the Contractor from his complete responsibility to supervise, direct, and control all construction work and activities. The design team has no authority over, or a responsibility to means, methods, techniques, sequences, or procedures of construction provided by the Contractor or for safety precautions and programs, or for failure by the Contractor to comply with all law, regulations, and codes.

B. Prior to the "Final" observation visit, the attached "Final Observation Checklist" shall be completed by the Contractor. Any non-applicable items shall be marked "N/A". The completed form shall be submitted, indicating that all necessary items are complete and requesting a final observation within 10 days. The Contractor shall be notified of any uncompleted items within seven (7) days. A resubmittal of the form and a new final observation request by the Contractor is required if the form is returned and noted as incomplete.

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 03

TRENCHING AND BACKFILLING FOR PLUMBING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and the General Requirements.

1.2 SCOPE OF WORK

A. The work in this section includes the furnishing of all labor, materials, equipment, transportation, hauling and services required in connection with the excavation, backfilling, compaction, grading and removal of earth from the site required for the installation of the mechanical work specified herein under Division 22.

1.3 SAFETY REGULATIONS

A. All work performed under this CSI number shall conform to the requirements of the General Conditions, Supplementary Conditions and Safety Requirements for this type of work.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 - EXECUTION - (See CSI Division 23, CSI Number 23 05 03 for applicable requirements).

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 04

PIPE AND PIPE FITTINGS FOR PLUMBING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

B. Lead Ban: All piping, solder and flux used in the installation of piping systems furnished and installed under CSI Division 22, shall be lead-free.

1.2 RELATED CSI NUMBERS

A. See CSI Number 22 05 00 for Common Work Requirements for Plumbing.

1.3 SUBMITTAL DATA

A. Contractor shall furnish complete submittal data for all piping materials, including manufacturer's specifications, certifications, class, type and schedule. Submittal data shall additionally be furnished for pipe hangers and supports, seismic restraints, pipe sleeves, including sealing and fire-safety materials and installation.

PART 2 - PRODUCTS — (See CSI Division 23, CSI Number 23 05 04 for applicable requirements).

PART 3 - EXECUTION — (See CSI Division 23, CSI Number 23 05 04 for applicable requirements).

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 05

PIPING SPECIALTIES FOR PLUMBING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The Contractor shall furnish and install all piping specialties necessary for satisfactory operation of the systems. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Requirements for Plumbing.
B. See CSI number 22 05 04, for Pipe and Pipe Fittings for Plumbing.
C. See CSI number 22 05 23, for Valves for Plumbing.
D. See CSI number 22 07 00, for Plumbing Insulation.
E. See CSI number 22 05 49, for Plumbing & Electrical Installation Coordination.

1.3 SUBMITTAL DATA

A. The Contractor shall furnish complete submittal data for all piping specialties, including manufacturer's specifications, performance characteristics, ratings, installation instructions, certifications and approvals of listing agencies, wiring diagrams, and selection analysis.

PART 2 - PRODUCTS — (See CSI Division 23, CSI number 23 05 05, Piping Specialties).

PART 3 - EXECUTION — (See CSI Division 23, CSI number 23 05 05, Piping Specialties).

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 23

VALVES FOR PLUMBING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. All Valves shall conform with current applicable provisions of the General Conditions, Supplementary Conditions, and General Requirements.

B. All Valves shall meet the current MSS Specifications covering Bronze & Iron Valves. MSS-SP-80, MSS-SP-70, MSS-SP71, MSS-SP-85 where applicable.

C. Lead Ban: Valves shall be lead free.

1.2 RELATED CSI NUMBERS

A. CSI number 22 05 00 for Common Work Requirements for Plumbing.
B. CSI number 22 05 00 for Valve Identification.
C. CSI number 22 05 04 for Pipe and Pipe Fittings.
D. See CSI Division 22 for Valves.

1.3 SCOPE

A. Contractor shall furnish and install all valves and accessories necessary for satisfactory operation of the systems.

1.4 VALVE REQUIREMENTS

A. All Gate, Globe, Check, Ball valves shall be manufactured by Milwaukee, Nibco, Apollo, Stockham, Powell, Crane, Grinnell, or equivalent.

B. Butterfly valves shall be as manufactured by Milwaukee, W.C. Norris, Centerline, Crane, Demco, Keystone, Grinnell, Victaulic, Nibco, or Dezurik, or equivalent.

C. Ball valves shall be utilized in lieu of gate valves and globe valves for all plumbing systems for sizes 2" and smaller**.**

D. All valves of the same type shall be products of a single manufacturer.

E. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

PART 2 - PRODUCTS — (See CSI Division 23, CSI number 23 05 23 for applicable requirements).

PART 3 - EXECUTION — (See CSI Division 23, CSI number 23 05 23 for applicable requirements).

END OF CSI NUMBER

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SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 48

VIBRATION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with the applicable provisions of the General Conditions, Supplementary Conditions, and General Requirements.

1.2 RELATED CSI NUMBERS

A. CSI number 22 05 00 Common Work Results for Plumbing
B. CSI number 22 05 04 Pipe & Pipe Fittings for Plumbing
C. CSI number 22 11 00 Facility Water Distribution
D. CSI number 22 13 00 Facility Sanitary Sewage

1.3 SCOPE

A. It shall be understood that the requirements for seismic restraints are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements for seismic restraint as specified herein, shown on the drawings and required by Code.

B. The work under this section shall include furnishing all labor, materials, tools, appliances and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed and/or scheduled on the drawings and/or specified in this section of the specifications.

1.4 SUBMITTALS

A. See CSI number 22 05 00 for general requirements for submittal materials. In addition to the requirements contained in CSI number 22 05 00, provide submittal information for all products and materials covered under this Section of the Specifications as listed herein.

B. Furnish complete catalog data on all vibration isolators, restraints, and equipment vibration bases to be utilized for the project in order to establish compliance with the plans and specifications and all code requirements.

C. Furnish complete shop drawing information including construction details for all vibration bases; support points and anchor bolt requirements and locations; method of support for piping; method of isolation for piping and ductwork passing through the building structure; and location and arrangement of seismic restraints.

D. Drawings shall be reviewed and certified by a registered Professional Engineer, with a minimum of five (5) years' working experience in this field, certifying that the submitted seismic restraint system design and anchorage details complies with all specification requirements and applicable codes.

1.5 CODE REQUIREMENTS

A. Pipe restraints shall be provided for equipment, materials and systems furnished and installed under CSI Division 21 of this Specification in accordance with the requirements of the 2018 International Building Code; and NFPA No. 13 for fire protection system as adopted and interpreted by the State of Arizona and the Town of San Simon, for listed per structural engineering drawings.

PART 2 - GENERAL

2.1 VIBRATION ISOLATORS

A. Floor mounted vibration isolators shall be either spring isolators designed for seismic restraint application or pre-compressed molded fiberglass or ribbed neoprene units as specified herein and in the Mechanical Equipment Schedule on the drawings.

B. Hanger type vibration isolators shall consist of steel springs in series with neoprene element as scheduled and specified on the drawings.

C. All vibration isolation devices shall be furnished by a single manufacturer to assure sole source responsibility for the proper performance of the materials used.

D. Vibration isolators shall be provided to maintain a minimum of 1-inch operating clearance.

E. Vibration isolators shall have a minimum static deflection as specified on the drawings. Isolators shall be selected by the manufacturer for non-resonance with the equipment forcing frequency and the building structure's natural frequencies. Isolators shall be provided for suitable mounting to equipment and supporting structure.

F. Vibration isolators shall be furnished by Kinetics Noise Control, Mason, or seismic control products.

2.2 EQUIPMENT BASES

A. Structural steel bases shall be designed and supplied by the isolator manufacturer. Kinetics Noise Control. Bases shall be designed with isolator brackets to reduce the mounting height of the equipment. To assure adequate stiffness, the height of the members shall be a minimum of 8% of the longest span between isolators, or at least 6 inches. Where thinner sections are necessary, due to head room limitations, etc., the section modules of the members selected shall equal or exceed the section modules of wide flange steel members whose thickness is 8% of the longest span between isolators.

2.3 FLEXIBLE CONNECTIONS

A. Flexible connections for piping systems shall be as specified in CSI number 22 05 04.

2.4 SNUBBER TYPES

A. Type A: Coil Spring Isolator Incorporated within a Ductile Iron or Cast Aluminum Housing:

1. Cast iron or aluminum housing are brittle when subjected to shock loading and are therefore not approved for seismic restraint applications.

B. Type B: Coil Spring Isolator Incorporated within a Steel Housing:

1. Spring isolators shall be seismic control restrained spring isolators, incorporating a single or multiple coil spring element, having all of the characteristics of free standing coil spring isolators as specified in the vibration isolation portion of this specification. Springs shall be restrained using a housing engineered to limit both lateral and vertical movement of the supported equipment during an earthquake without degrading the vibration isolation capabilities of the spring during normal equipment operating conditions.

2. Vibration isolators shall incorporate a steel housing and neoprene snubbing grommet system designed to limit motion to no more than 1/4" in any direction and to prevent any direct metal-to-metal contact between the supported member and the fixed restraint housing. In addition to the primary isolation coil spring, the load path will include a minimum 1/4" thick neoprene pad

3. Spring elements shall be color coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy power coated and shall have a minimum of a 1,000 hour rating when tested in accordance with ASTM B-117.

4. To facilitate servicing, the isolator will be designed in such a way that the coil spring element can be removed without the requirement to lift or otherwise disturb the supported equipment.

5. Spring isolators shall be listed Isolator/restraint as manufactured by Kinetics Noise Control, or by other manufacturer's who can meet the requirements as specified herein.

C. Type C: Coil Spring Isolator Incorporated within a Steel Housing:

1. Spring isolators shall be control restrained spring isolators, incorporating one or more coil spring elements, having all of the characteristics of free standing coil spring isolators per the vibration isolation section of this specification, for equipment which is subject to load variations and/or large external forces.

2. Housing assembly shall be made of fabricated steel members and shall consist of a top load plate complete with adjusting and leveling bolts, adjustable vertical restraints, isolation washers, and a bottom load plate with internal non-skid isolation pads and holes for anchoring the housing to the supporting structure. Housing shall be hot dipped galvanized for outdoor corrosion resistance. Housing shall be designed to provide a constant free and operating height within 1/8".

3. The isolator housing shall be designed to withstand the project design.

4. Coil spring elements shall be selected to provide static deflections as shown on the vibration isolation schedule or as indicated or required in the project documents. Spring elements shall be color coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy powder coated and shall have a minimum of 1,000 hour rating when tested in accordance with ASTM B-117.

5. Spring isolators shall be Model FLSS as manufactured by Kinetics Noise Control, or by other listed manufacturers who can meet the requirements as specified herein.

D. Type E: All Direction Neoprene Isolator:

1. Vibration isolators shall be neoprene, molded from oil resistant compounds, designed to operate within the strain limits of the isolator so to provide the maximum isolation and longest life expectancy possible using neoprene compounds. Isolators shall include encapsulated cast-in-place top steel load transfer plate for bolting to equipment and a steel baseplate with anchor holes for bolting to the supporting structure. Ductile iron or cast aluminum components are not acceptable alternatives and shall not be used due to brittleness when subjected to shock loading.

2. Isolator shall be capable of withstanding the design loads in all directions with no metal-to-metal contact.

3. Isolator shall have minimum operating static deflections as shown on the project vibration isolation schedule or as otherwise indicated in the project documents and shall not exceed published load capacities.

4. Neoprene isolators shall be as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as specified herein.

E. Type F: All Direction External Snubber Assembly:

1. Equipment shall be restrained against excessive movement during.

F. Type J: Cable Restraints for Suspended Piping:

1. Wire rope cable restraints shall consist of steel wire strand cables, sized to resist loads, arranged so to offer restraint capabilities for piping, ductwork, and suspended equipment in all lateral directions.

2. End connection fittings shall be designed to swivel in order to ensure proper cable alignment and to avoid bending of rope. Protective thimbles shall be used at connection points so to eliminate bending cable across sharp edges.

3. Anchoring hardware at each end of the cable shall be designed so to exceed the working project design load of the wire cable by a minimum of 50 percent.

4. Cable restraints shall be as manufactured by Kinetics Noise Control, or by other listed manufacturer's who can meet the requirements as specified herein.

PART 3 - EXECUTION

3.1 GENERAL

A. All mechanical equipment scheduled on the drawings shall be isolated from building structure by means of resilient vibration and noise isolators supplied by a single manufacturer to the Contractor. The isolator manufacturer shall submit a tabulation of the design data on the isolators including spring O.D., free operating and solid heights of

springs, free and operating heights of neoprene isolators. Static deflection scheduled is the minimum acceptable and represents the static deflection required based on the combined weight of the equipment; motor bases and any other accessories specified in the mechanical equipment schedule. Isolation bases shall be furnished by the Vibration Isolator Manufacturer. Vibration isolation system shall have a maximum lateral motion under equipment start-up and shutdown conditions of 1/4-inch. Restrain excess motion by spring type mountings. Connections to equipment shall allow for deflections equal to or greater than equipment deflections.

B. Restraints shall be in accordance with the State of Arizona requirements and the International Building Code.

C. The Contractor shall coordinate the installation of the vibration isolation and restraint devices with all trades and Sub-Contractors. Contractor shall verify with the Engineer that the devices and supports are adequate as intended and do not overload the building structural components in any way. The exact method and means of connection of the mechanical system to the building structural system shall be reviewed by the Engineer.

D. Installation of all restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions.

E. Upon completion of installation of all restraint materials and before start-up of restrained equipment, all debris shall be cleaned from beneath all protected equipment, leaving equipment free to contact snubbers.

F. No rigid connections between the equipment and the building structure shall be made which degrades the restraint system herein specified. All electrical conduit to restrained equipment shall be looped to allow free motion of equipment without damage to the electrical wiring.

3.2 EQUIPMENT CONNECTIONS

A. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified.

B. Electrical circuit connections to isolated equipment shall be looped to allow free motion of isolated equipment; see Division 26.

C. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.

3.3 EQUIPMENT ISOLATORS

A. The minimum operating clearance between the equipment frame or the equipment vibration base frame and the housekeeping pad or floor shall be 1".

B. The equipment vibration base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.

C. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks to the isolator. When all isolators are properly adjusted, the blocks or shims shall be free and shall be removed.

D. Isolator static deflection shall be (minimum) as specified or scheduled on the Drawings.

E. Position all corner or side restraints with equipment operation for proper operating clearance and weld or bolt restraint to anchor plates in housekeeping pad.

F. Install equipment with flexibility in piping and wiring connections.

G. Verify all installed isolators and mounting systems permit equipment motion in all directions.
Adjust or provide additional resilient restraints to limit start-up equipment lateral motion to 1/4".

H. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators or seismic restraints.

3.4 RESTRAINT FOR PIPING

A. Restrain all piping listed below. Use cable restraints for all piping supported by vibration isolation hanger assemblies, including:

1. All piping located within mechanical equipment and service rooms equal to or greater than 1-1/4" in inside diameter.
2. All other piping equal to or greater than 2-1/2" in inside diameter.

3.5 PIPING AND CONDUIT EXCLUSIONS

A. Per the IBC (International Building Code), piping which have diameter or cross-sectional areas less than those noted herein do not require additional restraint over and above the normal suspension hardware

3.6 INSPECTION

A. The Contractor shall notify the local representative of the restraint materials manufacturer's representative prior to installing any restraint devices. The Contractor shall seek the representative's guidance in all installation procedures.

B. The local representative of the restraint and snubber materials manufacturer shall conduct periodic inspections, minimum of monthly during construction period for equipment, piping and ductwork restraint system installation. Inspection reports shall be in writing to the Contractor any deviations from good installation practice observed. These reports shall be forwarded to the Engineer for review.

C. On completion of installation of all restraint and vibration isolation devices herein specified, the vibration isolation manufacturer shall inspect the completed system and submit an inspection report to the Engineer. This report shall identify any installation error, improperly selected isolation devices, or other problems that could affect the performance of the system. The manufacturer's report shall include recommendations for any actions required to properly complete the vibration isolation and restraint work. The cost of the inspection shall be included in the contractor's bid price.

D. The installing Contractor shall submit a final report to the Project Engineer, including the manufacturer's representative's final report, certifying that all restraint material has been properly installed, or steps to be taken by the Contractor to properly complete the restraint work per the specifications.

END OF CSI NUMBER

SECTION 920-2 - PLUMBING

CSI NUMBER 22 05 49

PLUMBING AND ELECTRICAL INSTALLATION COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED CSI DIVISIONS AND CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Results for Plumbing.
B. See CSI Division 26, for Electrical.
C. See CSI Division 28, for building fire alarm.

1.3 SCOPE

A. It is the intention of this CSI number to summarize the coordination of effort defined in the related CSI numbers and CSI divisions of this specification.

B. If there is a conflict between this CSI number and other CSI numbers and CSI Divisions of this specification, this CSI number shall be the governing and decisive CSI number.

C. Make all connections to motors and controls for equipment supplied and/or installed under CSI Division 15 according to Table 1 on the following page.

PART 2 - PRODUCTS

A. Not Applicable

PART 3 - EXECUTION

A. INSTALLATION

1. No work shall be performed until the reviewed and marked submittal data has been reissued to the Contractor unless written permission is obtained from the Architect.

TABLE 1

Item or System	Note	Supplied By (3)	Installed By (3)	Powered By	Control Field Wiring By
Equipment Motors		Div. 22	Div. 22	Div. 26	N/
Motor Control Center Including Starters, Pilot Lights, Heater, Switches, Auxiliary Contacts, and Internal Control Wiring		Div. 26	Div. 26	Div. 26	Div.23
Stand Alone Motor Starters (outside motor control centers)	(1)	Div. 26	Div. 26	Div. 26	Div. 23
Variable Frequency Drives (VFD's)		Div. 22	Div. 22	Div. 26	Div. 23
Fused and Non-Fused Disconnects	(1)	Div. 26	Div. 26	Div. 26	N/
Control Relays & Control Transformers	(1)	Div. 22	Div. 22	Div. 26	Div. 23
Boilers & Domestic Water Heaters		Div. 22	Div. 22	Div. 26	Div. 23
Pressure Booster Pump Systems		Div. 22	Div. 22	Div. 26	Div. 23
Water Softeners & Other Process Water Equipment		Div. 22	Div. 22	Div. 22	N/A
Facility Management System (FMS) for Automatic Control and/or Monitoring of Plumbing System & Equipment	(2)	Div. 23	Div. 23	Div. 26	Div. 23
Medical Gas System - Alarm Panels, Sensors, Pressure Switches	(3)	Div. 22	Div. 22	Div. 26	Div. 22

TABLE NOTES:

1. Unless specified to be supplied with the equipment

2. CSI Division 26 shall coordinate with CSI Division 23, FMS Contractor as required to provide 120 VAC power to each mechanical space and the central plant as necessary for the FMS and as shown on the drawings. Any additional power, transformers, and distribution shall be provided by the Section or Division indicated.

3. CSI Division 22 indicates the plumbing contractor or their designated representative including equipment suppliers, sub-contractors, etc.

END OF CSI NUMBER

SECTION 920-2 - PLUMBING

CSI NUMBER 22 07 00

PLUMBING INSULATION

PART 1- GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

B. The Midwest Insulation Contractors Association and Industrial Insulation Standards, Latest Edition, shall be utilized as a standard for the work provided under this specification.

C. Materials shall conform to applicable ASTM standards.

1.2 RELATED CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Requirements for HVAC.
B. See CSI number 22 05 04, for Pipe and Pipe Fittings.

1.3 SCOPE

A. Domestic hot water pipe, circulating hot water, domestic cold water piping.

1.4 FITTINGS

A. All fittings except as otherwise specified, shall be insulated with the same material and thickness as specified for the pipe.

1.5 TESTING

A. All piping shall be tested in accordance with the applicable Specification CSI numbers, before any insulation is applied.

PART 2 - PRODUCTS

2.1 INSULATION

A. Insulation shall be as manufactured by Owens-Corning Fiberglas, Knauf, CertainTeed, Johns Manville, or Armstrong, or equivalent, and shall be equal to that specified below. Insulation and all materials on the interior and exterior surfaces of pipes, shall have a composite fire and smoke hazard rating not exceeding: Flame spread - 25; fuel contribution - 50; smoke developed - 50, as determined in accordance with ASTM Standard E-84. All insulation materials used for valves and fittings shall have the same ratings as the pipe insulation. Information must be submitted by means of manufacturer's literature showing that the proposed materials conform to above specification without exception.

B. Elastomeric foam insulation for piping and equipment shall be flexible, cellular, molded or sheet, conforming to ASTM C534, with 'K' factor of 0.28 at 75^0F., maximum service temperature of 220^0F., maximum flame spread rating of 25 and maximum smoke development rating of 50 (3/4" thickness and less). Connections shall be made using manufacturers approved waterproof vapor barrier retarder adhesive. Provide outdoor U.V. protective coating on all insulation exposed to ambient conditions.

2.2 FITTINGS

A. Valves and fittings, where required to be insulated, shall be covered with the same insulation material and thickness as specified for the pipe insulation and finished with PVC covers.

B. Valves and fittings with systems specified to be covered with metal or canvas, or polyvinyl chloride (PVC) jacket shall be covered with material to match piping system jacketing.

2.3 PIPE HANGERS AND SUPPORTS

A. See Specification CSI number 22 05 04 for requirements associated with hangers and supports for piping systems.

B. All insulated piping systems shall be provided with individual hangers sized to encircle the insulation. Hangers for domestic cold water may be installed under the insulation, provided that the vapor barrier system for cold piping and the hanger rods are protected from the formation of condensation by application of a heavy coating of vapor barrier mastic material.

C. Insulated piping supported by means of trapeze hangers or roller type hangers shall not rest directly on the hanger or support.

D. The insulation at hangers, trapezes and supports shall be protected by means of galvanized steel insulation half diameter support shields. Factory fabricated thermal pipe shield, and specified in CSI number 22 05 04, shall be used.

2.4 PIPE SLEEVES

A. See Specification CSI number 22 05 04 for requirements associated with pipe sleeves for piping penetrations for building walls and frames.

B. Pipe sleeves shall be provided at penetrations through concrete and masonry construction and at fire rated and smoke rated walls and penetrations when required to comply with U.L. approved penetration assembly. Insulated piping passing through fire walls and smoke walls shall be provided with U.L. approved fire safing insulation to match the required insulation thickness and the space between the piping penetration and the adjacent wall construction shall be sealed air tight with U.L. approved fireproof caulking material. Pipe penetration arrangement and installation requirements shall match the applicable U.L. approved penetration assembly details.

PART 3 - EXECUTION

3.1 DOMESTIC HOT WATER PIPING

A. Domestic hot water piping with operating temperatures of 140^0F and less, shall be insulated with 3/4-inch thick elastomeric insulation. Fittings shall be finished with PVC fitting covers.

3.2 DOMESTIC COLD WATER

A. Domestic cold water piping shall be insulated with 3/4-inch thick elastomeric insulation. Fittings shall be finished with PVC fitting covers. Cold water piping installed within interior partitions, not less than 10 feet from an exterior wall, and where no return air is present, need not be insulated.

3.3 HANDICAP LAVATORY

A. Domestic hot and cold water piping and P-traps exposed below handicapped lavatories shall be insulated per CSI number 22 40 00 to satisfy ANSI A117.1 requirements. Insulation shall have a flexible vinyl finish which protects against burning and cushions impact.

3.4 TERMINATION OF INSULATION

A. The termination of all insulation on pipes, at uninsulated valve connections, or unions, flexible connections, etc., shall be beveled and finished.

3.5 FACTORY INSULATED EQUIPMENT

A. Domestic water hot water heaters and other equipment as specified in the equipment schedules on the drawings shall be factory insulated.

END OF CSI NUMBER

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SECTION 920-2 – PLUMBING

CSI NUMBER 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with the applicable provisions of the General Conditions, Supplementary Conditions, and the General Requirements.

B. Lead Ban: All piping, solder, and flux used in the installation of piping systems delivering water for human consumption shall be lead free. The term lead free is defined as pipe which does not contain more than 8.0% lead, and solder and flux which does not contain more than 0.2% lead. Solder shall be 95/5 tin antimony, alloy Sb5, conforming to FS QQ-S-571.

1.2 RELATED CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Requirements for Plumbing
B. See CSI number 22 05 04, for Pipe and Pipe Fittings for Plumbing.
C. See CSI number 22 05 05, for Piping Specialties for Plumbing.
D. See CSI number 22 05 23, for Valves for Plumbing.
E. See CSI number 22 07 00, for Plumbing Insulation.

1.3 SCOPE

A. A complete domestic cold water and hot water, including water heaters, pumps, backflow protection**,** shock absorbers, and associated miscellaneous accessories. This section shall include all work within the building to a point approximately 5'-0" outside the building, or as otherwise indicated.

B. Coordinate with CSI Division 2 for site utility drawings and specifications.

PART 2 - PRODUCTS

2.1 PIPING

A. Domestic water piping below grade or slab-on-grade shall be Type K soft copper, ASTM B88. Copper piping 2" and smaller shall be soft tubing and 2-1/2" thru 4" shall be either soft tubing or hard pipe. Domestic water piping 6" and larger below grade within the building and to a point approximately 5'-0" from the building shall be ductile iron pressure pipe, minimum 150 PSIG working pressure with mechanical joints. Wrap all underground copper pipe and fittings with minimum 20 mil polyethylene with minimum 50% overlay, provide for taping.

B. Domestic water piping and non-potable water piping above grade within the building 4" and smaller shall be Type L hard drawn copper, ASTM B88.

C. Proper insulating fittings, as specified in CSI number 22 05 04, shall be installed to

prevent electrolytic action between steel and copper piping connections.

2.2 FITTINGS

A. Fittings for copper piping shall be wrought copper or cast brass conforming to ANSI B16.22 and B16.23, with 95-5 solder joints, as specified in CSI number 22 05 04.

B. Mechanically formed tee connections and couplings for copper piping system as specified in CSI number 22 05 04, may be utilized where approved.

C. Fittings for galvanized steel pipe shall be screwed Class 150, standard galvanized malleable iron conforming to ANSI B16.

D. Fittings for ductile iron pipe shall be flanged or mechanical joint conforming to ANSI/AWWA C110 and C111, Class 250 minimum, cement lined, with bituminous coating.

2.3 JOINTS

A. Joints in copper piping system shall be made using approved "lead-free" solder and flux as described herein and approved by all applicable codes and regulations. Surfaces to be soldered shall be cleaned bright by manual or mechanical means.

B. All joints shall be properly fluxed with a non-corrosive "lead-free" type flux manufactured to approved standards, Federal Specification QQ-S-517. Joints for copper piping systems for cold water 3" and smaller and hot water 2" and smaller shall be made using composition 95-5 tin-antimony solder. Composition 15% silver solder shall be used for all other piping sizes and for all underground joints.

2.4 SHOCK ABSORBERS

A. Furnish and install factory sealed shock absorbers conforming to Federal Specification WW-P-541 at locations shown on the drawings and/or as outlined by Plumbing Drainage Institute Standard WH-201. Josam, Precision, Jay R. Smith, Wade, Watts, Zurn or equivalent.

2.5 DOMESTIC HOT WATER GENERATING EQUIPMENT

A. Water heaters and associated auxiliary equipment shall be as specified on the equipment schedule on the drawings. Electric domestic water heaters shall be as manufactured by Bock, Bradford-White, Lochinvar, P.V.I., Ruud, Rheem, A.O. Smith, State, or equivalent.

B. Furnish and install expansion tank on cold water makeup supply to hot water generating equipment as recommended by manufacturer or as shown on the drawings and specified in the plumbing equipment and fixture schedule on the drawings.

2.6 VALVES

A. Valves other than automatic control valves are specified in CSI number 22 05 23, Valves.

B. Automatic control valves shall be as specified in CSI number 23 09 00, Facility

Management System, except for automatic control valves furnished as a part of equipment packages, including hot water generating equipment, as specified on the equipment schedule.

2.7 PUMPS

A. Pumps shall be of the type and capacity listed in the equipment schedule. Pumps shall be selected so that the motors will not overload under any operating condition. Furnish one spare mechanical seal of each size required in conjunction with the pumps furnished under this Contract. Pumps shall be installed so that they may be removed without the removal of the associated piping. All pumps for potable water applications shall have bronze or stainless steel body and trim.

B. Domestic water inline recirculating pumps shall be as specified on the drawings and as manufactured by Armstrong, Bell & Gossett, Taco, Thrush, or equivalent.

2.8 BACKFLOW PROTECTION

A. All cross-contamination control shall be provided to ensure that no installation of the potable water supply piping system shall be made in a manner that will allow used, unclean, polluted, or contaminated water or substances to enter the domestic potable water system.

B. All backflow devices and assemblies shall be approved by the applicable Administration Authorities and shall be installed according to all applicable codes, regulations, and manufacturer's instructions. Installation shall allow for required access and clearance for required testing, maintenance, and repair.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Piping installation shall conform to the requirements of Section 920-22 05 00, Common Work Requirements for Plumbing and CSI number 22 05 04, Pipe and Pipe Fittings for Plumbing. Installation of specialties shall conform to the requirements of CSI number 22 05 05, Piping Specialties for plumbing.

B. Insulating Fittings: Insulating unions shall be furnished and installed at all connections between dissimilar metals.

C. Valves: Each water service main, branch main and branch to a group of two or more fixtures shall be valved. Stop valves shall be as specified under fixtures.

3.2 STERILIZATION

A. All new water piping shall be charged with a chlorine solution containing not less than 50 PPM available chlorine. The solution shall remain in the piping for a period of 24 hours, during which time valves shall be opened and closed to permit a small flow of the solution. At the end of 24 hours, the solution shall be tested and must contain a residual of at least 5-10 PPM chlorine. The system shall then be drained and flushed to provide satisfactory potable water before the final connection is made to the existing distribution system.

B. The Contractor shall submit a sample of the water, after sterilization and flushing for testing by an approved laboratory. A copy of the acceptable test report shall be submitted to the Architect prior to substantial completion.

3.3 BACKFLOW PROTECTION

A. Protection: All plumbing fixtures, faucets with hose connections, and all other equipment having plumbing connections shall have their water supplies protected against back-siphonage.

B. Testing: Arrange for testing backflow devices as required by the local health authorities.

3.4 TESTS

A. All water piping, hot and cold, shall be made tight under a hydrostatic test pressure of 150 lbs. per square inch and maintained without pressure loss for a minimum of four (4) hours. No caulking of joints will be permitted. Any joint found to leak under this test shall be broken, remade and a new test applied.

END OF CSI NUMBER

SECTION 920-2 – PLUMBING

CSI NUMBER 22 13 00

FACILITY SANITARY SEWAGE

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions and Special Conditions.

B. Furnish and install all concrete, grout, and other required materials to fill all blockouts and/or sleeves left open for this Contractor's convenience or for the installation of this work.

1.2 RELATED CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Results for Plumbing.

B. See CSI number 22 05 04, for Pipe and Pipe Fittings for Plumbing.

1.3 SCOPE

A. Complete soil, waste, and vent system, and associated miscellaneous accessories. This section shall include all work within the building to a point approximately 5'-0" outside the building, or as otherwise indicated.

B. Coordinate with CSI Division 2 site utility drawings and specifications.

C. Plumbing equipment drains.

PART 2 - PRODUCTS

2.1 PIPING

A. Soil, waste, and vent piping below slab on grade shall be service weight cast iron bell and plain end pipe, coated inside and outside, conforming to ASTM A-74 and 87 Standards**.**

B. Soil, waste, and vent piping above grade shall be either service weight cast iron bell and plain end or no-hub pipe, coated inside and outside, conforming to ASTM A-74 and 87 Standards. Vent piping 2" and smaller above grade may be Schedule 40 galvanized steel.

C. No-hub cast iron pipe shall conform to CISPI Standard 301 and shall be marked with CISPI Label.

2.2 FITTINGS

A. Fittings for cast iron sanitary soil, waste and vent piping system shall be service weight or no- hub cast iron drainage pattern conforming to ASTM C564. Fittings shall be provided to match the required piping system.

B. Fittings for galvanized steel vent system shall be galvanized malleable iron conforming to ANSI B16.4. Fittings for galvanized steel soil and waste piping shall be galvanized drainage pattern.

B. No-Hub pipe fittings shall comply with CISPI Standard 301 and shall be marked with CISPI Label.

2.3 JOINTS

A. Joints for cast iron pipe and fittings shall be suitable to match the required piping system and shall be either lead and oakum, double seal compression-type molded neoprene gaskets conforming to ASTM C-564 Standards, and suitable for the class of pipe being jointed, with adhesive type joint lubricant. No-hub coupling shall be minimum four (4) band type with neoprene gasket material conforming to ASTM C-564, and 0.008-inch minimum, Type 304 stainless steel shear ring. Couplings shall be Tyler, Huskey, Clamp-All, Mission, Iron Clad, or equivalent.

2.4 PLUMBING EQUIPMENT DRAINS

A. Equipment drain lines shall be either Schedule 40 galvanized steel pipe with galvanized malleable iron fittings or Type M copper tubing with wrought solder fittings. Provide a dielectric union at all connections between ferrous to copper materials.

2.5 DRAINS

A. Floor drains and floor sinks shall be Josam, Jay R. Smith, Wade, Watts, Zurn, or equivalent, as specified on the drawings, and compatible with the required piping systems.

2.6 TRAPS AND TAILPIECES

A. Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel, not less than 20 gauge and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal to metal or metal to plastic type as required for the application. Outlet shall be threaded or socket for solder joint connection as required by the application. Tailpiece shall be copper-alloy to match P-trap. Furnish cast brass wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated. Underground P-traps shall be coated cast iron as required by the application.

B. Traps and associated trim shall be furnished by the plumbing fixture manufacturer as specified in CSI number 22 40 00 and in the Fixture Schedule on the drawings, or shall be as manufactured by Dearborn, EBC, McGuire, T & S Brass, or equivalent.

2.7 SUMP PUMPS

A. Sump pumping systems shall be furnished and installed of the capacity and arrangement specified in the pumping fixture and equipment schedule and detailed on the drawings. Pumps shall be submersible type, electric driven, complete with all required safety and operating control systems, including magnetic starters, disconnects, hand-off-auto control switches, pilot lights, control transformers, relays, and interlocks installed within a NEMA approved system control panel. Furnish pump water level control float type switches, field adjusted to start and stop pumps at required operating water levels. Pump discharge piping for each pump shall be installed above the floor for service and maintenance, and the discharge piping shall be provided with a union or flange connection, a non-clog check valve, and service shut-off valve located accessibly near the pumps. Aurora, Hydro-Matic, Weil or equivalent.

2.1 CLEANOUTS

A. Cleanouts shall be as manufactured by Zurn, Jay R. Smith, Watts, Wade, or Josam, and shall be of the same size as the pipe, except that cleanout plugs larger than 4 inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarter-bend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings. A standard cleanout fitting, with polished bronze top shall be caulked into the hub of the fitting and finished flush with the floor. Where cleanouts in connection with threaded pipe are shown and are accessible, they shall be cast iron drainage T-pattern, 90-degree branch fittings with square head brass screw plugs of the same size as the pipe up to and including 4 inches. Wall cleanouts in finished areas with polished stainless steel or chrome plated metal cover.

B. Install cover flush with grade (outside) to avoid tripping hazard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping installation shall conform to the requirements of CSI number 22 05 00, Common Work Requirements for plumbing, and CSI number 22 05 05, Pipe and Pipe Fittings for Plumbing. Installation of specialties shall conform to the requirements of Section 15080, Piping Specialties.

B. All soil, waste, and vent piping shall be properly graded and installed in strict accordance with all applicable codes and requirements.

C. Make all changes in direction of drainage piping by use of 45-degree wyes, long turn tee wyes, long sweep quarter bends, sixth, eighth or sixteenth bends. Short turn sanitary tees permissible on horizontal to vertical where space conditions require.

3.2 DRAINS

A. All floor drains, and floor sinks shall be installed with grates square with building lines and with the top of grates installed level with adjacent finished floor.

B. The Contractor shall extend drain lines from all equipment requiring drainage, relief valves, and drain pans to the nearest floor drain or floor sink and shall terminate indirectly with a minimum clearance of one (1) inch or as otherwise required by applicable codes and standards. Relief valve drain lines shall be extended to the nearest floor drain and shall be equal in size to relief valve outlet port.

3.3 TESTS

A. The sanitary soil waste and vent system and condensate drain system shall be tested by filling system with water. System shall remain filled with no loss of water for a minimum of 2 hours. The system water test shall be applied to the drainage and vent systems either in its entirety or in sections. Preliminary testing shall be accomplished as necessary prior to final test.

B. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than ten (10) feet of water. In testing successive sections, at least the upper ten

(10) feet of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost ten feet) of the system shall have been submitted to a test of less than a ten (10) foot head of water. The system shall then be tight at all points.

END OF CSI NUMBER

CSI NUMBER 22 15 00

GENERAL SERVICE COMPRESSED AIR

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Materials and operations required for the installation of piping systems, including: compressed air, fittings, filter /dryer, air regulator, valve equipment, joints and tests.

B. Materials shall be as described in these specifications.

1.2 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME Code for Pressure Piping, ANSI/ASME B3.

B. Employ welders certified in accordance with ASME Section IX, as modified by ANSI/ASME B31, Pressure Piping.

C. Brazing: Certify brazing procedures, braziers, and operators in accordance with ANSI/ASME B31 for shop and jobsite brazing of piping work.

D. Soldering: Shall conform to Section 117 of ANSI/ASME B31 for shop and jobsite brazing of piping work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The firms mentioned in the following Materials Section are of acceptable type, quality and performance.

2.2 MATERIALS FOR COMPRESSED AIR SYSTEMS (FOR 150 PSIG)

A. Piping: Schedule 40 black steel, seamless Type S or welded Type E, ANSI/ASTM A53, Grade A or B; or Type L hard drawn copper tubing, ASTM B88.

B. Fittings:

1. 1-1/2 Inches and Smaller: Class 300 banded malleable iron, screwed, ANSI B16.3; or wrought copper and bronze solder-joint ANSI B16.22.

2. 2 to 2-1/2 Inches: Class 300 banded malleable iron, screwed, ANSI B16.3; or wrought copper and bronze solder-joint ANSI B16.22.

C. Underground piping shall be installed in polyvinyl chloride (PVC) protection sleeve pipe, Schedule 80, conforming to ASTM D1785

s:

1. Gate:

   a. Screwed: Class 150 bronze, rising stem inside thread union bonnet.

   b. Solder-Joint: Class 150, bronze, bolted bonnet, rising stem.

2. Globe:

   a. Screwed: Class 10 bronze, rising stem union bonnet.

   b. Solder-Joint: Class 150, bronze, union bonnet, rising stem.

3. Plug: Check and Relief Valves: 316 stainless and brass.

4. Ball:

   a. Screwed: Class 150, union swing-put body, bronze.

   b. Solder-Joint: Class 150, union swing-out body, bronze.

2.3 EQUIPMENT

A. General: All major items of equipment required for installation on this contract shall be as specified on the applicable contract drawing and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.

B. Compressed Air Receivers: Shall conform to the ASME Code requirements for unfired pressure vessels and shall be National Board certified and so stamped. Receiver shall be equipped with shut-off valve, ASME rated safety relief valve, automatic drain valve, manual bypass drain valve, pressure gauge with cock, pressure switch and any other appurtenances required for satisfactory operation. Size and capacity shall be as listed on the drawings.

C. Safety Relief Valves: Shall be ASME constructed. Size, capacity and setting shall be as indicated on the drawings. Discharge from safety relief valves shall be piped full size and extended to the outside of the building structure such that passers-by cannot be injured when it discharges, unless otherwise shown on the drawings.

D. Thermometers and Test Wells: Thermometers shall be as specified on the drawings. Thermometer test wells shall be equal to Trerice test well with stainless steel socket, plug, and chain, and of proper length for the pipe installed in.

E. Gauges: Gauges shall be as specified on drawings. Gauges shall be installed with a 1/4" bronze shutoff valve.

F. Air Vents: Air vents shall have brass bodies and all non-ferrous internals. Shall be capable of accepting 1/4" O.D. copper tubing.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General: Piping installation shall be coordinated with respect to space available with heating,

ating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

B. Reducers: Reduction in pipe shall be made with one-piece reducing fittings. Forged bushings will be acceptable ONLY when there is no room for reducing couplings or swagged nipples and the reduction of at least two pipe sizes.

C. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union pressure classes and end connections shall be the same as the fittings used in the lines with the unions.

1. Steel Unions: Shall have hardened stainless steel seating surfaces on both faces.

2. Dielectric Unions: Shall be used to join two dissimilar materials but must comply with ANSI/ASTM B31.1, Power Piping.

D. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above unless shown otherwise.

E. Hangers and Anchors:

1. All piping shall be rigidly supported from the building structure by means of adjustable ring-type hangers. (WELDING TO BUILDING STRUCTURE WILL NOT BE PERMITTED.) Where pipes run side by side, support on rod and angle iron or Unistrut trapeze hanger. Hanger spacing shall be as follows:

Steel Piping	Maximum Spacing
1" and under	7'-0"
1-1/4" through 4"	10'-0"

Copper Piping	Maximum Spacing
3/4" and under	6'-0"
1" through 1-1/2"	8'-0"
2" and larger	10'-0"

2. Round rods supporting the pipe hangers shall have the following dimensions:

1/2" to 2" pipe	3/8" rod
2-1/2" to 3" pipe	1/2" rod

3. Rods for trapeze hangers shall be a minimum of 3/8 inch and shall have the equivalent cross section listed above per pipe supported. The use of pipe hooks, chains, perforated iron strapping or wire for pipe supports will not be permitted.

4. Insulated pipes shall be protected using a galvanized steel shield similar to Grinnell
Figure 186 galvanized steel shield by Pipe Shields Incorporated.

5. Hanger rods shall be galvanized carbon steel per ASTM A307, Grade B, threaded per ANSI B1.1 coarse thread series, Class 2A fit:

a. Hanger rods shall have a minimum 6" threaded ends.

b. All hanger rod connection shall use double nut fastening.

6. Place a hanger within one foot of each horizontal elbow.

7. Use hangers which are vertically adjustable 1-1/2" minimum after pipe is erected.

8. Use copper straps on copper pipe and ferrous hangers on ferrous pipe.

9. Fasten vertical pipes to rigid structural members at 10'-0" maximum spacing.

F. Piping Equipment Supports and Fastenings: Fixtures and equipment shall be supported and fastened in a satisfactory manner, including suitable backing for all hanging fixtures and equipment. Bolt and nuts shall be hexagon. Fixtures or equipment shall be attached to concrete with expansion bolts.

G. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The Contractor may be required to disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions.

H. Joints:

1. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1. Care shall be taken that the inside of the pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.

2. Solder-Joints: All solder joints for copper tubing shall be made with 95-5 tin antimony solder with the following exceptions:

a. Silver solder shall be used for compressed air service greater than 60 PSIG.

b. Solder containing antimony SHOULD NOT be used to join metals containing zinc (e.g., galvanized iron galvanized steel, and brass).

c. The joint to be soldered should be prepared as follows:

1) Cut tube ends square. Ream, remove burrs and size.

2) Use sand cloth or steel wire brush to clean surfaces to be joined. Steel wool IS NOT permitted.

d. When joining a solder end valve ensure valve is fully open. Apply heat to tube first. Transfer as much heat as possible through the tube to the valve. Avoid prolonged heating of valve. Use a non-corrosive past flux and solid wire solder suitable for the service temperatures and pressures expected. Stay within the limitations stated above.

e. Silver-solder (brazed) Joints: Shall be made with copper alloy containing at least 45% silver. Joints shall comply with ANSI/ASME B31, Pressure Piping.

f. In all instances, the pressure rating of the solder joints shall be greater than the maximum working pressure of the systems as shown in Table 3.03.

3. Welded Joints: All pipe surfaces shall be thoroughly cleaned before welding. Each joint, except socket-weld joints, shall be beveled before being welded. The Contractor shall provide an approved non-asbestos mat or blanket to protect the structure and adequate fire protection equipment at all locations where welding is done. All elbows shall be long radius. Welding sockets or weld-o-lets may be used in lieu of reducing outlet tee for branch connections up to one-half the size of the main run. On connections larger than one-half the size of the main run, welding tees shall be used. The use of fittings formed from welded pipe section WILL NOT BE PERMITTED.

3.2 TABLE 3.03, PRESSURE RATINGS OF SOLDER JOINTS (ASA B16.18)

MAXIMUM WORKING PRESSURE, PSI

Solder used in Joints	Working Temperatures, Degree F.	incl.*	incl.*	incl.*
95-5	100	500	400	300
tin-antimony	150	400	350	275
	200	300	250	200
	250	200	175	150
Solders melting at or above 1100°F	350	270	190	155

* Standard water tube sizes.

3.3 TESTS

A. General: All piping, equipment, and accessories installed under this contract shall be inspected and pressure tested by the Contractor. All labor, material and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying the test. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with compressed air at a sufficient flow rate and period of time to ensure complete cleaning of the line of all dirt, scale, and foreign matter. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Testing: Compressed air piping shall be tested using compressed air, as indicated at the test pressures specified and shall show no drop in pressure in a two (2) hour period; leaks shall be located by soap testing.

C. Test Pressures: Unless otherwise specified, test pressure shall be 1-1/2 times the system operating pressure or as noted below.

1. Compressed Air System (150 PSIG): 150 PSIG air.

END OF CSI NUMBER

SECTION 920-2 – PLUMBING

CSI NUMBER 22 40 00

PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and the General Requirements.

1.2 RELATED CSI NUMBERS

A. See CSI number 22 05 00, for Common Work Requirements for Plumbing.
B. See CSI number 22 05 04, for Pipe and Pipe Fittings for Plumbing.
C. See CSI number 22 11 00, for Facility Water Distribution.
D. See CSI number 22 13 00, for Facility Sanitary Sewage.

PART 2 - PRODUCTS

2.1 FIXTURES AND EQUIPMENT

A. Vitreous china and enameled cast iron water closets and lavatories by American Standard, Kohler, Eljer, or equivalent as listed and described in the plumbing fixture schedule on the drawings. All vitreous china and enameled cast iron fixtures shall be white, unless otherwise indicated on the drawings. The material used for plumbing fixtures shall be of non-absorptive, acid-resistant vitreous china, enameled cast iron or stainless steel, and free from all imperfections. Each water service main, branch main, riser and branch to a group of fixtures shall be valved or as otherwise shown on the drawings to provide more stringent requirements. Stop valves shall be provided at each fixture. One piece chrome plated escutcheons shall be installed on all water piping and trap connections at walls or base cabi- nets. All exposed connecting piping and material shall be chrome plated. Refer to plans for flush valves.

B. Vitreous china and enameled cast iron waterless urinals by Sloan, Waterless Corp., Zurn or equivalent as listed and described in the plumbing fixture schedule on the drawings. All vitreous china and enameled cast iron fixtures shall be white, unless otherwise indicated on the drawings. The material used for plumbing fixtures shall be of non-absorptive, acid-resistant vitreous china, enameled cast iron or stainless steel, and free from all imperfections.

C. Handicap accessible lavatories and counter mounted sinks shall have exposed supply and waste services insulated with rigid, molded insulation kits as manufactured by T.C.I. "Skal-Gard", Brocar "Trap Wrap", True-Bro "Handi Lav-Guard", McGuire "Prowrap", or equivalent.

D. Closet seats shall be furnished for water closets as specified on the Plumbing Fixture Schedule on the drawings. Closet seats shall be white unless otherwise required to match water closet. All closet seats shall be of smooth non-absorbent material and shall be properly sized for the water closet bowl type. All closet seats for fixtures for public use, shall be open-front type without cover. Water closet seats provided for handicapped fixtures shall meet all handicapped requirements. Water closet seats shall be furnished by the plumbing

fixture manufacturer as specified on the Fixture Schedule on the drawings, or shall be as manufactured by Bemis, Beneke, Church, Olsonite, Sperzel, or equivalent.

E. Floor mounted mop sinks and shower floors shall be as specified on the Plumbing Fixture Schedule on the drawings, molded stone or terrazzo, size and arrangement as shown on the drawings, as manufactured by Fiat, Stern-Williams, Mustee, Designer's Choice, or equivalent.

F. Stainless steel sinks shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Kohler, American Standard, Elkay, Just, Designers Choice, or equivalent.

G. Electric water coolers (EWC) and drinking fountains shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Elkay, Haws, Halsey Taylor, Oasis, Sunroc, or equivalent.

H. Hose bibbs and wall hydrants shall be as specified on the Plumbing Fixture Schedule on the drawings and as manufactured by Zurn, Jay R. Smith, Wade, Woodford, Acorn, Chicago, T&S Brass, Watts, or equivalent. Handles, if specified shall be constructed of metal or brass and finished to match valve unit.

I. Shower valves and mixing valves shall be as specified on the Plumbing Fixture Schedule on the drawings, and as manufactured by Powers, Leonard, Lawler, Speakman, Symmons, Bradley, or equivalent.

J. Emergency fixtures including showers and eyewash shall be as specified on the Plumbing Fixture Schedule on the drawing and as manufactured by Bradley, Chicago, Haws, Speakman, Western, Guardian, or equivalent.

2.2 FAUCETS

A. Plumbing fixture faucets shall be brass construction and fully chrome plated, unless special finish is specified on the Plumbing Fixture Schedule on the drawings. Faucets shall be furnished complete with all accessories required for the necessary application, including aerators, handles, spouts, and operating cartridges. Contractor shall coordinate exact faucet requirements with required fixture drilling and water and waste rough-in. Faucets for handicapped fixtures shall meet all handicapped and ADA requirements, including a maximum of five (5) pounds of force to activate controls and adjustable metering faucet water flow duration of ten (10) seconds, minimum.

B. Plumbing fixture faucets shall be furnished by the fixture manufacturer as specified in the Plumbing Fixture Specification on the drawings and Paragraph 2.1 herein, or shall be as manufactured by Chicago, Delta, Speakman, T&S Brass, or equivalent, and shall be commercial grade.

2.3 PLUMBING FIXTURE TRIM

A. Plumbing fixture trim including P-traps, supplies and strainers shall be furnished by the manufacturer as specified in the plumbing fixture specification on the drawings and Paragraph 2.1 herein, or shall be as furnished by Chicago, Brass Craft, McGuire, T&S Brass, EBC, or equivalent.

B. Unless otherwise specified, traps shall be copper-alloy adjustable tube-type with slip joint inlet and swivel, not less than 17 gauge and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal-to-metal or metal-to-plastic type as required for the application. Outlet shall be threaded

or socket for solder joint connection as required by the application. Tailpiece shall be copper-alloy to match P-trap. Furnish brass or copper wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall provide all necessary supports and connection materials and trim for plumbing fixtures as required to assure a complete properly installed and operating system. Installation shall be in accordance with manufacturer's recommendations and with International Building Code and International Plumbing Code requirements. The Contractor shall caulk fixtures to the adjacent wall, floor and countertop construction with non-shrink, mildew resistance caulking material.

3.2 EQUIPMENT/FIXTURE SUPPORT

A. Furnish and install all "back-up" materials for fixtures and accessories, or as otherwise required by the equipment schedule to properly support and provide a sturdy installation.

3.3 FIXTURE CARRIERS

A. Fixture carriers shall be provided for all wall hung plumbing fixtures, including water closets, urinals, lavatories, sinks, etc., as manufactured by Josam, Jay R. Smith, Watts, Wade, Zurn, or equivalent. Carriers shall be bolted to the floor using all of the support bolts recommended by the manufacturer. Where the water closet nipple and studs extend beyond the maximum carrier recommended length, provide additional carrier support as recommended by manufacturer. Water closet carriers shall be horizontal or vertical, single or back-to-back units as required for the fixture installation and piping arrangement, and shall be adjustable.

B. Single water closet carriers shall have factory installed rear hold down lugs and anchor foot to provide cantilever support.

C. Wall hung urinals shall be provided with floor mounted fixture carrier complete with upper and lower fixture support plates as required to match fixture installation requirements.

D. Wall hung lavatories and sinks shall be provided with floor-mounted concealed arm type chair carriers, single or double (back-to-back) units as required for the fixture installation and arrangement.

E. Contractor shall be responsible to provide the proper arrangement and selection of fixture carriers required for fully concealed installation in the available plumbing chase and/or wall construction.

3.4 FIELD MEASUREMENTS AND COORDINATION

A. Exact location and rough-in requirements shall be carefully coordinated. Contractor shall refer to drawings and specifications, and shall check manufacturer's data, shop drawings and rough-in drawing submitted under CSI Division 22 and other CSI Divisions of this specification and make all field measurements to the extent necessary to ensure his understanding of the work required to provide for complete rough-in installation.

3.5 CLEANING

A. All fixtures shall be thoroughly cleaned before final acceptance of the work.

END OF CSI NUMBER

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SECTION 920-3 – MECHANICAL

CSI NUMBER 23 05 00

COMMON WORK REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. See General Conditions and Supplementary Conditions.
B. The requirements listed under General Conditions and Supplementary Conditions and the General Requirements are applicable to this section and all subsequent sections of CSI Division 23 and form a part of the contract.
C. See CSI Division 22 for Plumbing Systems.
D. See CSI Division 26 for Electrical Systems.
E. All electrical work, regardless of voltage which is provided under CSI Division 23 shall comply with the requirements of the National Electric Code (NEC) and CSI Division 26.

1.2 HEATING, VENTILATING & AIR CONDITIONING (HVAC) CSI DIVISION INDEX

CSI Number 23 05 00	Common Work Requirements for HVAC
CSI Number 23 05 03	Trenching & Backfilling
CSI Number 23 05 04	Pipe & Pipe Fittings
CSI Number 23 05 49	HVAC and Electrical Installation Coordination
CSI Number 23 05 93	Testing, Adjusting and Balancing
CSI Number 23 09 00	Facility Management System
CSI Number 23 30 00	HVAC Air Distribution Systems and Equipment

1.3 CODES AND PERMITS

A. The HVAC work shall be performed in strict accordance with the applicable provisions of the International Building Code, 2018 Edition; the International Plumbing Code, 2018 Edition; the International Mechanical Code, 2018 Edition and the International Fire Code, 2018 Edition as adopted and interpreted by the State of Arizona, and the National Fire Protection Association (NFPA Regulations), current adopted edition, regarding fire protection, heating and ventilating and air conditioning systems and electrical systems. All materials and labor necessary to comply with rules, regulations and ordinances shall be provided. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern. The Contractor shall hold and save the Architect free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.

B. Permits necessary for performance of the work shall be secured and paid for by the Contractor.

C. The following lists some applicable codes and standards that shall be followed.

Applicable county and state mechanical, electrical, plumbing, health and sanitary codes, laws and ordinances.

National Electrical Manufacturer's Association

Standards. National Electrical Code.

Underwriters Laboratories, Inc.

Standards. American National

Standards Institute.

American Society for Testing Materials

Standards. National Fire Protection Association

Standards.

American Society of Mechanical Engineers Boiler and Pressure Vessel

Codes. Occupational Safety and Health Act.

Commercial and Industrial Insulation Standards (MICA).

Applicable publications of Sheet Metal and Air Conditioning Contractors' National
Association, Inc. (SMACNA).

The American Society of Sanitary Engineering

1.4 RECORD DRAWINGS

A. See CSI Division 1, for requirements associated with Project Record Drawings.

B. The Contractor shall be responsible to maintain a complete and accurate set of marked up AS-BUILT Drawings showing information on the installed location and arrangement of all mechanical work, and in particular, where changes were made during construction. The Contractor shall be responsible for keeping record drawings accurate and up-to-date throughout the construction period. Record drawings may be reviewed and checked by the Architect during the construction and in conjunction with review and approval of monthly pay requests. Contractor shall include copies of all addenda, RFI's, bulletins, and change orders neatly taped or attached to record drawing set.

C. After installation and acceptance of direct buried underground piping and service lines in trenches, the Contractor shall take ‘as-built’ measurements, including all depths, prior to commencement of backfilling operations. It will not be sufficient to check offline locations. Definite measurements shall be taken for each service line. The location of buried piping and trench service lines shall be shown on the drawings and dimensioned from fixed points.

1.5 QUALIFICATIONS

A. All mechanics shall be skilled in their respective trade.

B. All welders shall be certified in accordance with the ASME Boiler Test Code, Section IX, latest issue.

1.6 QUALIFICATION PROCEDURES

A. The storage, handling, and transportation of all refrigerants, oils, lubricants, etc. shall be accomplished in strict compliance with all State, local, and Federal Regulations including all requirements set forth by the Environmental Protection Agency (EPA) for the safe handling of regulated refrigerants and materials. The Contractor shall utilize qualified and/or certified personnel and equipment as prescribed by these requirements. In no situation shall any refrigerant be discharged to the atmosphere.

1.7 HAZARDOUS CONDITIONS

A. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operation personnel, shall be cut back and/or protected to reduce the risk of injury.

1.8 SUBMITTALS

A. The Contractor shall submit submittal brochures of all equipment, fixtures and materials to be furnished under CSI Division 23, including but not limited to the following:

1. Materials, certification, shop drawings, and other information as specified in the individual CSI Division 23 Specification Sections within this Specification.

B. Unauthorized Substitutions: If substitute materials, equipment or systems are installed without prior review or are installed in a manner which is not in conformance with the requirement of this Specification and for which the Contractor has not received a written review, removal of all the unauthorized materials and installation of those indicated or specified shall be provided at no change in contract amount.

C. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

D. Expense: All costs for the preparation, correction, delivery, and return of the submittals shall be borne by the Contractor.

E. Submittals and one resubmittal will be reviewed by the Architect/Engineer. If the Contractor fails to provide the required data with his second submittal, he will be charged for the third and subsequent reviews.

F. See CSI Division 1 for additional submission requirements.

G. Complete data must be furnished showing performance, quality and dimensions. No equipment or materials shall be purchased prior to receiving written notification that submittals have been reviewed and marked either "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED". Submittals returned marked "EXCEPTIONS AS NOTED" do not require resubmittal provided that the Contractor agrees to comply with all exceptions noted in the submittal and so states in a letter.

H. Review of Submittals: Submittals will be reviewed with reasonable promptness, but only for conformance with the design concept of the Project and for conformance with the information indicated on the Drawings and stated in the Specifications. Review of a separate item as such will not indicate review of the assembly in which the item functions. Review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents, nor for errors or omissions

in the submittals; or for the accuracy of dimensions and quantities, the adequacy of connections, and the proper and acceptable fitting, execution, functioning and completion of the work. Review shall not relieve the Contractor of responsibility for the equipment fitting within the allotted space shown on the drawings with all clearances required for equipment operation, service and maintenance including minimum clearances required by applicable codes, manufacturer's installation instructions and as necessary for proper clearance in front of all electrical panels as defined by the National Electric Code (NEC). Any relocation of mechanical and/or electrical equipment, materials and systems required to comply with minimum clearances shall be provided by the Contractor without additional cost under the Contract.

I. Shop drawings will be returned unchecked unless the following information is included: cover sheet shall be provided for each submittal of equipment, products and material proposed for use on the project. A common cover sheet for similar equipment (example: all air handling units or all fire protection products) is acceptable. The cover sheet shall list equipment by symbol number; reference all pertinent data in the Specifications or on the drawings; provide size and characteristics of the equipment, name of the project and a space large enough to accept a review stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. Cover sheet shall clearly identify any deviations from the specifications for submitted equipment, products, and materials.

J. Use of substitutions reviewed and checked by the Engineer does not relieve the Contractor from compliance with the Contract Documents. Contractor shall bear all extra expense resulting from the use of any substitutions where substitutions affect adjoining or related work required in this Division or other Divisions of this Specification.

K. If Contractor substitutes equipment for that drawn to scale on the drawings, he shall prepare a 1/4" = 1'-0" installation drawing for each equipment room where a substitution is made, using dimensions of substituted equipment, and including piping, and electrical equipment requirements, to verify that equipment will fit space with adequate clearances for maintenance. This 1/4" = 1'-0" fabrication drawing shall be submitted for review with the shop drawing submittals of the substitution. Failure to comply with this requirement will result in the shop drawings being returned unchecked.

1.9 USE OF CADD FILES

A. Under certain conditions, the Contractor will be permitted the use of the Engineer's CADD files for documentation of as-builts, submittals, or coordination drawings.

B. The Engineer shall be compensated for the time required to format the CADD files for delivery to the Contractor. Such work may include removal of title blocks, professional seals, calculations, proprietary information, etc.

C. The Contractor shall complete the enclosed License, Indemnity and Warranty Agreement, complete with contractor's name, address, and Contractor's Representative signature prior to request for CADD file usage.

1.10 PRIOR REVIEW

A. Prior review of mechanical equipment is required.

B. See Division 1 for additional substitutions and product options requirements.

C. Identification of CSI Division 23 equipment, and materials listed within this specification and in the Equipment Schedules on the drawings, which are identified by Manufacturer's Name, Trade Name, and/or Model Numbers are generally not meant to give preference to any manufacturer but are provided to establish the design requirements and standards. Additional manufacturers judged to be "equivalent" to the specified product may also be listed.

1.11 GUARANTEE-WARRANTY

A. See CSI Division 1 for additional warranties.

B. The following guarantee is a part of the specifications and shall be binding on the Contractor: "The Contractor guarantees that this installation is free from mechanical defects. He agrees to replace or repair any part of the installation which may fail within a period of one year after date established below, provided that such failure is due to defects in the materials or workmanship or to failure to follow the specifications and drawings. Warranty of the Contractor-furnished equipment or systems shall begin on the date the system or equipment is placed in operation for beneficial use of the Owner or occupancy by the Owner, whichever occurs first; such date will be determined in writing, by means of issuing a 'Certificate of Substantial Completion', AIA Form G704", or equivalent.

C. The extent of guarantees or warranties by Equipment and/or Materials Manufacturers shall not diminish the requirements of the Contractor's guarantee-warranty to the Owner.

PART 2 - PRODUCTS

2.1 QUALITY OF MATERIALS

A. All equipment and materials shall be new and shall be the standard product of manufacturers regularly engaged in the production of heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design. Specific equipment, shown in schedules on drawings and specified herein, is to set forth a standard of quality and operation.

2.2 ALTITUDE RATINGS

A. Unless otherwise noted, all specified equipment capacities are for an altitude of **3,650 feet above sea level** and adjustments to manufacturer's ratings must be made accordingly.

2.3 ELECTRICAL SERVICES - MOTORS

A. Each motor, unless otherwise specified, of 3/4 HP and greater shall be designed for operation with 3 phase, 60 Hz, 208 volt electrical service. Unless otherwise specified, motors of 1/2 hp and less shall be designed for operation with single phase, 60 Hz, 120 volt electrical service. Motors shall be 1,750 RPM, squirrel cage, normal starting torque and normal starting current, in accordance with NEMA standards unless otherwise specified. All motors shall comply with the Energy Policy Act of 1992.

B. All T-frame, ODP motors **5** HP and above shall be premium efficiency motors with a minimum power factor of 0.85 on 1800 RPM motors and a minimum efficiency rating in accordance with IEEE Standard 112, Test Method 'B' as scheduled below. In addition, all motors used in conjunction with variable frequency drives shall be premium efficiency.

NEMA EFFICIENCY	
Motor Horsepower	**Efficiency, Minimum**
5	87.5
7-1/2	88.5
10	89.5

C. Motors, including premium efficiency motors shall be manufactured by General Electric Baldor, U.S., Louis Allis (Spartan), Marathon, Reliance Electric, Westinghouse, or equivalent having equal efficiencies.

Special motors as may be necessary by the application and as specified herein and on the drawings include C-FACE, totally enclosed fan cooled (TEFC),explosion-proof, electronically commutated, etc., shall be provided as required and shall be furnished manufacturer's premium efficiency rating for 5 HP and larger.

D. Each motor shall be of the horsepower as specified and suitable for use at an altitude of 3,650 feet. All motors shall have grease lubricated sealed ball bearings. Motors larger than 1 HP shall have a standard grease fitting "Zerk" and a separate grease relief tapping. Motors shall be factory lubricated. Motors shall be commercially dynamically balanced and tested at the factory before shipment and shall be selected for quiet operation. Motors for V-belt drives shall be provided with a cast iron or steel base, with slide rail and adjustable belt tension screw device. The Contractor shall line up motors and drives and place motors and equipment on foundations ready for operation.

E. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall have a service factor of 1.15 with total temperature rise of 65°C in the above conditions. Motors located in areas exceeding 40°C. in the ambient shall be factory rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Unless otherwise specified for a particular application use electric motors with the following requirements.

1. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

2. Polyphase Motors: NEMA Design B, Squirrel cage, induction type. Each two speed motor shall have two separate windings.

3. Rating: Continuous duty at 100% capacity in an ambient temperature of 40°C.

F. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first submit his request for the change and shall then coordinate the change with the Division 26 Contractor and shall pay all additional charges in connection with the change.

2.4 ELECTRICAL WIRING AND CONTROL EQUIPMENT

A. All wiring and conduit shall be furnished and installed as scheduled in CSI number 23 05 49 unless otherwise noted or directed.

B. The Contractor shall coordinate completely with all trades and Sub-Contractors as required to ensure that all necessary components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

2.5 V-BELT DRIVES

A. V-belt drives shall be of fabric and rubber construction of approved manufacturer. Multiple belts shall be matched and all belts shall be adjusted to drive the apparatus properly and to prevent slippage and undue wear in starting. Unless otherwise specified in the Mechanical Equipment Schedule, drive horsepower ratings shall be 150 percent of the specified motor nameplate rating. Motor sheave shall be adjustable unless otherwise specified in the Equipment Schedule on the Drawings. Belt data (for location and size) shall be included with maintenance and O&M data.

2.6 PAINTING

A. All finish painting of HVAC systems and equipment will be under "Painting", unless equipment is hereinafter specified to be provided with factory applied finish coats.

B. All equipment shall be provided with factory applied prime finish, unless otherwise specified.

C. Touch-Up: If the factory finish on any equipment is damaged in shipment or during construction of the building, the equipment shall be refinished.

2.7 BELT AND FAN GUARDS

A. The Contractor shall provide for each V-belt drive a galvanized iron belt guard which shall be constructed around an angle iron frame, securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements. Hinged access doors not less than 6" X 6" shall be provided for access to motors and fan shaft for test purposes. Furnish wire mesh screen cover reinforced with bars or rods for double inlet fans and for all open inlets and outlets for propeller fans, installed so as not to restrict the air flow. All Zerk fittings and oil cups shall be accessible without removing belt guards. All belt guards shall be constructed in accordance with OSHA requirements.

2.8 DUCTWORK SYSTEM IDENTIFICATION

A. Means of Identification: All new piping and duct systems installed and/or modified as part of this project shall be identified by each of the means described below. The Contractor shall provide shop drawing submittal data for proposed labeling system materials and manufacturer's recommended installation procedures.

B. Piping Systems shall be identified by means of an identifying legend on color coded background appropriately worded to indicate the "service" name of the pipe as shown on the drawings. Color-coded banding shall also be provided. Additionally, an arrow shall be included to indicate the direction of flow through the pipe.

C. Locations of Piping System Identification: The identifying legends and directional arrows described in the paragraphs preceding shall be located at the following points on each

piping system:

Adjacent to each valve in piping system.

At every point of entry and exit where piping passes through a

wall. On each pipe riser and junction.

At a maximum interval of 20 feet on pipelines exposed and concealed above accessible ceilings.

Adjacent to all special fittings (regulating valves, etc.) in piping

systems. At every access door.

D. Piping identification shall meet the standards of the Federal Occupational Safety Health Act (OSHA) which refers to the ANSI Standard A13.1. The following standardized color code scheme shall be used:

Yellow - Hazardous Materials
Green - Liquid Materials of Inherently Low Hazard
Blue - Gaseous Materials of Inherently Low
Hazard Red - Fire Protection Material A

E. The size of letter and length of color field shall conform to the ANSI standard and shall be as follows:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
------ to 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3 1/2"

F. All pipe labels exposed within mechanical equipment spaces shall be semi-rigid micarta identification markers. Each label shall have appropriately color-coded background with printed legend. Directional flow arrows shall be included on label. Labels shall "snap-on" around pipe without the requirement for adhesive or bonding of piping sizes 3/4" through 5". Labels for piping 6" and larger shall be furnished with spring attachment at each end of label. Labels shall be "SETMARK" Type SNA, 3/4" through 5" size and Type STR, 6" and larger, as manufactured by Seton Name Plate Corporation, Brady, or equivalent.

G. Attach pipe markers to lower quarter of the pipe on horizontal runs and on the centerline of vertical piping where view is not obstructed. Flow indicator arrow shall point away from pipe marker.

H. Provide the following labels, with ANSI/OSHA color for all piping systems as shown on the drawings and as listed below:

Letter **Background**

Service/Legend	Color	Color
Condensate Return, Gravity	Black	Yellow

2.9 IDENTIFICATION OF CONTROL SYSTEM DEVICES

A. All automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays and starters shall be clearly tagged and identified. Wording shall be identical to that on the control diagram in the contract drawings.

2.10 EQUIPMENT TAGS

A. Furnish and install equipment identification tags for all items of HVAC equipment furnished and installed under CSI Division 23, including each air supply unit or fan, each exhaust fan, and other equipment as listed on the mechanical equipment schedule. Equipment tags shall be minimum of 3/32" thick laminated phenolic plastic.

2.11 ACCESS DOORS

A. Provide all access doors required for access to valves, dampers, controls, or other items for which access is required for either operation or servicing. All costs incurred through failure to perform this function as the proper sequence of this work shall be borne by the Contractor. The type of access door shall be as required by the room finish schedule. Acoustical tile access doors shall be 16-gauge steel, 12- gauge frame and shall accommodate acoustical tile, or acoustical plaster for sidewall drywall or plaster construction. Access door shall be 16 gauge steel frame with 14 gauge door panel.

B. Access doors shall be not less than 24" X 24" in size except that larger panels shall be furnished where required, and panels in tile or other similar patterned ceilings shall have dimensions corresponding to the tile or pattern module.

C. Where access doors are installed in walls required to have a specific fire rating, the access door installed shall be a fire rated access door with U.L. label. Access door in 1-hour construction shall be Class C and access doors in 2-hour construction shall be Class B.

PART 3 - EXECUTION

3.1 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other parts of these specifications covering the work of other trades which must be carried on in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination. The Contractor shall be responsible for the size and accuracy of all openings.

3.2 DRAWINGS

A. The HVAC drawings show the general arrangement of HVAC piping, ductwork, equipment, etc., and shall be followed as closely as actual building construction and work of other trades will permit. Whenever discrepancies occur between plans and specifications, the most stringent shall govern. All Contract Documents, including but not limited to CSI Division 21 Fire Suppression, CSI Division 22 Plumbing and CSI Division 26

Electrical shall be considered as part of the work insofar as this information furnishes the Contractor with details relating to design and construction of the building. Architectural and structural drawings shall take precedence over the HVAC, plumbing and fire suppression drawings. Because of the small scale of the HVAC, plumbing and fire suppression drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves, and accessories as may be required to meet such conditions. Should conditions necessitate a rearrangement of piping, such departures and the reasons therefore shall be submitted by the Contractor for review in the form of detailed drawings showing the proposed changes. No such changes shall be made without the prior written approval. All changes shall be marked on the set of record drawings by the Contractor.

B. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, the question shall be submitted in writing.

C. Installation of all HVAC equipment, piping, ductwork, and electrical systems shall be arranged to provide all clearances required for equipment operation, service, and maintenance, including minimum clearances required by applicable codes, manufacturer's installation instructions and as necessary for proper clearance in front of all electrical panels as defined by the National Electric Code (NEC). Piping and ductwork systems shall not be routed through or above electrical equipment room or electrical equipment space designed within mechanical equipment rooms.

D. The installation of all concealed HVAC systems shall be carefully arranged to fit within the available space without interference with adjacent structural and electrical systems. The Contractor shall make all necessary provisions for penetrations of piping and ductwork, including sleeves and blockouts in structural systems. The exact location of all exposed HVAC systems, including grilles, registers, and diffusers; access doors; piping and ductwork exposed within finished areas; and other equipment and devices as applicable, shall be coordinated with the Architect, who shall have final authority for the acceptance of the work as it specifically relates to the architectural aesthetic design requirements for the facility.

3.3 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions and conditions governing his work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions, including dimensions of equipment, fixtures and materials furnished, and those indicated on the drawings. Contractor shall examine adjoining work, on which his work is dependent for perfect efficiency, and shall report any work which must be corrected. Coordination of all HVAC work within the building will be the direct responsibility of the Contractor. Review of submittal data in accordance with paragraph "Submittals" shall in no manner relieve the Contractor of responsibility for the proper installation of the HVAC work within the available space. Installation of equipment and systems within the building space shall be carefully coordinated by the Contractor with all building trades. Each contractor shall so harmonize his work with that of the several other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Sewer lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork. Installation of HVAC, plumbing and fire suppression systems within the ceiling cavity shall be in the following order of priority: plumbing waste lines; supply, return, outside air, and exhaust ductwork; fire sprinkler mains; fire sprinkler branch piping and sprinkler runouts; refrigerant piping; domestic

hot and cold water; control piping, wiring and conduit**.**

3.4 EQUIPMENT SUPPORT

A. Contractor shall provide support for equipment to the building structure. Contractor shall furnish all necessary structures, inserts, sleeves, and hanging devices for installation of mechanical and plumbing equipment, ductwork and piping, etc. Contractor shall completely coordinate installation of such devices with all trades and Sub-Contractors. Contractor must further verify that the devices and supports are adequate as intended and do not overload the building's structural components in any way.

3.5 PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be responsible for the protection of all work, materials and equipment furnished and installed under this section of the specifications, whether incorporated in the building or not.

B. Air handling equipment, fans, air terminal units and other items of HVAC equipment and materials, including ductwork and piping, valves and fittings, etc., shall be protected from damage and contamination. Equipment and materials shall not be stored outside and exposed to weather and ambient conditions without appropriate protection measures and without review by the Architect. Ductwork sections, air terminal units, fan coil units, heat pump units, etc., shall be delivered to the jobsite and maintained while on the jobsite with all openings, controls and control panels covered with sheet metal caps, with heavy duty polyethylene wrap or other proper means. Equipment and materials where stored within the building shall be protected at all times from construction damage and contamination from dust, dirt, debris, and especially during fireproofing, painting and gypboard sanding and finishing. Unprotected equipment, piping, and ductwork will require special field cleaning by the Contractor prior to acceptance by the Architect**.**

C. The Contractor shall be responsible for all damage done to property, equipment and materials. Storage of materials within the building shall be reviewed by the Architect prior to such storage.

D. At the completion of the HVAC work, equipment and materials shall be cleaned and polished thoroughly and delivered in a condition satisfactory to the Architect**.**

3.6 MANUFACTURER'S INSTRUCTIONS

A. All equipment shall be installed in strict accordance with recommendations of the manufacturer. If such recommendations conflict with plans and specifications, the Contractor shall report such conflicts to the Architect**,** who shall make such compromises as he deems necessary and desirable.

3.7 CONCRETE BASES AND HOUSEKEEPING PADS

A. Concrete bases and housekeeping pads shall be installed under all pieces of mechanical equipment unless specifically deleted by the specifications or drawings.

B. Contractor shall be responsible for the accurate dimensions of all pads and bases and shall furnish and install all vibration isolators, anchor bolts, etc.

C. Contractor shall provide concrete housekeeping pad foundations for all floor mounted or slab on grade equipment installed under this section unless otherwise shown on the drawings. All concrete bases and housekeeping pads shall conform to the requirements

specified under CSI Division 3, Concrete, portions of these specifications. Pad foundations shall be 4" high minimum, unless otherwise indicated on the drawings. Chamfer edges shall be 1". Faces shall be free of voids and rubbed smooth with carborundum block after stripping forms. Tops shall be level. Provide dowel rods in floor for lateral stability and anchorage.

D. Equipment anchor bolts shall be set in a galvanized pipe or sheet metal sleeves 1" larger than bolt diameter. Anchor bolts shall be high strength steel J shape. Anchor bolt design shall be arranged and paid for by the Contractor.

3.8 LUBRICATION

A. The Contractor shall provide all oil for the operation of all equipment until acceptance. The Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the equipment. The Contractor shall protect all bearings and shafts during installation and shall thoroughly grease the steel shafts to prevent corrosion. Bearings for items of HVAC equipment shall be marked at each bearing location as to whether the bearing is a sealed type or relubricating type unit.

3.9 TESTS

A. Tests shall be conducted in the presence of the designated and authorized Owner's Representative. The Contractor shall notify the Architect and Engineer a minimum of one week in advance of scheduled tests. Requirements for testing are specified under the sections covering the various systems. The Contractor shall furnish all necessary equipment, materials, and labor to perform the required tests.

3.10 INSTALLATION CHECK

A. An experienced, competent, and authorized representative of the equipment listed below shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is approved and accepted.

B. Each equipment supplier's representative shall furnish a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated under full load conditions and that it has operated satisfactorily.

3.11 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall furnish complete operating and maintenance instructions covering all units of HVAC equipment herein specified together with parts lists. Equipment spare parts shall include all components requiring service, including motors, v-belts, bearings, shafts, etc.

Provide tabular listing of all air filter sizes for all HVAC units, filter grilles, etc. Furnish four (4) copies of all the literature; each shall be suitably bound in loose leaf book form.

B. Complete temperature control diagrams including control descriptions, system sequence of operation and operating instructions shall also be provided, in duplicate suitably bound in loose leaf book form. In addition, one copy of the schematic pneumatic and electric

control diagrams shall be framed under plexiglass and mounted on the equipment room wall in the vicinity of the installed equipment.

C. See CSI Division 1 for additional requirements concerning manuals, manual distribution, and maintenance materials.

D. Operating and maintenance manuals as required herein shall be submitted for review and distribution to the Owner not less than two (2) weeks prior to the date scheduled for the Contractor to provide Operating and Maintenance Instructions to the Owner as specified herein.

E. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the HVAC systems and equipment for a period of two (2) days of four (4) hours each. During this period, the Contractor shall instruct the Owner or his representative fully in the operations, adjustment and maintenance of all equipment furnished. Contractor shall provide at least two weeks notice in advance of this period, with a written schedule of each training session, the subject of the session, the Contractors' representatives who plan to attend the session, and the time for each session.

F. Operational test shall be conducted by the Contractor with the assistance of the representatives from the Temperature Control Sub-Contractor, and Testing and Balancing Sub-Contractor. Test shall be conducted in the presence of the designated and authorized Owner's Representative.

3.12 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify in writing that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these specifications. Submit certifications and acceptance certificates, including proof of delivery of O&M manuals, spare parts required, and equipment warranties which shall be bound with O&M manuals.

3.13 OPERATION PRIOR TO ACCEPTANCE

A. Operation of equipment and systems installed by the CSI Division 23 Contractor for the benefit of the Owner prior to substantial completion will be allowed providing a written agreement between the Owner and the Contractor has established warranty and other responsibilities to the satisfaction of both parties.

B. Operation of equipment and systems installed by the CSI Division 23 Contractor, for the benefit of the Contractor, except for the purposes of testing and balancing will not be permitted without a written agreement between the Owner and the Contractor establishing warranty and other responsibilities.

3.14 SITE VISITS AND OBSERVATION OF CONSTRUCTION

A. The design professional shall make periodic visits to the project site at various stages of construction in order to observe the progress and quality of various aspects of the Contractor's work, in order to determine in general if such work is proceeding in accordance with the Contract Documents. This observation, however, shall in no way release the Contractor from his complete responsibility to supervise, direct, and control all construction work and activities. The design team has no authority over, or a responsibility to means, methods, techniques, sequences, or procedures of construction

provided by the Contractor or for safety precautions and programs, or for failure by the Contractor to comply with all law, regulations, and codes.

B. Prior to the "Final" observation visit, the attached "Final Observation Checklist" shall be completed by the Contractor. Any non-applicable items shall be marked "N/A". The completed form shall be submitted, indicating that all necessary items are complete and requesting a final observation within 10 days. The Contractor shall be notified of any uncompleted items within seven (7) days. A resubmittal of the form and a new final observation request by the Contractor is required if the form is returned and noted as incomplete.

END OF CSI NUMBER

SECTION 920-3 – MECHANICAL

CSI NUMBER 23 05 03

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and the General Requirements.

1.2 SCOPE OF WORK

A. The work in this section includes the furnishing of all labor, materials, equipment, transportation, hauling and services required in connection with the excavation, backfilling, compaction, grading and removal of earth from the site required for the installation of the HVAC work specified herein under CSI Division 23.

1.3 SAFETY REGULATIONS

A. All work performed under this Section shall conform to the requirements of the General Conditions, Supplementary Conditions and Safety Requirements for this type of work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TRENCHING AND BACKFILLING

A. General Excavation: The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated material not required or suitable for backfill shall be removed and wasted. Berming and grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Sheeting and shoring shall be done as required for the protection of the work and for the safety of personnel.

B. Trench Excavation: Trenches shall be of adequate width for the proper laying of the pipe, and the banks shall be as nearly vertical as practicable and safe for workmen. The bottom of the trenches shall be accurately graded and bedded to provide uniform bearing and support for each section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and bedded in order that the pipe rests upon the prepared bottom for as nearly its full length as practicable. Care shall be taken not to excavate below the depths indicated. Where rock excavation is required, the

rock shall be excavated to a minimum overdepth of 4 inches below the trench depths indicated on the drawings or specified. Overdepths in the rock and common excavation shall be backfilled with coarse sand, fine gravel, or otherwise suitable material. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel, or other suitable materials, as hereinafter specified.

C. The Contractor shall move trucks and equipment on prescribed roads and keep the roads free from mud, dirt and spillage.

D. If additional material is needed for fill on the project, it shall be furnished by the Contractor. E. Bracing and Bulkheading: In all excavation work the Contractor shall provide necessary underpinning, bracing, or bulkheading to safeguard the work, the present structures, workmen, the public, and the property, and shall assume all responsibility in connection therewith.

F. Backfilling: The trenches shall not be backfilled until all required pressure tests are performed and until the utilities as installed conform to the requirements specified. The trenches shall be carefully backfilled with materials approved for backfilling, free from large clods of earth or stones. The entire depth of trench shall be backfilled in 12" layers, and each layer shall be spread evenly, wetted to optimum moisture and thoroughly mixed to uniform consistency and compacted to the required maximum density obtainable as the same soil, as determined by ASTM D698.

G. All imported fill required under this section will be furnished by the Contractor. Imported fill will be base course material approved for use by the State Highway Department.

H. Fill material shall be free from trash, lumber or any type of debris which may be detrimental to producing the required density in the fill.

I. The earth beneath all sidewalks and concrete slabs shall be backfilled and compacted to at least 8" below any gravel or sub-base material before the placement of gravel or other base material and shall be coordinated with requirements contained within Division 2.

J. All piping not encased in concrete shall be bedded in sand or fine gravel, without rocks or other foreign material. Bedding material shall be placed around the pipe in accordance with manufacturer’s recommendations. The bedding material shall be distributed around pipe to assure full consolidation.

K. In grass and planted areas, the Contractor shall backfill his excavation to approximately 8" below finished grade. Contractor shall coordinate backfill requirements contained in CSI Division 2.

L. The Contractor shall protect from damage all existing underground indicated on the Contract Drawings. Any damage to such existing utilities shall be repaired by the Contractor without additional costs to the Owner.

M. Provide density test for trench, backfill in accordance with Division 2 requirements.

END OF CSI NUMBER

SECTION 920-3 – MECHANICAL

CSI NUMBER 23 05 04

PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

B. Lead Ban: All piping, solder and flux used in the installation of piping systems furnished and installed under CSI Division 23, shall be lead free. The term lead free is defined as pipe which does not contain more than 8.0% lead and solder and flux which does not contain more than
0.2% lead.

1.2 RELATED CSI NUMBERS

A. See CSI number 23 05 00, for Common Work Requirements for HVAC.

1.3 SUBMITTAL DATA

A. Contractor shall furnish complete submittal data for all piping materials, including manufacturer's specifications, certifications, class, type and schedule. Submittal data shall additionally be furnished for pipe hangers and supports, seismic restraints, pipe sleeves including sealing and fire safety materials and installation.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Piping system materials shall be furnished as specified under the Sections describing the various piping systems. Pipe fittings shall be compatible with the piping systems in which they are installed.

B. Pipe fittings for steel piping systems shall be weld, screwed or mechanical couplings. Butt weld fittings shall be manufactured by Weld-Bend, Laddish, or equivalent, standard or extra strong as specified in the applicable Sections of this Specification, conforming to ANSI Standard B16.9. All 90^0 weld elbows shall be long radius unless otherwise specified. Wherever tee connections are required in the piping system, manufacturer's straight or reducing tees shall be utilized. The use of fittings formed from welded pipe or pipe sections will not be permitted. Forged steel "Weld-O-Lets", "Branch-O-lets", and "Thred-O-Lets", as manufactured by Bonney Forge or equivalent, may be utilized for welded branch and tap connections up to one-half the size of the main. Forged steel half-couplings conforming to ANSI B16.11 may be used for drain, vent and gauge connections. Flanges shall be forged steel weld neck or slip-on, raised face, Class 150 or 300 as specified in the applicable Sections of this Specification with full face or ring type non-asbestos gasket material suitable
for the application.

C. Socket weld fittings shall be Schedule 40, 2000-pound construction, as specified in the applicable Sections of this Specification, conforming to ANSI B16.11, as manufactured by Anvil International or equivalent.

D. Screwed fittings shall be Class 150 standard, black or galvanized, malleable iron or cast iron, as specified in the applicable Sections of this Specification, as manufactured by Anvil International or equivalent. Screwed malleable iron fittings shall conform to ANSI B16.3 and cast iron screwed fittings shall conform to ANSI B16.4. Bushing reduction of a single pipe size or use of close nipples will be permitted.

E. Pipe couplings and fittings as manufactured by Victaulic, Gruvlok, Tyco-Grinnell, or equivalent may be utilized for steel piping systems in lieu of butt weld fittings, as specified in the applicable Sections of this Specification. Couplings shall consist of ductile or malleable iron housing, with gasket, and nuts and bolts required to secure the unit. Gaskets shall be molded of synthetic rubber or other compound as recommended by the manufacturer for the fluid application including required pressure and temperature operating ranges. Fittings utilized in conjunction with Victaulic type piping system shall be manufacturer's full flow cast iron, malleable iron, or steel fittings with grooves designed to accept mechanical couplings. All piping shall be prepared in accordance with manufacturer's specifications, furnished for factory or field installed roll grooves without metal removal. Square cut grooves will not be permitted. Assembly of couplings, fittings and piping shall be in accordance with manufacturer's published instructions. Gaskets, pipe ends, fittings and coupling housings shall be properly lubricated with water-based type lubricant or silicon based furnished by the coupling manufacturer. Couplings shall be Victaulic Style 07 "Zero-Flex", Gruvlok 7401, or equivalent, rigid coupling through 24" size. Adapter connections between Class 125 and 150 flanged components and grooved piping system shall be made utilizing Victaulic Style 741 and 742, Gruvlok 7012/7013, or equivalent flange adapter. Branch and tap connections up to one-half the size of the main may be made utilizing Victaulic Style 72, or equivalent, outlet couplings and Style 920 or 921, or equivalent branch outlet connections, or Gruvlok 7042.

F. Pipe fittings for copper piping system shall be wrought copper conforming to ANSI B16.22. Cast brass fittings conforming to ANSI B16.23, may be utilized for sanitary drainage, waste and vent systems, HVAC gravity condensate drainage system, and other non-pressure applications. Mechanical grooved couplings and copper fittings as manufactured by Victaulic or Gruvlok may be used.

G. Bronze flanges, Class 125 and Class 150, shall conform to ANSI B16.24. "T-drill" or equivalent mechanically formed tee connections and couplings may be utilized for water and drainage services. Installation of mechanically formed connections shall be in strict accordance with the manufacturer's specifications. Mechanically extracted collars shall be formed in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Branch tube shall be notched and dimpled in a single process to provide free flow such that the branch tube penetrates the fitting sufficiently for proper brazing and ensures that the branch tube does not obstruct the flow in the main line. All joints shall be brazed with cadmium brazing alloy. Mechanically formed collars shall be listed by the National Standard Plumbing Code, I.A.P.M.O., and Underwriters' Laboratory.

H. Cast iron fittings for cast iron sanitary soil, waste, and venting piping systems shall be as specified in CSI Division 22.

I. Ductile iron fittings for ductile iron water service piping systems shall be as specified

in CSI Division 22.

2.2 FLOOR, WALL AND CEILING PLATES

A. Where uncovered, exposed pipes pass through finished floors, finished walls, or finished ceilings, they shall be fitted with chromium plated spun brass escutcheon plates. Plates shall be large enough to completely close the hole around the pipe, and shall be not less than 1-1/2" or more than 2-1/2" larger than the diameter of the pipes. All plates shall be securely held in place.

2.3 UNIONS

A. Piping 2-1/2" and larger shall be provided with bolted flange union connections. Weld flanges and bolting shall conform to ANSI B16.5. Bronze flanges shall conform to ANSI B16.24. Flange class shall be as specified in the applicable Sections of the Specifications.

B. Malleable iron-grooved joint unions with brass to iron seats, Class 125, 250, or 300, as required by the application and compatibility requirements with the piping system fitting classification, conforming to MSS SP-77 and ANSI B16.39, shall be provided in piping systems 2" and smaller. Copper unions conforming to ANSI B16.22 shall be provided in copper piping systems. Union connections shall be installed at all coils, control valves, equipment connections, and at other locations shown on the drawings, and required for proper system operation and maintenance.

2.4 DIELECTRIC FITTINGS

A. Dielectric insulating fittings shall be provided to connect dissimilar metals, such as copper tubing to ferrous metal pipe. Connections 2" and smaller shall be threaded dielectric union conforming to ANSI B16.39. Connections 2-1/2" and larger shall be flange union with dielectric gasket and bolt sleeves, conforming to ANSI B16.42. Insulating fittings will not be required between bronze valves and copper piping, unless otherwise specified.

2.5 PIPE HANGERS AND SUPPORTS

A. All piping shall be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Pipe hangers shall be Grinnell, Anvil International, B-Line, or equivalent.

B. No attempt has been made to show all required piping supports in all locations, either on the drawings or in the details. The absence of pipe supports and details on any drawing shall not relieve the Contractor of the responsibility for furnishing and installing proper hangers and supports throughout.

C. Piping hangers shall be spaced on the scheduled maximum spacing and shall have hangers not more than one foot from each elbow and other changes in direction or elevation. Provide additional hangers and supports at valves, strainers, in-line pumps adjacent to flexible connections, and other required heavy components. Piping system shall be installed in an approved manner and shall not overload the building structural frame. Contractor shall provide additional hangers and miscellaneous steel supports as may be required to distribute the piping system load over multiple structural members where required or directed. Maximum allowable spacing for steel and copper piping, other than fire protection piping, shall be as scheduled in Table No. 1.

TABLE NO.
1

MAXIMUM SUPPORT SPACING FOR STEEL AND COPPER PIPING SYSTEMS

Steel Piping	- Maximum Spacing
1/2"	- 5'-0"
3/4" and 1"	- 6'-0"
1-1/4" through 2"	- 8'-0"
2-1/2" through 6"	- 10'-0"
Copper Piping	**- Maximum Spacing**
1/2"	- 5'-0
3/4" through 2"	- 6'-0"
2-1/2" through 4"	- 8'-0"
5" and larger	- 10'-0"

D. Round rods supporting the pipe hangers shall be of the minimum dimensions as scheduled in Table No. 2. Hanger rods shall be hot-rolled steel, ASTM A-36 or A575, galvanized, all-thread. Provide for controlling level and slope by turnbuckles or other reviewed means of adjustment and incorporate locknuts.

TABLE NO.2

HANGER ROD SIZE FOR PIPE HANGER SUPPORTS

1/2" to 2" pipe	- 3/8" rod
2-1/2" to 3" pipe	- 1/2" rod
4" to 5" pipe	- 5/8" rod
6" pipe	- 3/4" rod
8" to 12" pipe	- 7/8" rod
14" and 16" pipe	- 1" rod
18" and 20" pipe	- 1-1/4" rod
24" and 30" pipe	- 1-1/2" rod

E. Cast iron soil, waste and vent piping shall be provided with steel clevis type hangers. Anvil International at each pipe joint and at each fitting.

F. Fire protection system shall be supported in strict accordance with the requirements contained in the applicable NFPA pamphlets and as specified in CSI Division 21, Fire Suppression Systems.

G. Hangers, clamps and other support materials in contact with copper piping shall be copper or copper plated to prevent electrolysis. Hangers for copper piping shall be copper plated adjustable ring type Grinnell Fig. CT-269, adjustable swivel ring, Grinnell Fig. CT69, Fig. CT-
65, or adjustable clevis type, Anvil International, or equivalent. Provide minimum 10 mil plastic wrap around copper pipe at any ferrous point of attachment including trapeze hangers, clamps, and other supports.

H. Hangers for steel shall be steel clevis type hangers, Grinnell Fig. 260, Anvil International or equivalent.

I. Where piping is installed side by side, the Contractor may support the piping utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be galvanized steel channel, not less than 1-1/2" X 1-1/2" X 12" gauge, or Unistrut. Contractor shall provide heavier steel members as required for the load to be supported and the distance span. Trapeze hangers shall not be utilized for fire and sprinkler piping and plumbing drain waste and vent piping. Hanger rods shall be as specified above, properly sized for the load supported but not less than 5/8" diameter. Uninsulated copper piping shall be isolated from the steel trapeze. - Individual pipe shall be guided on the horizontal member at every other hanger point with 1/4" U-bolt fabricated from steel rod. Provide full circle galvanized sheet metal insulation shield for insulated piping at trapeze hangers with U-bolt guide and galvanized sheet metal insulation half-shield at other trapeze hangers. Insulation shield shall be 18 gauge minimum, Grinnell Fig. 167, Anvil International or equivalent.

J. Supports for special piping systems including glass piping, refrigeration piping shall be provided as recommended by the pipe manufacturer and as specified in the applicable Sections of this Specification.

K. Vertical piping shall be supported at each floor level by means of riser clamps, Grinnell Fig. 261 and Fig. G-121 copper clad for copper piping systems, Anvil International, or equivalent. Proper allowance for the expansion and contraction of the vertical risers shall be provided. Contractor shall submit shop drawings indicating proposed method for support and control of expansion and contraction of vertical piping.

L. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

M. All insulated piping systems specified in CSI number 22 07 00, Plumbing Insulation and HVAC Insulation shall be provided with individual hangers sized to encircle the insulation. See applicable sections for insulation thickness requirements. The specified piping systems where supported by means of trapeze hangers shall not rest directly on the trapeze horizontal members. The insulation at hangers and trapeze hangers shall be protected by means of insulation shield, Grinnell Fig. 167, Anvil International, or equivalent. Grinnell Fig. 160 or equivalent, curved steel pipe saddle, shall be provided at roll hangers. Contractor shall provide section of high density calcium silicate insulation or thermal hanger shields as manufactured by Pipe Shields, Inc., or equivalent, at all insulation piping system hanger and support points for piping 1-1/2” or larger.

N. Attachment of piping hangers to the building structure shall be provided in a manner reviewed by the Architect**.** The Contractor shall provide concrete inserts in the building construction at the time the concrete is poured and hangers shall be attached to these inserts. Self-drilling expansion anchors, Federal Specification FF-S-325, may be used in concrete construction not less than 4" thick. Applied load shall not exceed manufacturer's approved ratings. Power driven fasteners may be used in existing concrete or masonry not less than 4" thick where reviewed by the Architect. Attachment to steel construction shall be by means of beam clamps Grinnell Fig. 131, C-clamps Grinnell fig. 86, Anvil International, or equivalent may be utilized for attachment of light loads as reviewed by the Structural Engineer. Attachment to wood construction shall be by means of wood screws or lag bolts.

2.6 PIPE SLEEVES

A. Pipe sleeves shall be furnished and set by the Contractor and he shall be responsible for their proper and permanent location. Piping will not be permitted to pass through footings, beams or ribs except with written consent of the Architect. Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through gypboard stud walls and concrete, and masonry construction and at all fire and smoke rated walls and partitions. Pipe sleeves, except sleeves in footings and beams shall be equal to Pipe Shields Incorporated Model WFB for walls, DFB for decks, or QDFB for corrugated decks, or equivalent. Each sleeve shall be adjustable, with annular spacing packed with U.L. approved mineral fiber fire safety material. Where insulated piping is installed, calcium silicate inserts to match the insulation thickness and extending 1" past the sleeve on both ends, shall be provided. Pipe sleeves in concrete and masonry construction, footings and beams shall be Schedule 40 black steel pipe. Pipe sleeves in gypboard construction shall be galvanized steel metal. Sleeves shall be not less than 1" or more than 2" larger in diameter than the pipe to be installed. Pipe sleeves in floors shall extend 2" above finished floor in chases and equipment room areas unless otherwise reviewed by the Architect. Openings between piping and sleeves shall be made watertight with plastic cement installed to a minimum depth of 2". Where pipes pass through exterior walls, the annular space between the wall and the pipe shall be sealed by sealing elements made of synthetic rubber, pressure plates, and cadmium plated bolts as manufactured by Link-Seal, or equivalent.

B. Uninsulated piping passing through fire walls, smoke wall, sound control walls and air plenum separations shall be sealed airtight to the adjacent construction by means of U.L. approved fireproof caulking materials.

C. Insulated piping passing through fire walls and smoke walls, shall be provided with a section of U.L. approved fire safety insulation to match the required insulation thickness or Pipe Shields, Inc. pipe shield sleeves as specified above at the required wall penetrations. The space between the piping sleeve penetration and the adjacent wall Construction shall be sealed airtight with U.L. approved fireproof caulking material. Penetrations of gypboard sound walls and air plenum separators shall be caulked airtight with an approved caulking compound.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Provide and erect, according to the best practices of the trade, all piping shown on drawings and required for the complete installation of these systems. The piping shown on the drawings shall be considered as diagrammatic for clearness in indicating the general run and connections, and may or may not in all parts be shown in its true position. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper erection of systems or piping in every respect suitable for the work intended as described in the specifications. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods. All changes in direction shall be made with fittings. All open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton waste or

similar materials may not be used in plugging. All piping shall be arranged so as not to interfere with removal and maintenance of equipment or filters or devices; and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment including refrigeration machines. All piping shall be installed to ensure noiseless circulation. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated, packed and adjusted at the completion of the work before final acceptance. All piping shall be erected to ensure proper draining.

3.2 JOINTS

A. Caulked Joints: Caulked joints in hub-and-spigot piping and vent piping shall be packed firmly with white oakum, "Sealite No. 110", or hemp and caulked with pure molten lead not less than 1" deep. Resilient molded gasket joints or "Ty-Seal" may be used in lieu of lead and oakum for sanitary soil, waste and vent piping. No-hub pipe and fittings will be accepted with the exception that no-hub pipe and fittings shall not be allowed for buried installation.

B. Screwed Joints: Shall have American Taper pipe threads. Ream pipe ends and remove burrs after threading. Make up joints using Teflon tape or other approved compound applied to the male threads only.

C. Solder Joints: Copper tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for sweated fittings shall be made with a non-corrosive paste flux and solid 95-5 Tin-antimony wire solder, unless otherwise specified. Cored solder will not be permitted. 50/50 lead solder shall not be permitted for any applications.

D. Welded Joints: On black steel piping 2-1/2" and above in size, the joints may be welded. Welding shall be done using either gas or electric welding equipment. Certified welders shall be used. Welders shall be certified in accordance with Section IX of ASME Boiler and Pressure Vessel Code, latest edition. All pipe surfaces shall be thoroughly cleaned before welding. Each joint shall be beveled before being welded. Piping shall be securely aligned and spaced, and the width of circumferential welds shall form a gradual increase in thickness from the outside surface to the center of the weld. All fittings used in the welded piping systems shall be standard ASA fittings and shall be of standard pipe thickness. The Contractor shall provide a fireproof mat or blanket to protect the structure and adequate fire protection at all locations where welding is done. The use of fittings formed from welded pipe sections will not be permitted.

E. Flanged Joints: Flanged joints shall conform to the American Standard for cast iron flanged pipe fittings, Class 125, 150 or 300 as specified in the applicable Sections of these specifications. Gaskets shall be full face or ring type, non-asbestos, suitable for the service on which used.

3.3 PUMP AND EQUIPMENT CONNECTIONS

A. All piping connecting to pumps and other equipment whether connected utilizing flexible connectors or with solid pipe connectors, shall be installed without strain at the pipe connection of the equipment. The Contractor shall be required, if so directed, to disconnect piping to demonstrate that piping has been so connected.

3.4 EXPANSION AND CONTRACTION

A. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets or loops and anchors as required to prevent undue strain. Contractor shall provide shop drawings for proposed method and arrangement for control of expansion and contraction of piping. See CSI number 23 05 05 for expansion joints, expansion compensators, pipe guides and pipe anchors.

3.5 PROTECTIVE COATINGS

A. All underground steel pipe shall be wrapped with "Scotchwrap" No. 50 tape or equivalent, to give not less than two complete layers on the entire underground piping system, or piping shall have X-Tru-Coat factory applied plastic protective covering.

3.6 FLUSHING, DRAINING AND CLEANING PIPE SYSTEMS

A. The Contractor shall flush out all water systems with water before placing them in operation. Other systems shall be cleaned by blowing them out with compressed air or nitrogen. After systems are in operation and during the test period, all strainer screens shall be removed and thoroughly cleaned.

B. See applicable HVAC piping system specification sections for chemical cleaning of piping systems.

3.7 TESTING

A. Before any insulation is installed or before piping is covered or enclosed, all piping systems shall be tested and proven tight at not less than 150% of the maximum service pressure which the piping systems will be required to handle. Piping system tests shall be as specified in the applicable sections of this Specification. All tests shall be witnessed and reviewed by the Architect.

B. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying the tests. To perform tests, all lines shall be flushed and cleaned.

C. All safety measures required by codes or ordinances or reasonably applicable to the situation shall be provided by the Contractor in conjunction with the testing of the piping systems.

D. Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Underground piping may be partially backfilled prior to pressure test when required for application of the test except that joints shall remain exposed until after the test. Tie rods, clamps etc., shall be in place and fastened.

E. Tests shall not be used to establish pressure ratings.

F. Protect all piping and equipment against over pressure, collapse from vacuum, and hydraulic shock during the filling, testing and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating.

G. Apply test pressure only after the system and test medium are at approximately the same

temperature, preferably not less than 60^0F. Note that some applicable codes may require testing above a specified minimum temperature.

H. Remove from the system all pumps, turbines, traps, expansion joints, instruments, control valves, safety valves, rupture discs, orifice plates, etc., which might be damaged by the test. Also remove all items such as orifice plates which might trap air in a system to be hydrostatically tested. Disconnect all instruments and air lines where copper tubing starts.

I. Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

J. During hydrostatic testing of lines, provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

END OF CSI NUMBER

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SECTION 920-3 – MECHANICAL

CSI NUMBER 23 05 49

HVAC & ELECTRICAL INSTALLATION COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED CSI DIVISIONS AND NUMBERS

See CSI number 23 05 00, for Common Work Requirements for HVAC
See CSI Division 26, for Electrical

1.3 SCOPE

A. It is the intention of this section to summarize the coordination of effort defined in the related sections and divisions of this specification.

B. If there is a conflict between this CSI number and other CSI number and CSI Divisions of this specification, this CSI number shall be the governing and decisive CSI number.

C. Make all connections to motors and controls for equipment supplied and/or installed under CSI Division 23 according to Table 1 on the following page.

PART 2 - PRODUCTS

A. Not Applicable

PART 3 - EXECUTION

A. INSTALLATION

1. No work shall be performed until the reviewed and marked submittal data have been reissued to the Contractor, unless written permission is obtained from the Architect.

TABLE 1

Item or System	Note	Supplied By (3)	Installed By (3)	Powered By	Control Field Wiring By
Equipment Motors		Div. 23	Div. 23	Div. 26	N/A
Motor Control Center, including Starters, Pilot Lights, Heater, Switches, Auxiliary Contacts, and Internal Control Wiring		Div. 26	Div. 26	Div. 26	Div. 23
Stand Alone Motor Starters (outside motor control centers)	(1)	Div. 26	Div. 26	Div. 26	Div. 23
Fused and Non-Fused Disconnects	(1)	Div.26	Div. 26	Div. 26	N/A
Control Relays & Control Transformers	(1)	Div. 23	Div. 23	Div. 26	Div. 23
A/C Units including Mixing Dampers		Div.23	Div. 23	Div. 26	Div. 23
HVAC Unit Smoke Detectors		Div. 28	Div. 23	Div. 28	Div. 28
Fan Coil Unit Condensate Float Switches		Div.23	Div. 23	N/A	Div. 23
Supply, Return & Exhaust Fan with unit mounted 115 VAC 2-position damper actuators interlock with fan motor/starter		Div. 23	Div. 23	Div. 26	N/A
Non-FMS Control Devices Including Wall Switches, Timers, Thermostats		Div.23	Div. 23	Div. 26	Div. 26
Facility Management System (FMS)	(2)	Div. 23	Div. 23	Div. 23	Div. 23
Facility Management System – Light Controls		Div. 26	Div. 26	Div. 26	Div. 26
Fire Alarm System & Interface w/HVAC System		Div. 28	Div. 28	Div. 28	N/A

TABLE NOTES:

1. Unless specified to be supplied with the equipment

2. CSI Division 26 shall provide 120 VAC power to each mechanical space and the central plant as indicated on the drawings. Any additional power, transformers, and distribution shall be provided by the Section or Division indicated.

3. CSI Division 23 indicates the HVAC contractor or their designated representative including equipment suppliers, sub-contractors, etc.

END OF CSI NUMBER

CSI NUMBER 23 05 93

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 GENERAL

A. Conform with applicable provisions of the General Provisions and the General Requirements.

B. The testing, adjusting and balancing of the mechanical systems shall be performed by an independent testing and balance (TAB) Agency approved by the Owner, or other qualified and approved TAB Agency as established under Paragraph 1.4 herein.

C. The testing, adjusting and balancing of the mechanical systems for the building shall be executed by the TAB Agency as described herein and shall be paid for by the Contractor and included in the contract price.

D. The Contractor shall provide services of a qualified manufacturer's representative of the temperature controls and qualified representatives of the mechanical and electrical subcontractors as required during the TAB work.

1.2 SCOPE

A. This Specification covers the system's testing, adjusting, and balancing of HVAC work furnished and installed in other sections of the C S I Division 23 Specifications and a TAB report as specified herein.

B. Before final acceptance and after final adjustments have been completed and the systems have been balanced, an operating test shall be performed in accordance with the requirements specified in CSI number 23 05 00. The operating tests and training session for the Owner's operating and maintenance personnel shall not be performed until the Test and Balance Report has been accepted.

C. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these Specifications and shown on the drawings. Services shall include checking equipment performance, taking the specified measurements, adjusting system and equipment to provide specified performance, and recording and reporting the results. The Contractor and TAB Agency shall provide a joint and cooperative effort to coordinate the test and balance with the mechanical subcontractor, electrical subcontractor, controls subcontractor and general contractor, to solve (not just document) any problems in balancing and control interlocks in order to establish proper system performance before leaving the job and preparing the final test and balance report.

D. The representative of the TAB Agency who will be in charge of test and balance work shall be present at all required Construction Conferences, including the Preconstruction Conference, to meet with and discuss the project with the other subcontractors, Owner's Representative, and design personnel.

E. This same representative must be available on the site when requested to review job progress, establish damper locations, check duct pitot station locations, etc., and he shall

re and submit reports as needed to keep all parties posted on the testing and balancing work progress and related problems. Before final acceptance and after final adjustments have been completed, and after the component checkout has been performed, the system shall be balanced. Balancing shall not begin until all systems, including temperature controls work are completed and in proper working order.

1.3 DEFINITIONS, REFERENCES, STANDARDS

A. All work shall be in accordance with the latest edition of the AABC National Standards. If these Contract Documents set forth more stringent requirements than the AABC National Standards, these Contract Documents shall prevail.

1. AABC: The Associated Air Balance Council is a non-profit association of independent, certified agencies specializing in testing, adjusting, and balancing HVAC systems. The AABC National Standards (latest edition) provides standards and operational criteria for HVAC systems.

1.4 QUALIFICATIONS

A. Unless otherwise noted, the Contractor, as part of this Contract, shall obtain the services of a qualified TAB Agency to perform the balancing work as herein specified. Prior to Bidding the Project under this section of the specifications, Tab agencies and desiring to be considered, shall submit for Prior Review, in accordance with requirements in Section 920-23 05 00, and shall have been accepted to bid the project. The criteria for determining qualifications shall include the following:

1. Qualifications for membership in the Associated Air Balance Council (AABC), **or** certification by National Environmental Balance Bureau (NEBB). Submit satisfactory proof that the balancing organization meets the technical standards for membership of the AABC as published in the AABC "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173.

2. A local metropolitan area office.

3. The balancing organization shall have a minimum of five (5) years of experience in the balancing field.

4. A project engineer registered in the state where the project is located and who will be directly responsible for all test and balance work.

5. TAB Agency company resume listing personnel and project experience in air and hydronic system balancing, including a copy of the agency’s Test and Balance Engineer’s (TBE) Certificate and listing of prior project experience relevant to this project scope with engineering, Contractor and Owner references.

1.5 SUBMITTALS

A. The Contractor shall submit the name of the organization he proposes to employ for required TAB work within thirty (30) days after Contract Award. If the Contractor fails to submit the name of an acceptable agency within the specified time, a firm may be selected to accomplish the work; and this selection shall be binding upon the Contractor at no additional cost.

B. TAB Agency submitted shall include a listing of proposed project TAB personnel, including resumes with related project experience and certifications.

C. TAB Agency shall submit proposed TAB procedures, instrumentation and measurement equipment, proposed agenda to be utilized for this project, and sample TAB report forms required for the project.

1.6 TAB PREPARATION AND COORDINATION

A. The Contractor shall provide the TAB Agency with the project documentation necessary to perform the required TAB services, including shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work.

B. Mechanical HVAC system installation and equipment startup shall be complete prior to the Tab Agency's beginning the test, adjust, and balance work.

C. The building control system shall be complete and operational. The building controls subcontractors shall install and make operational, all necessary control systems and equipment, including computers and computer programs. Controls subcontractors shall provide all necessary assistance including that required for reprogramming, coordination, and problem resolution which may become evident due to TAB work and which is required to obtain specified system performance.

D. The Contractor shall provide the services of qualified installation or startup personnel for the operation and adjustment of the mechanical systems and equipment. Assistance shall be provided as required for coordination and problem resolution which may become evident due to TAB work and which is required to obtain specified system performance.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards.

B. The Testing and Balance Agency shall provide not less than the following instruments and equipment for testing and balancing purposes.

1. Pitot tubes and draft gauges.
2. Flow Hood, calibrated
3. Velometer, calibrated
4. Thermometers, mercury and bi-metallic stem types
5. Ampere - voltmeter
6. Speed Indicator
7. Octave Band Analyzer

PART 3 - EXECUTION

3.1 GENERAL

A. The mechanical HVAC systems shall be reviewed and inspected by the TAB Agency for conformance to design documents and testing, adjusting and balancing on each system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards and adjustment tolerances shall be within 10% minimum, unless otherwise specified herein.

B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control, and similar controls and devices shall be marked to show final settings.

C. All information necessary to complete a proper TAB project and report shall be per AABC Standards unless otherwise noted. The descriptions for TAB work required herein are a guide to the minimum information needed.

D. As part of the work of this Specification, make any changes in the pulleys, belts, and dampers, and shall include the addition of manual balancing dampers as may be required for correct balance at no additional cost to the Owner.

3.2 SYSTEM TEST AND BALANCE REPORT

A. When installation has been completed, the TAB Agency shall prepare a complete report, thoroughly documenting the results for the TAB process, including design and final balanced conditions compared.

B. The TAB report shall include the building names, the name of the installing Contractor, the instruments used to perform tests, the name of the person performing the tests, and the date the tests were performed.

C. All forms shall be a standard 8-1/2" X 11", good quality paper, and bound together to form a complete report. All forms shall be typewritten; handwritten forms are not acceptable. Five (5) copies of the complete TAB report shall be submitted a minimum of two (2) weeks before the operating and maintenance instruction, in accordance with Section 15010. One (1) copy will be returned to the Contractor with review comments.

3.3 AIR HANDLING SYSTEMS

A. The Contractor shall place all HVAC air handling systems in operation with all filters installed and automatic control systems completed and operating. The TAB Agency shall temporarily load air filters by partially blanking or other approved means to produce air pressure drop midway between the clean and dirty conditions.

B. All HVAC air handling systems and fan units shall be tested and proven free from mechanical defects and to be in good operating condition. Air quantities handled shall be checked by measuring fan speed, fan discharge and suction pressure, duct pitot stations, etc. Grille discharge and return velocities shall be measured and tabulated with grille performance factor applied to show actual CFM handled vs. specified CFM. All grilles, registers and ceiling outlets shall be adjusted to provide correct throw, drop and spread in the air stream to maintain draftless, comfortable conditions. The TAB Agency shall also make such other tests as may be required to demonstrate that the air handling and air distribution equipment performance complies with the specification requirements. The air conditioning systems shall be balanced to provide even temperatures throughout the conditioned space for both heating and cooling. Upon completion of all tests, balancing, etc., the data herein requested shall be tabulated in a legible form and submitted a minimum of two (2) weeks before final inspection. Main system air quantities shall be balanced to plus or minus 5% of CFM's specified. Room grilles and registers shall be plus or minus 10%, however, maintain positive, neutral, or negative pressures as shown. Submit (as part of report) duct layouts with all test points noted and identified. Include on these plan sheets specific data to show where each pitot station is, access panel locations, etc. The Contractor shall provide and install new sheave or sheaves, and new belts, as required, if a change in fan speed is necessary which cannot be made by adjusting the sheave originally installed.

C. The TAB Agency shall provide testing, adjusting, and balancing for all air handling system and equipment in accordance with AABC Standards and as generally described herein, but not limited to the following as described below.

D. Supply, return, and exhaust fans, including fan coil units, heat pump A/C unit(s):

1. Fan Nameplate - Record unit make, model, size, serial number, and equipment schedule number.

2. Fan Speeds - Test and adjust fan RPM to achieve maximum or design CFM. Record actual and specified values.

3. Current and Voltage - Test and record motor nameplate, actual running voltage, amperage and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

4. Pitot Tube Traverse - Perform a pitot tube traverse of main supply, return, exhaust and outside air ducts, as applicable to obtain total CFM. Where pitot tube traverse is not practical, other methods of testing air flow may be used if approved.

5. Outside Air - Test and adjust the outside air on applicable equipment using a pitot tube traverse. If a traverse is not practical, use the mixed air temperature method if the inside and outside temperature difference is at least 20 degrees F or use the difference between pitot tube traverses of the supply and return air ducts.

6. Static Pressure - Test and record system static profile for each fan unit, including, as applicable, component pressure drop for louvers, dampers, filters, coils, and other installed components and devices. Measure and record component and total fan unit static pressure drops and compare with specified quantities.

7. System Static Pressure - Measure and record duct system static pressures throughout each VAV distributing network, as required to determine any performance deficiencies, testing shall be done under design conditions.

E. Zone, Branch and Main Ducts:

1. Adjust supply, return, exhaust, and outside air ducts to within 5% plus or minus of design CFM requirements. As applicable, at least one (1) zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one (1) outlet or inlet volume damper completely open.

F. Diffusers, Registers and Grilles:

1. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% plus or minus of specified design requirements. Minimize drafts. Record actual and specified values.

2. Identification - Identify the manufacturer, model number and type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets and TAB report drawings.

G. Coils:

1. Air Temperature - Once air flows are set to acceptable limits, measure and record wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Measure and record dry bulb temperature on the entering and leaving side of each heating coil.

3.4 LIMIT DEVICES

A. All limit devices including, but not limited to freezestats, flow switches, firestats, smoke detectors, etc., shall be checked to verify proper operation. Final setpoints shall be included in the TAB report.

3.5 REFRIGERANT SYSTEMS

A. General: Perform refrigerant system test after the piping system has been flushed out with nitrogen and completely cleaned.

B. Data: The following data shall be gathered after the refrigerant system has been tested:

1. Condensing unit and condenser manufacturer, Model No., nameplate, serial number, unit size, tonnage, and fan cfm.

2. Nameplate locked motor amps, running amps, horsepower, and voltage of the compressor and condenser motors.

3. Measure and record the locked motor amps, running amps, horsepower, and voltage on each leg of the compressor and condenser fan motors.

4. Refrigerant suction and discharge pressure.

5. Refrigerant suction and discharge temperature.

6. Outside air wet bulb and dry bulb temperature during test.

3.6 LIFE SAFETY CONTROLS

A. The TAB Agency shall test and record life safety control operation on the HVAC equipment. It shall verify the installation of required smoke detectors in air handling equipment, and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shutdown or other required functions as described on the control drawings and sequence of operation. With the contractor and assistance of the temperature control and electrical sub-contractors, the TAB Agency shall verify the operation of interconnected systems, such as the smoke detector's activation of the fire alarm system and the alarm system's activation of the life safety control sequence.

END OF CSI NUMBER

SECTION 920-3 – MECHANICAL

CSI NUMBER 23 09 00

FACILITY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 REQUIREMENTS

A. The entire Facility Control System specified hereafter shall be approved and listed by Underwriters Laboratories, Inc., under UL 864 (Energy Management and Control System).

1.2 RELATED CSI NUMBERS

CSI number 23 05 00 Common Work Requirements for HVAC
CSI number 23 05 93 Testing, Adjusting, and Balancing for HVAC
CSI number 26 05 00 Common Work Requirements for Electrical

1.3 SCOPE

A. It is the intent of this section to provide, install, connect, and calibrate the entire Facility with individual thermostat as indicated on the drawings and as necessary to provide a weekly programmable thermostat for all systems as shown in the control drawings, stated in the sequences of operation, and as otherwise indicated in the Contract Documents.

B. It is the responsibility of the bidder to read and conform to all sections of the specifications, review all contract drawings of all divisions, and coordinate with all equipment suppliers of material specified under other sections of the specifications**.**

C. The engineering, installation supervision, programming, calibration, start up, and checkout necessary for a complete and fully operational control system as specified hereafter shall be provided under this section.

D. Provide startup documentation verifying proper operation of all points and all integrated systems.

E. Provide training and instruction of the installed control system.

F. All variable refrigerant units shall be connected to a centralized controller in addition to the local thermostat.

1.4 PRIOR APPROVAL

A. Prior approvals are not required. Individual unit controller or Thermostat System suppliers will be authorized factory representatives or branch offices of the air conditioning unit manufacturer.

1.5 SUBMITTALS

A. Within thirty (30) days of contract award, submit eight (8) sets of shop drawings and submittal data in accordance with 15010 and the General Contract Requirements. These submittals shall be delivered first to the Mechanical and Electrical sub-contractors for coordination review and evaluation prior to being submitted for final review. Letters from these sub-contractors. verifying that they have reviewed the submittals, and any comments regarding the submittals, must be

attached as part of the final submittal.

B. Submittals shall consist of project specific shop drawings, catalogue data sheets, sequence of operations, and point verification forms as defined in the following paragraphs.

1. Shop drawings shall be provided which show all control devices, electrical ladder diagrams, control system schematics, sequences of operation, and a material list. All systems and the associated control components as well as all connections between components shall be clearly indicated. The submittal shall clearly indicate the required coordination with equipment supplied by others. Simply showing a connection with no identification or termination will be considered unacceptable. All connections shown on the drawings shall be labeled on both ends and these same labels shall be used for the installation process for ease of comparing the shop drawings to the actual field installation. Each control component shall be given a unique identifier. This identifier shall be used in the sequence of operation so that reference to the drawings can be easily made.

a. Electrical Ladder Diagrams shall be shown on the shop drawings. Electrical ladder diagrams shall show all switches, relays, motor starters, etc. The electrical ladder diagrams shall show the correct control wiring and interlock wiring of all equipment provided under the Contract. Each diagram shall reference the correct power source by breaker panel and circuit number or from a control transformer. If equipment shown is provided by another contractor, then this shall be noted.

b. The sequence of operation for each controlled system shall be provided with reference to the control device identifier. The sequence of operation shall break down the control operation by major function (i.e., occupied-unoccupied, etc.) and describe in detail the correct operation and interaction with other system functions. Use of the sequence of operation stated on the drawings is acceptable; however, it shall be modified to reflect actual control device identifiers.

c. A complete material listing shall be included on the shop drawings which show the device model numbers, device identifiers, quantities, manufacturers, etc., of all equipment provided under this section. The material list shall be organized in alphabetical order so that it can be easily compared to the associated catalogue data sheets. The quantities are to be provided only to confirm a general understanding of the contract requirements and will not be verified as a complete material list.

2. Catalogue data sheets will be provided for each different piece of equipment provided under this section. At a minimum the data sheet shall contain sufficient information so that compliance with the specification can be verified. Where multiple models or options are indicated on the same catalogue data sheet, the equipment proposed shall be highlighted or otherwise indicated. The catalogue data sheets shall be organized in alphabetical order to match the material listing on the shop drawings.

1.6 RECORD DRAWINGS

A. Record drawings shall be provided as required by 15010 and the general contract requirements. Record drawings shall not be completed until after installation is complete. Any changes made during installation shall be recorded on the approved shop drawings as they are made so that a current record drawing is constantly being updated. These as constructed drawings shall be available at all times for inspection by the Owner's Representative. At completion of the project, all manual changes shall be incorporated into a clean reproducible set of as constructed drawings. These as constructed drawings shall be available for use during the training sessions.

B. With the reproducible record drawings, the Contractor shall furnish a complete spare parts lists,

operating instructions, and maintenance literature, for proper maintenance of all control equipment, in accordance with the requirement specified in Section 15010.

C. Record drawing shall all be provided on magnetic media directly compatible Autodesk AutoCAD Rev. 14.

D. In addition to the record drawings, the following documents and manuals will be delivered to the Owner. Two sets of these documents will be provided prior to training begins:

1.7 SYSTEM TESTING

A. The operation and accuracy of each component shall be demonstrated to the satisfaction of the Owner and Engineer. This review shall include an operational evaluation of all stated sequences of operation, electrical interlocks, safety devices, and final as-constructed drawings. Training will not occur until the testing is complete and a report stating such has been accepted by the Owner's Representative.

1.8 TRAINING

A. Upon completion of the work provide 8 hours total of on-site instruction to the Owner's operating personnel who have responsibility for the mechanical system. A complete operating booklet shall be provided and used during the training period. The booklet shall include the as constructed drawings as stated previously.

1.9 SERVICE AND WARRANTY

A. The system supplier shall maintain a local maintenance support facility complete with system technicians, diagnostic and test equipment, and new spare components. Emergency service shall be available in the local office on a 24-hour, 7-day a week basis. The service agent shall provide a continuously monitored local service telephone number for emergency service and this number shall be provided to the Owner.

B. Service and maintenance must be provided for one (1) year from time of Owner acceptance of the control system. Service during this period shall be available within 12-hours from the time the trouble call is placed. Warranty shall be for all materials and labor provided as the scope of work of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products required for this project shall be selected in accordance with this Part of the section. Installation of the components shall be in accordance with Part 3 of the Section. If a component is required to meet the requirements shown on the drawings and is not specified in the Part of the specification, the Supplier shall select and submit on components that meet all design requirements indicated on the drawings, stated in the sequence of operation, and elsewhere in the Contract documents.

2.2 CONTROLLERS

A. Hardware Requirements

1. Thermostat applications for typical for variable refrigerant volume heat

pump and energy recovery units.

a. The Thermostat Controllers shall have the ability to perform all the following routines as standard sub-routines:
   - Fan Speed
   - Set Temperature
   - Diagnostics Display
   - ON/OFF
   - Set Temperature Range Limit
   - After-hour occupant override

2. Centralized Controller: Variable refrigerant and split system units shall be controlled by a centralized controller capable of controlling connected fan coil units. The centralized controller support operations to supersede control of the remote thermostat and include system configuration, daily/weekly scheduling, operation and malfunction. The system shall be equipped with ethernet port to support optional interconnection with a network PC via a closed/direct Local Area Network (LAN). The system shall be securely accessible via PC's web browser to support operation monitoring, daily/weekly/yearly scheduling and maintenance diagnostics. The central control panel shall include a fully interactive color display (Touch screen or user workstation) and be programmed and configured to manage, control, monitor, and display the following equipment for both phase I and phase II of the project as follows:
   Phase I equipment:
   - IUW, CUW-1
   - IUW, CUW-2
   - IUW, CUW-3

   Phase II equipment:
   - CU-4, IU-4A, IU-4B
   - CU-5, IU-5A, IU-5B, IU-5C, IU-5D, BC-1
   - CU-6, IU-6A, IU-6B
   - CU-7, IU-7
   - CU-8, IU-8A, IU-8B, IU-8C
   - CU-9, IU-9A, IU-9B
   - ERV-1

   Minimum centralized Controller features shall include:
   - Manage, monitor and control all indoor IU units individually, in a group, or in a collective batch operation. Shall also control ERV-1 based on occupancy schedule and as described below.
   - Support dual set point functionality.
   - Shall include interactive display showing installed equipment settings including compressor speed, hi/low pressure, space temperature, error codes, unoccupied setback / setup temperatures / temperature ranges, and indoor unit status.
   - Functions shall include initial setting, operation data back-up
   - Operators shall be able to locally permit or prohibits remote controller functions including unit on/off, change operation mode, change set-point temperature, change fan speed, temperature settings, fan speed setting.
   - Temperature set point range limits that can be set for local remote controllers.
   - User defined indoor unit functions including: (auto, cool, heat, fan, setback, drying)
   - Scheduling including daily, annual, weekly, and seasonal schedule holiday scheduling.
   - Trend data including fan operation time, setpoint temperature, room temperature.
   - Memory back-up via usb port.

- System shall support an interlock from the fire protection system that shall shut down all IU/OU units and erv-1 upon a positive detection of smoke.
- Provide all programming including scheduling and temperature settings per owner's preference. Confirm all settings and setpoints with owner prior to programming, some areas, including it area will operate 24-hours/day.

C. The centralized controller shall be capable and configured to monitor and control the outside air energy recovery ventilator (ERV-1) based on the programmed occupancy schedule. The centralized controller shall be capable of control and monitoring functions as follows:

- Outside air Energy Recovery (ERV) Start, Stop, and Damper control based on occupancy schedule
- ON/OFF
- Monitor the outside supply air temperature
- Fan status for each fan, and alarm on fault of either

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

A. Not Applicable.

3.2 GENERAL

A. All devices, conduit, wiring, raceways, etc. shall be installed in a neat professional manner by skilled persons.

1. The installation all aspects of the system shall comply with all applicable codes and regulations.

2. The installation of all materials shall be in accordance with the published manufacturer's recommendations without exception. If for some reason a particular component cannot be installed in compliance with these recommendations, the Contractor shall advise the Engineer of the situation.

3. Where miscellaneous materials are required to complete an installation, i.e. isolation valves for pressure switches, wall switches for an exhaust fan control circuit, etc., the materials shall be supplied as defined in the relevant section of these Specifications. For example, Section 15100 specifies valve requirements. Division 16 specifies electrical products and requirements.

4. Coordinate with other trades where installation of a particular component requires other trades to be involved. Installation coordination includes location the correct placement of thermowells, flow switches, dampers, control valves, control power circuits, etc. Care must be exercised to identify locations that meet the requirements of the manufacture including upstream and downstream distances, pressures, temperatures, etc.

END OF CSI NUMBER

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SECTION 920-3 - MECHANICAL

CSI NUMBER 23 30 00

HVAC AIR DISTRIBUTION AND EQUIPMENT

PART I - GENERAL

1.1 SCOPE OF WORK

1.1.1 Furnish all labor, materials, services, equipment, appliances required for air distribution and ductwork specified herein.

1.2 WORK INCLUDED, BUT NOT INCLUSIVE

1.2.1 All ductwork.

1.2.2 Grilles, registers and diffusers.

1.2.3 Dampers, etc.

1.3 DESIGN AND FABRICATION

1.3.1 Supply air distribution devices shall be designed, installed and adjusted to provide the throw and spread required with no apparent drafts or excessive air movements within the ventilation or air-conditioned spaces. Any air distribution accessories required to affect these conditions shall be furnished and installed as a part of the supply unit.

1.3.2 Prepare shop drawings of all ductwork systems prior to installation. See mechanical plans for additional requirements.

1.4 REFERENCE PUBLICATION

1.4.1 All installations shall conform to the latest edition of the Sheet Metal and Air Conditioning Contractor's National Association Manual.

1.5 MANUFACTURER

1.5.1 The drawings were prepared and this specification written on the basis of using the products of specific manufacturers. It is not the intent to limit competitive bidding. Equal products by other manufacturers will be considered when submitted under the conditions outlined in the SUPPLEMENTAL GENERAL CONDITIONS.

PART II - PRODUCTS

2.1 DUCTWORK

2.1.1 Shall be in accordance with plans, International Mechanical Code, and SMACNA guidelines. Flexible ductwork shall only be used for branch ends where concealed above ceiling, see plans for maximum allowable length. Exposed ductwork shall be lock-form quality steel. Round duct shall be spiral seam. Install ducts with protective plastic cover on duct ends to be removed after installation. Finished ductwork shall be free of oil marks, handprints, or other visual residues. Refer to plans for additional specifications

2.1.2 Lining and Insulation:

2.1.2.1 No Lining shall be installed on round duct on this project. Concealed round air conditioning duct shall be wrapped with foil backed insulation and seams shall be taped.

2.1.2.2 Rectangular return ducts shall be lined or wrapped in accordance with plans.

2.1.2.3 Supply and return duct drops extending from all rooftop units shall be fully lined for noise abatement.

2.1.2.4 Ducts shall be cleaned following installation per ASHRAE or SMACNA recommended practice by a qualified duct cleaning specialist. A duct cleaning report shall be furnished to owner prior to turn over to Owner.

2.1.2 Finished Appearance Painting:

2.1.2.4 Following installation of duct branches, return and supply boots, and volume dampers but prior to the installation or grilles and diffusers, the interior ductwork, plenums, boots, and volume dampers visible through grilles and diffusers will be painted flat black with a direct to metal paint per Architect Requirements. Grilles, Registers, and Diffuser color and paint shall be as directed by the Architect.

2.2 DAMPERS

2 .2.1 Volume Dampers:
See Plan Schedule for Requirements.

2.2.2 Fire Dampers (Where Required):
As manufactured by Greenheck or equal and shall bear the UL label and shall be in accordance with the NFPA bulletin 90A and rated for service per plans. All fire dampers shall be dynamic rated.

2.2.3 Instrument Test Ports:
Young Regulator No. 1100 or Vent Fab No. 699 as manufactured by Vent Fabrics, Inc., Chicago, Illinois or approved equal.

2.3 AIR DISTRIBUTION DEVICES

2.3.1 Ceiling Diffusers:
Equal to Titus with neck size as indicated on plans.

2.3.2 Sidewall Supply Registers:
Equal to Titus with boot size to match duct connection per plans.

2.3.3 Return Grilles
Equal to Titus with boot to match return duct per plans.

2.3.4 Exhaust Registers:
Equal to Titus per plans.

PART III – EXECUTION

3.1 DUCTWORK

3.1.1 Locations and Conditions:

Erect all ductwork in the general locations shown on the drawings but conform to all structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the jobsite and make all necessary changes in cross sections, offsets, etc., whether they are specifically indicated or not. All ductwork is shown as net inside dimensions. Where ductwork is specified on plans to be internally lined, that ductwork must be increased in size to accommodate the insulation.

3.1.2 Installation

3.1.2.1 Support all horizontal rectangular ducts up to and including 40" in their greater dimensions by means of a 360-degree encircling steel band hanger supported to structure by means of threaded rods. Support rectangular horizontal ducts larger than 40" in their greatest dimension by means of angle iron trapeze hangers. Each section of duct shall have at least one pair of supports. Support round branch ducts 24” and smaller exposed to occupied areas with minimum 3/8” treaded rods with fully encircling steel bands. Support 26” and greater round ducts and all flat oval ducts from their flanges.

3.1.2.2 All exposed ducts that are visible and exposed to occupants, including ducts in the service bays, shall be supported with Unistrut and all-thread rods. Do not use flat strap or wire supports. Spiral ducts shall be supported about the duct centerline with fully encircling perimeter bands. All exposed ducts shall be free of scuffs, dents, dings, scratches, tags, markings, and shall be wiped clean at job completion. Exposed ducts shall be internally sealed with mastic. Paint color as directed by Architect.

3.2 DAMPERS

3.2.1 Install dampers where shown on the drawings and whenever necessary for complete control of the air flow, including all supply and return branches, "division" in main supply and return ducts, each individual air supply outlet and fresh air ducts. Install fire dampers as required by plans and local and governing codes. See plans for additional damper requirements.

3.3 AIR DISTRIBUTION DEVICES

3.3.1 Install grilles, registers and diffusers as indicated on the Architectural Reflected Ceiling Plan for exact location. Sizes and types shall be indicated and scheduled on the Mechanical Drawings or specified herein.

3.4 ACCESS DOORS

3.4.1 Furnish and install in the ductwork, hinged across doors to provide access to all automatic dampers, etc. Access doors shall be low leakage and secured by means of a sash lock. Installation per SMACNA.

3.5 TURNING VANES

3.5.1 Where square elbows are shown or are required for good air flow, provide and install Airfoil Type or double thickness turning vanes per plan details.

3.6 FAN CONNECTORS

3.6.1 Install flange type expansion joint connector at intake to each exhaust fan conveying air. Installation shall be in accordance with fan manufacturer's installation instructions.

3.7 GENERAL

3.7.1 All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched, not pin punched, shall not be any larger than necessary, and shall include a bushing. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time. All panels in un-insulated rectangular ducts l2" or larger shall be cross broken. Sheet metal screws shall not be used in duct construction except for round ducts. Installation shall be in accordance with the standards of the SMACNA Manual, latest edition.

3.8 CLEAN UP

3.8.1 Upon completion of the work of this section, remove all debris relating to the conduct of this portion of the work from the premises.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 10

GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

A. The drawings and specifications do not specify exact installation means and methods or Contractor safety procedures. Installation means and methods and safety procedures are, and shall remain, the responsibility of the Contractor. No instruction or statement made on the drawings, specifications, future addenda, or change orders shall be interpreted to shift this responsibility away from the Contractor.

B. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions. Where the word "provide" or "provision" is used, it shall be definitely interpreted as "furnishing and installing complete in operating condition." Where the words "as indicated" or "as shown" are used, they shall mean “as shown on contract drawings." Where items are specified in the singular, this Division shall provide the quantity as shown on the drawings, plus any spares or extras mentioned on drawings or in specifications. All specified and supplied equipment shall be new.

1.2 CODES, PERMITS AND FEES

A. Comply with all applicable laws, ordinances, rules, regulations, codes or rulings of governmental units having jurisdiction, as well as standards of the National Fire Protection Association and serving utility requirements.

B. Obtain and pay for permits, fees, inspections, meters, utility connections and extensions and the like associated with work in each CSI number of this Division.

C. Installation procedures, methods, and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.3 STANDARDS

A. The following standard publications of the latest editions and supplements thereto shall form a part of these specifications. All electrical work shall, at a minimum, be in accordance with the applicable sections of these standards.

National Fire Protection Association Standards (NFPA).

Underwriters' Laboratories, Inc. (UL).

Certified Ballast Manufacturers Association (CBM).

National Electrical Manufacturers Association (NEMA).

Institute of Electrical and Electronic Engineers (IEEE).

American Society for Testing and Materials (ASTM).

National Board of Fire Underwriters (NBFU).

American National Standards Institute (ANSI).

National Electrical Testing Association (NETA).

Insulated Power Cable Engineers Association (IPCEA).

Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction (MAG).

Electrical Testing Laboratories (ETL).

Local Building Codes.

1.4 WORK AND MATERIALS

A. All electrical materials and equipment shall be new and of the type and quality specified, and shall be listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. Replace or repair any nonconforming, damaged, or defective items at no extra cost to the Owner.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. Houston Wire and Cable
   3. Belden Inc.
   4. Encore Wire Corporation.
   5. General Cable Technologies Corporation.
   6. Southwire Incorporated.

C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, Type UF, Type USE, and Type SO.

E. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, metal-clad cable, Type MC, mineral-insulated, metal-sheathed cable, Type MI, Type SO and Type USE with ground wire.

F. Metal-clad (MC) cable shall be steel corrugated interlocking type and shall include an equipment ground conductor, AFC, AmerCable, or as accepted. Metal-clad (MC) cable shall not be permitted to be used in this project unless indicated on the drawings or as noted in PART 3 of this CSI number. Non-metallic, residential wire (such as Romex) are not acceptable.

G. Mineral insulated cable shall be AmerCable, M.I. Cable Company (MICC), or as accepted.

H. Armor-clad (AC) cable shall not be permitted to be used in this project.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders rated smaller than 100A; copper for feeders rated 100A and larger. Stranded for all sizes.

B. Branch Circuits: Copper. Solid for No. 14 AWG and smaller; stranded for No. 12 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type XHHW-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

F. Feeders in Cable Tray: Type XHHW-2, single conductors larger than No. 1/0 AWG.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

J. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Wire Pulling Lubricant: Richards "Gel Lube 7/5"; American Polywater A, C, G&J; Quelcor "Quelube"; American Colloid "Slip X-300"; Thomas/Jet Line "Slipry Loob"; Ideal "Wire Lube"; Mac "Wirepull"; Minerallac "Wire-Wax"; or Electro "Y-er Eas."

E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

G. Support cables per NEC.

H. Complete cable tray systems installation prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Record values in the field.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 **inches** of slack.

D. Terminations at Circuit Breakers and Switches:
   1. #10 and #8 AWG wire, locking tongue lug, Buchanan "Termend," or as accepted.
   2. #6 AWG and larger wire, round flange solderless lug, Burndy "Quick-Lug" type QDA, or as accepted.

E. Fixture Connections: Pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or accepted equal.

F. Motor Connections: Solderless lug with RayChem GelCap, or as accepted.

G. Wire Splices:
   1. Joints in Wire: #8 AWG and smaller wire, pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or as accepted. #6 AWG and larger wire, irreversible compression type, Burndy, Ilsco, or as accepted.
   2. Wire Taps: Solderless lug, solderless compression lug, each with Raychem Gtap, Ilsco GTA, or GTT with insulating cover, or as accepted.
   3. Exterior Below Grade Joints in Wire: Solderless lug, solderless compression lug, each with Raychem GelCap or as accepted.

H. Applied Insulation: Insulating materials shall be listed for the application. Voltage rating shall be equal to or greater than the factory-applied wire insulation. Raychem, 3M, Ilsco, or as accepted.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables.

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

C. Markers and Tags: Plastic Wire Markers: T&B or Brady.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
      a. All emergency feeders.
      b. All normal powered feeders rated 100A and larger.
      c. 10% of branch circuits and feeders rated 60 – 100A.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 2 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
      a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
      b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test and Inspection Reports: Prepare a written report to record the following:
   1. Procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI number Includes grounding and bonding systems and equipment.

B. CSI number Includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Ground bonding common with lightning protection system.
   3. Copper building ground.
   4. Foundation steel electrodes.
   5. Signal Reference Grid

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Ground bus bars.
   5. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
   1. Include the following:
      a. Instructions for periodic testing and inspection of grounding features at test wells ground rings based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (24" long U.N.O.) in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless irreversible compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, #4/0 AWG minimum.
1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with

substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
   9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.
   1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
   2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
   3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in CSI number 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
   1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
   1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches from building's foundation.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and

their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This CSI number Includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4

6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this CSI number are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets. (Including floor boxes for concrete and raised floor installations)
7. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.

12. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel or aluminum.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.

2. Anamet Electrical, Inc.

3. Arnco Corporation.

4. CANTEX Inc.

5. CertainTeed Corporation.

6. Condux International, Inc.

7. Electri-Flex Company.

8. Kraloy.

9. Lamson & Sessions; Carlon Electrical Products.

10. Niedax-Kleinhuis USA, Inc.

11. RACO; Hubbell.

12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.

2. Hoffman.

3. Mono-Systems, Inc.

4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Moulded Products, Inc.

2. Hoffman.

3. Lamson & Sessions; Carlon Electrical Products.

4. Niedax-Kleinhuis USA, Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mono-Systems, Inc.

b. Panduit Corp.

c. Wiremold / Legrand, G3000 Series

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated.

b. Mono-Systems, Inc.

c. Panduit Corp.

d. Wiremold / Legrand, G3000 Series

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Mono-Systems, Inc.

b. Panduit Corp.

c. Wiremold / Legrand.

2. Material: Aluminum with clear anodized finish.
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.
18. Panduit.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.

3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Floor boxes for installation in raised floors, suitable for plenum use, with power and data terminations, Panduit Panzone.

H. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

J. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

K. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

L. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

M. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

N. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

O. Gangable boxes are prohibited.

P. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

Q. Cabinets:

1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. NewBasis.

d. Oldcastle Precast, Inc.

e. Quazite: Hubbell Power System, Inc.

f. Synertech Moulded Products.

3. Standard: Comply with SCTE 77.
4. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. Nordic Fiberglass, Inc.

d. Oldcastle Precast, Inc; Christy Concrete Products.

e. Quazite: Hubbell Power System, Inc; Hubbell Power Systems.

f. Synertech Moulded Products.

3. Standard: Comply with SCTE 77.
4. Color of Frame and Cover: Gray.
5. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
6. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
7. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
8. Cover Legend: Molded lettering, "ELECTRIC.".
9. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
10. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit (Subject to physical damage): GRC, IMC.

2. Exposed Conduit, Not Subject to Physical Damage: EMT (with weatherproof compression fittings)
3. Concealed Conduit, Aboveground: GRC, IMC, EMT.
4. Underground Conduit: RNC, Type EPC-80-PVC, concrete encased (as applicable).
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Encased in concrete decks: RNC, Type EPC-80-PVC, concrete encased

2. Exposed, (Subject to Physical Damage): GRC, IMC.
3. Exposed, (Not Subject to Severe Physical Damage): EMT.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in CSI number 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in CSI number 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in CSI number 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in CSI number 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in CSI number 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in CSI number 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in CSI number 07 84 00 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Ladder cable trays.
2. Single-rail cable trays.
3. Trough cable trays.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:.

1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to side of cable trays.
4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

B. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.2 LADDER CABLE TRAYS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cooper B-Line, Inc.
2. Walker
3. P-W Industries

C. Description:

1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
2. Rung Spacing: 6 inches o.c.
3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.

5. No portion of the rungs shall protrude below the bottom plane of side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a200-lb concentrated load, when tested according to NEMA VE 1.
7. Minimum Usable Load Depth: 4 inches.
8. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
9. Width: 18 inches unless otherwise indicated on Drawings.
10. Fitting Minimum Radius: 36 inches.
11. Class Designation: Comply with NEMA VE 1, Class 12B.
12. Splicing Assemblies: Bolted type using serrated flange locknuts.
13. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.
14. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.3 SINGLE-RAIL CABLE TRAYS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cooper B-Line, Inc.
2. Walker
3. P-W Industries

C. Description:

1. Configuration: Center rail with extruded-aluminum rungs arranged symmetrically about the center rail.
2. Construction: Aluminum rungs mechanically connected to aluminum center rail in at least two places, with ends finished to protect installers and cables.
3. Rung Spacing: 6 inches o.c.
4. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
5. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
6. Width: 18 inches unless otherwise indicated on Drawings.
7. Support Point: Splice fittings shall be hanger support point.
8. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
9. Loading Depth: 4 inches.
10. Maximum Loads: 25 lb/ft..

11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
13. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.
14. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.

2.4 MATERIALS AND FINISHES

A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Mill galvanized before fabrication.

    a. Standard: Comply with ASTM A 653/A 653M, G90.
    b. Hardware: Galvanized, ASTM B 633.

5. Finish: Electrogalvanized before fabrication.

    a. Standard: Comply with ASTM B 633.
    b. Hardware: Galvanized, ASTM B 633.

6. Finish: Hot-dip galvanized after fabrication.

    a. Standard: Comply with ASTM A123/A123 M, Class B2.
    b. Hardware: Chromium-zinc plated, ASTM F 1136.

7. Finish: Epoxy-resin paint.

    a. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
    b. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
    c. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
    d. Hardware: Chromium-zinc plated. ASTM F 1136.

8. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
9. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

C. Stainless Steel:

1. Materials: Low-carbon, passivated, stainless steel, Type 304L or Type 316L, ASTM F 593 and ASTM F 594.
2. Hardware for Stainless-Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.5 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Covers: Solid type made of same materials and with same finishes as cable tray.

C. Barrier Strips: Same materials and finishes as for cable tray.

D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 WARNING SIGNS

A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

B. Comply with requirements for fasteners in CSI number 26 05 53 "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA FG 1 NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in CSI number 26 05 29 "Hangers and Supports for Electrical Systems."

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support bus assembly to prevent twisting from eccentric loading.

K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.

L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

M. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

N. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

O. Make changes in direction and elevation using manufacturer's recommended fittings.

P. Make cable tray connections using manufacturer's recommended fittings.

Q. Seal penetrations through fire and smoke barriers. Comply with requirements in CSI number 07 84 00 "Penetration Firestopping."

R. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

S. Install cable trays with enough workspace to permit access for installing cables.

T. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

U. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

V. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

W. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in CSI number 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch

intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. Fasten cables on vertical runs to cable trays every 18 inches.

D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.

F. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.

4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

3. Sealing Elements: EPDM Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in CSI number 07 92 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF CSI NUMBER

SECTION 920-4 – ELECTRICAL

CSI NUMBER 26 05 48

VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This CSI number includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

1.2 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

4. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
5. Field-fabricated supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this CSI number are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.

7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF CSI NUMBER

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 73.16

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. CSI number includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal

of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Specialist.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in CSI number 01 78 23 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this CSI number. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by the following:

1. ESA Inc.
2. Operation Technology, Inc.
3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists

between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 241 and IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other CSI numbers and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.

7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance withprotective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

END OF CSI NUMBER

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 05 73.19

OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. CSI number includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in CSI number 01 78 23 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this CSI number. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by one of the following:

1. ESA Inc.
2. Operation Technology, Inc.

3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in CSI number 26 05 53 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

3.3 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except 240-V ac and 208-V ac systems fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.4 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Gather and tabulate the following input data to support coordination study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other CSI numbers and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
9. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
10. Motor horsepower and NEMA MG 1 code letter designation.
11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.5 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.

5. Control panel.

3.6 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.7 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF CSI NUMBER

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 09 36

LIGHTING CONTROLS

PART 1 - GENERAL

SUMMARY

A. The work covered in this CSI number is subject to all of the requirements in the General Conditions of the specifications.

B. Contractor shall coordinate all of the work in this CSI number with all of the trades covered in other CSI numbers of the specification to provide a complete and operable system. Provide a complete central lighting system including interconnecting data cabling, power supplies, remote switches, relay panels, sensors, photosensors, addressable devices, wired and wireless devices, to accomplish the proposed sequence of operations as indicated on the plans.

C. CSI Number Includes:
   1. Lighting control system and associated devices.

REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org and www.ieee.org)

B. ASTM International (ASTM) (www.astm.org)
   1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. Canadian Standards Association (CSA) (www.csa.ca)
   1. CSA C22.2 # 14 Industrial Control Equipment
   2. CSA C22.2 # 184 Solid-State Lighting Controls
   3. CSA C22.2 # 156 Solid-State Speed Controls

D. International Electrotechnical Commission (www.iec.ch)
   1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
   2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

E. International Organization for Standardization (ISO)
   1. 9001:2000 – Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL)www.ul.com
   1. 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

2. 508 (1999) - Standard for Industrial Control Equipment.
3. 1472 (1996) - Solid-State Dimming Controls.
4. 924 (2003) - Emergency Lighting and Power Equipment

H. Federal Communications Commission (FCC) rules – Part 15 (Class B): Radio Frequency Devices

SYSTEM DESCRIPTION

A. The lighting control system shall be a distributed system containing communication gateways on each building floor and interconnected to form a complete system including software and licenses. All local devices shall connect to the control system via bridges and control wiring. Extent of lighting control system work is indicated by drawings and by the requirements of this CSI number. It is defined to include, but not by way of limitation:
   1. Low voltage switching system with lighting automation relay panels/controllers and associated low voltage switches.
   2. Low voltage lighting automation relay panels and controllers.
   3. Low voltage wall stations, control interfaces, and sensors.
   4. Panel Master ON/OFF control capability.
   5. Programmable lighting controls for complete system via software with graphic interface specific to the project.

B. The lighting control system supplier shall provide fully trained field personnel (based local to the project) to facilitate the programming and coordination with the BAS system integrator.

C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation on control equipment and wiring. Not work of this CSI number.

D. Conduit stubouts from switches and other devices shall be required to accessible ceilings. Where no ceilings are utilized, conduit must be routed back to the relay panel. Where applicable, wiring and devices shall be plenum rated.

SUBMITTALS (INCLUDING CLOSEOUT SUBMITTALS)

A. Shop Drawings; include:
   1. Sequence of Operation: Submit the project specific sequence of operation, control functions and setpoints for each type of space or control strategy.
   2. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers, room names and numbers.
   3. Schematic of system.
   4. Submit dimensioned drawings (1/8" = 1'-0" AutoCAD Latest Version) of all lighting control system components and accessories with project name and address.
   5. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, low voltage switches, programmable panel master switches, programmable system switch panels, telephone override cards, global switching/annunciation and wire. Clearly delineate line voltage wiring connections.
   6. Submit interior photosensor locations in accordance with S.P.O.T.
   7. Cut sheet of gateways, bridges, wiring devices, and relay panels.

B. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

C. Include all conduit requirements within the submittal. Where conduits are indicated on the Division 26 drawings, the quantity and size shall be a minimum. The vendor shall confirm all quantities and sizes on the submittal.

D. Provide Operation and Maintenance Manuals:
   1. Including:
      a. Warranty Information
      b. System Start-up Information
      c. Installation Guide
      d. Set-up and Programming Guide
   2. Electronic format to be available on Lighting Control System manufacturer website.

QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.

B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

C. System Checkout: Factory-trained technicians shall be based locally and shall be available to functionally test each component in a programmable system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

D. Distributed lighting control system:
   1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

PROJECT CONDITIONS

E. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. Lighting control system must be protected from dust during installation.

WARRANTY

A. Provide Manufacturer's 5 Year Limited Parts Warranty and 2 Year Labor Coverage:
   1. 5-year limited parts warranty for the replacement of defective Lighting System Components from the date of system startup completion and 2-year 100 percent labor coverage from the date of the system startup completion.

MAINTENANCE MATERIAL SUBMITTALS

A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

B. Make new replacement parts available for minimum of 10 years from date of manufacture.

PART 2 – PRODUCTS

MANUFACTURERS

A. Basis of design product: subject to compliance and prior approval with specified requirements of this CSI number, one of the following:
   1. Sensorswitch nLight
   2. Lutron QS
   3. Dynalite
   4. Encellium

B. Substitutions:
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

GENERAL

A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.

C. Products: As scheduled on plans.

D. Wiring devices: White device body, stainless steel faceplate unless noted otherwise.

PART 3 - EXECUTION

INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Define each dimmer's load type, shade settings, and set control functions.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Mount exterior daylight sensors to point due north with constant view of daylight.

F. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

G. Systems Integration:
   1. Equipment Integration Meeting Visit
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.

STARTUP AND PROGRAMMING

A. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
   1. Qualifications for factory-certified field service engineer:
      a. Minimum experience of 2 years training in the electrical/electronic field.
      b. Certified by the equipment manufacturer on the system installed.
   2. Make visits (minimum 1, and as necessary) upon completion of installation of lighting control system:
      a. Verify connection of power feeds and load circuits.
      b. Verify connection and location of controls.
      c. Program system data.
      d. Verify proper connection of digital control link.
      e. Verify proper operation of manufacturers interfacing equipment.
      f. Obtain sign-off on system functions.
      g. User to be trained on system operation.

B. After Hours Start-up
   1. Provide factory certified Field Service Engineer to perform manufacturer's start-up procedures outside normal working hours (Monday through Friday, 7a.m. to 5 p.m.)

FIELD QUALITY CONTROL

C. [Manufacturer Services
   1. Aim and Focus Visit
      a. Facility Representative to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.]

CLOSEOUT ACTIVITIES

D. Training Visit
   1. Lighting Control System Manufacturer to provide 2 day additional on-site system training to site personnel.

E. On-site Walkthrough
   1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

MAINTENANCE

A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

C. System Optimization Visit
   1. Lighting Control System Manufacturer to visit site 6 months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.

8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in CSI number 01 78 23 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and [install temporary electric heating (250 W per section)] [connect factory-installed space heaters to temporary electrical service] to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 110 deg F.
b. Altitude: Not exceeding 6600 feet.

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.

2. Eaton

3. GE

4. Siemens

C. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

D. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

E. Front- and Rear-Accessible Switchboards:

1. Main Devices: Drawout mounted.
2. Branch Devices: Individually compartmented and drawout mounted.
3. Sections front and rear aligned.

F. Nominal System Voltage: 480Y/277 V, 208Y/120 V.

G. Main-Bus Continuous: As indicated on plans.

H. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

I. Indoor Enclosures: Steel, NEMA 250, Type 1.

J. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

K. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Flat roof; for each section, with provisions for padlocking.
3. Doors: Personnel door at each end of aisle, minimum width of 30 inches; opening outwards; with panic hardware and provisions for padlocking.
4. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; ground-fault circuit interrupter (GFCI) duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
5. Walk-in Aisle Heating and Ventilating:

    a. Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F with outside design temperature of.
    b. Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F with outside design temperature of 23 deg F.
    c. Ventilating openings.
    d. Thermostat: Single stage; wired to control heat and exhaust fan.

6. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a control-power transformer within the switchboard. Supply voltage shall be 120-V ac.
7. Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.

L. Barriers: Between adjacent switchboard sections.

M. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

N. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

O. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

P. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.

Q. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

R. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.

S. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

T. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

U. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity,with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
9. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

V. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

W. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of .

X. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Square D; a brand of Schneider Electric.
   b. Eaton
   c. GE
   d. Siemens

C. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

   1. Fuses, rated at 200-kA interrupting capacity.
   2. Fabrication using bolted compression lugs for internal wiring.
   3. Integral disconnect switch.
   4. Redundant suppression circuits.
   5. Redundant replaceable modules.
   6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   7. LED indicator lights for power and protection status.
   8. Audible alarm, with silencing switch, to indicate when protection has failed.
   9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
   10. Six-digit, transient-event counter set to totalize transient surges.

D. Peak Single-Impulse Surge Current Rating: [160 kA per mode/320 kA per phase] [120 kA per mode/240 kA per phase] [80 kA per mode/160 kA per phase].

E. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

F. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:

   1. Line to Neutral: 800 V for 480Y/277.
   2. Line to Ground: 800 V for 480Y/277.
   3. Neutral to Ground: 800 V for 480Y/277.

G. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:

   1. Line to Neutral: 400 V, 800 V from high leg.
   2. Line to Ground: 400 V.
   3. Neutral to Ground: 400 V.

H. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V.
2. Line to Ground: 1500 V for 480 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in CSI number 26 09 13 "Electrical Power Monitoring and Control."
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    i. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Full-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time time adjustments.
    c. Ground-fault pickup level, time delay, and I^2t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Remote trip indication and control.
6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in CSI number 26 09 13 "Electrical Power Monitoring and Control."
7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
8. Control Voltage: 120-V ac.

C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Square D; a brand of Schneider Electric.
    b. Eaton
    c. GE
    d. Siemens

2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

    a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
    b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
5. Service-Rated Switches: Labeled for use as service equipment.
6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

    a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.

c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

E. Fuses are specified in CSI number 26 28 13 "Fuses."

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; [**double**] secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Megawatts: Plus or minus 2 percent.
e. Megavars: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch diameter or 6 inches square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

E. Feeder Ammeters: 2-1/2-inch minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.

F. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with drawout test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

G. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording [**five**] [**15**] [**30**] <**Insert time period**>-minute integrated demand of totalized system.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control Circuits: 120-V ac, supplied from remote branch circuit.

C. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-

power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

D. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

E. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.7 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.

1. Nameplate: At least 0.0625-inch- thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.

C. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.

D. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

E. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

F. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in CSI number 03 30 00 "Cast-in-Place Concrete." CSI number 03 30 53 "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in CSI number 26 25 00 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in CSI number 26 05 36 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges [as indicated.] [as specified in CSI number 26 05 73.16 "Overcurrent Protective Device Coordination Study."]

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protective Device

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in CSI number 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton
3. GE
4. Siemens

5.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

E. Mains: As indicated on plans.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

I. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton

3. GE
4. Siemens

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: As indicated on plans.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton
3. GE
4. Siemens

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in CSI number 26 09 13 "Electrical Power Monitoring and Control."
    f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
    h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in CSI number 26 28 13 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in CSI number 03 30 00 "Cast-in-Place Concrete." CSI number 03 30 53 "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with CSI number 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as provided by Engineer of Supplier's time-current coordination study approved by the Engineer.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge-suppression units.
4. Isolated-ground receptacles.
5. Hospital-grade receptacles.
6. Tamper-resistant receptacles.
7. Weather-resistant receptacles.
8. Snap switches and wall-box dimmers.
9. Solid-state fan speed controls.
10. Wall-switch and exterior occupancy sensors.
11. Communications outlets.
12. Pendant cord-connector devices.
13. Cord and plug sets.
14. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no fewer than one.
2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this CSI number.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).

b. Hubbell; HBL5351 (single), HBL5352 (duplex).

c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8310 (single), 8300 (duplex).

b. Hubbell; HBL8310 (single), HBL8300 (duplex).

c. Leviton; 8310 (single), 8300 (duplex).

d. Pass & Seymour; 8301 (single), 8300H (duplex).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG5362RN.

b. Hubbell; IG5362.

c. Leviton; 5362-IG.

d. Pass & Seymour; IG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.

b. Hubbell; HBL8300SGA.

c. Leviton; 8300-SGG.

d. Pass & Seymour; TR63H.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.

b. Hubbell; GFR5352L.

c. Pass & Seymour; 2095.

d. Leviton; 7590.

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFTR20.

b. Pass & Seymour; 2095TR.

D. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; VGFH20.

    b. Hubbell; HFR8300HL.

    c. Leviton; 7899-HG.

    d. Pass & Seymour; 2095HG.

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 5362BLS.

    b. Hubbell; HBL5362SA.

    c. Leviton; 5380.

    d. Pass & Seymour; 5362BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; IG5362BLS.

    b. Hubbell; IG5362SA.

    c. Leviton; 5380-IG.

    d. Pass & Seymour; IG5362BLSP.

2. Description:

    a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
    b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting

strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement sd.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8300BLS.

b. Hubbell; HBL8362SA.

c. Leviton; 8380.

d. Pass & Seymour; 8300BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Comply with NFPA 70.

E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG8300HGBLS.

b. Hubbell; IG8362SA.

c. Leviton; 8380-IG.

d. Pass & Seymour; IG8300BLSP.

2. Description:

a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
b. Comply with UL 498 Supplement sd.
c. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Cooper Crouse-Hinds.

b. EGS/Appleton Electric.

c. Killark; Division of Hubbell Inc.

2.7 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; CWL520R.

b. Hubbell; HBL2310.

c. Leviton; 2310.

d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IGL520R.

b. Hubbell; IG2310.

c. Leviton; 2310-IG.

d. Pass & Seymour; IG4700.

2. Description:

a. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.8 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.9 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:

2) Cooper; AH1221.
3) Hubbell; HBL1221.

4) Leviton; 1221-2.

5) Pass & Seymour; CSB20AC1.
6) Two Pole:

7) Cooper; AH1222.
8) Hubbell; HBL1222.

9) Leviton; 1222-2.

10) Pass & Seymour; CSB20AC2.
11) Three Way:

12) Cooper; AH1223.
13) Hubbell; HBL1223.

14) Leviton; 1223-2.

15) Pass & Seymour; CSB20AC3.
16) Four Way:

17) Cooper; AH1224.
18) Hubbell; HBL1224.

19) Leviton; 1224-2.

20) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.

b. Hubbell; HBL1201PL for 120 and 277 V.

c. Leviton; 1221-LH1.

d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.

b. Hubbell; HBL1221L.

c. Leviton; 1221-2L.

d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.

b. Hubbell; HBL1557.

c. Leviton; 1257.

d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.

b. Hubbell; HBL1557L.

c. Leviton; 1257L.

d. Pass & Seymour; 1251L.

2.11 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6252.

b. Hubbell; DR15.

c. Leviton; 16252.

d. Pass & Seymour; 26252.

B. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR6252.

b. Hubbell; DR15TR.

c. Pass & Seymour; TR26252.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" CSI number.

C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TWRBR15.

b. Hubbell; DR15TR.

c. LevitonTRW15.

d. Pass & Seymour; TRW26252.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" CSI number, when installed in wet and damp locations.

D. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF15.

b. Hubbell; GF15LA.

c. Leviton; 8599.

d. Pass & Seymour; 1594.

E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TWRVGF15.

b. Hubbell; GFTR15.

c. Pass & Seymour; 1594TRWR.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" CSI number.

F. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 7621 (single pole), 7623 (three way).

b. Hubbell; DS115 (single pole), DS315 (three way).

c. Leviton; 5621-2 (single pole), 5623-2 (three way).

d. Pass & Seymour; 2621 (single pole), 2623 (three way).

G. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 7631 (single pole), 7633 (three way).

b. Hubbell; DS120IL (single pole), DS320 (three way).

c. Leviton; 5631-2 (single pole), 5633-2 (three way).

d. Pass & Seymour; 2625 (single pole), 2626 (three way).

2. Description: With neon-lighted handle, illuminated when switch is "off."

2.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening

2.14 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.

2. Pass & Seymour/Legrand.

3. Square D/Schneider Electric.

4. Thomas & Betts Corporation.

5. Wiremold/Legrand.

C. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Pedestal type with services indicated complying with requirements in CSI number 27 15 00 "Communications Horizontal Cabling."
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.

7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in CSI number 27 15 00 "Communications Horizontal Cabling."

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Universal Electric Corp. (Starline)

2. Mono-Systems SWA4800 Series 2 Compartment Aluminum Raceway, 6” x 2.3”

3. Hubbell Incorporated; Wiring Device-Kellems.

4. Wiremold/Legrand G3000 Series.

C. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 18 inches.
3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

2.16 SERVICE POLES

A. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Nominal 2.5-inch- square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Manufacturer's standard painted finish and trim combination.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.
6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this CSI number.

7. Voice and Data Communication Outlets: Blank insert with bushed cable opening complying with requirements in CSI number 27 15 00 "Communications Horizontal Cabling."

2.17 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz..

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches, enclosed controllers, and motor-control centers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches fuseholders and panelboards.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class RK1, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK5, time delay.
4. Other Branch Circuits: Class RK5, time delay.
5. Control Circuits: Class CC, fast acting.

B. Plug Fuses:

1. Motor Branch Circuits: Edison-base type, dual-element time delay.
2. Other Branch Circuits: Edison-base type, dual-element time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit. (Basis of Design)

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit. (Basis of Design)

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

F. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Bussmann, Inc.

2. Ferraz Shawmut, Inc.

3. Littelfuse, Inc.

C. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

D. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

F. Accessories:

1. Oiltight key switch for key-to-test function.

2. Oiltight green ON pilot light.
3. Isolated neutral lug; 100 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

K. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in CSI number 26 09 13 "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO NC contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic ground-fault trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Integrally mounted, self-powered;.

2.6 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NO contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered;.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 Type 9.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in CSI number 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in CSI number 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges[as specified in CSI number 26 05 73.16 "Overcurrent Protective Device Coordination Study."]

END OF CSI NUMBER

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SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. CSI number includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Current Technologies SL3-200 (Basis of Design)

2. ABB France.

3. Advanced Protection Technologies Inc. (APT).

4. Eaton Corporation.

5. Emerson Electric Co.

6. GE Zenith Controls.

7. LEA International; Protection Technology Group.

8. Leviton Manufacturing Co., Inc.

9. PowerLogics, Inc.

10. Schneider Electric Industries SAS.

11. Siemens Industry, Inc.

C. SPDs: Comply with UL 1449, Type 1.

D. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
e. Surge counter.

E. Comply with UL 1283.

F. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

G. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

H. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 1000 V.
3. Line to Line: 1000 V.

I. SCCR: Equal or exceed 200 kA.

J. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Current Technologies (Basis of Design)

2. ABB France.

3. Advanced Protection Technologies Inc. (APT).

4. Eaton Corporation.

5. Emerson Electric Co.

6. GE Zenith Controls.

7. LEA International; Protection Technology Group.

8. Leviton Manufacturing Co., Inc.

9. PowerLogics, Inc.

10. Schneider Electric Industries SAS.

11. Siemens Industry, Inc.

12. United Power

13. Liebert

C. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Comply with UL 1283.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V 1200 V for 208Y/120 V

G. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.

4. Line to Line: 1200 V.

H. SCCR: Equal or exceed 100 kA.

I. Inominal Rating: 10 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4X.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads.

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG.

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in CSI number 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in CSI number 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF CSI NUMBER

SECTION 920-4 - ELECTRICAL

CSI NUMBER 26 51 00

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. CSI Number Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

1.2 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. LER: Luminaire efficacy rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Air and Thermal Performance Data: For air-handling lighting fixtures.
6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in CSI number 23 37 13 "Diffusers, Registers, and Grilles."
7. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

a. Air outlets and inlets.
b. Speakers.
c. Sprinklers.
d. Smoke and fire detectors.
e. Occupancy sensors.
f. Access panels.

7. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. ANSI ballast type (M98, M57, etc.) for HID luminaires.
c. CCT and CRI for all luminaires.

G. Air-Handling Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly.

1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat-Removal Units: Air path leads through lamp cavity.
3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 EMERGENCY POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate fixture continuously at an output of 1400 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate fixture continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Nightlight Connection: Operate one lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.
      c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
      d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
      f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
      g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

   3. Master/Remote Sign Configurations:

      a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
      b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

C. Self-Luminous Signs: Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 20 years.

D. Self-Luminous Signs: Using strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Provide with universal bracket for flush-ceiling, wall, or end mounting.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with CSI number 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Exterior Grade-Mounted Fixtures and Pole-Mounted Fixtures: Install concrete bases for bollards, poles, light columns, and other landscape fixtures (unless supported by stakes or other means). Pole base designs shall be sealed by a structural engineer registered in the project state.

E. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

F. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

G. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

I. Connect wiring according to CSI number 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in CSI number 26 05 53 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF CSI NUMBER

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REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Non-segregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
XI. Certification Regarding Use of Contract Funds for Lobbying
XII. Use of United States-Flag Vessels:

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

> "It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov*, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily

excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B)
This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
EXECUTIVE ORDER 11246, July 1, 1978

(Revised November 3, 1980)

1. As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted:

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority:

c. "Employer Identification Number" means the Federal Social Security Number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin):

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless or race):

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands): and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership or participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown plan. Each Contractor or Subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment ad training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has collective bargaining agreement , to refer either minorities or women shall excuse the Contractor's obligations under these specifications. Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such site or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or women sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on the job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations: by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and

Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative actions obligations (7a through p). The efforts of a contractor association, joint contractor- union, contractor community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a seperate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government Contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as al imitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

ADOT

TITLE VI / NON-DISCRIMINATION ASSURANCES
APPENDIX A

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, the *Federal Highway Administration,* as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performance by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the *Federal Highway Administration* to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the *Federal Highway Administration,* as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the *Federal Highway Administration* ,may determine to be appropriate, including, but not limited to:

   a. withholding payments to the contractor under the contract until the contractor complies; and/or
   b. cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with request to any subcontract or procurement as the Recipient or the *Federal Highway Administration* may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

ADOT

TITLE VI / NON-DISCRIMINATION ASSURANCES
APPENDIX E

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.,* 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin): and 49 CFR Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 *et seq.*), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq.*), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq.*), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1687 et. seq).

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)

JULY 1, 1978 (Revised November 3, 1980)

(Revised April 15, 1981)

1. The bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

	Minority	Female
Tucson and balance of Pima County	24.1	6.9
Cochise, Graham, Greenlee and Santa Cruz Counties	27.0	6.9
Phoenix and balance of Maricopa County	15.8	6.9
Apache, Coconino, Gila, Mohave, Navajo, Pinal, Yavapai and Yuma Counties	19.6	6.9

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in all areas where he has Federal or federally assisted work.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3 (a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

EQUAL EMPLOYMENT OPPORTUNITY
COMPLIANCE REPORTS

(Project, Training and Annual)

Federal-Aid Projects

February 1, 1977; Revised July 1, 1978; Revised November 3, 1980
Revised April 15, 1981; Revised September 7, 1983
Revised October 15, 1998; Revised August, 1, 2005;
Revised March 1, 2015

ANNUAL REPORT:

For each contract in the amount of $10,000 or more, and for each subcontract, regardless of tier not including material suppliers, in the amount of $10,000 or more, the contractor and each subcontractor regardless of tier shall submit an annual Equal Employment Opportunity (EEO) Report containing all the information required on Form FHWA-1391. Contractors and subcontractors are required to submit the required information through the LCPtracker system, a labor compliance software monitoring certified payroll and prevailing wage.

The staffing figures to be reported should represent the project workforce on board in all or any part of the last payroll period preceding the end of July.

The report shall be submitted no later than September 1.

"General Decision Number: AZ20260035 05/18/2026

State: Arizona

Construction Types: Highway

Counties: Arizona Counties of
Cochise

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ENGI0012-046 12/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR: BULLDOZER	$ 35.56	18.12

ENGI0012-053 12/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR: TRACTOR	$ 35.56	18.12

ENGI0012-078 12/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR: (CRANE/DERRICKS)	$ 39.17	18.12

LABO1184-016 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: HORIZONTAL DIRECTIONAL		

DRILL.....$ 31.98
9.26

LABO1184-027 06/01/2025

Rates
Fringes
LABORER: GRADE SETTER.....$ 29.91
9.26

LABO1184-033 06/01/2025

Rates
Fringes
POWER EQUIPMENT OPERATOR: TRENCHER.....$ 30.88
9.26

LABO1184-047 06/01/2025

Rates
Fringes
TRUCK DRIVER: CONCRETE.....$ 30.88
9.26

SUAZ2023-020 11/19/2024

Rates
Fringes
TRUCK DRIVER: WATER.....$ 26.13
7.09
TRUCK DRIVER: SWEEPER.....$ 20.24
5.48
TRUCK DRIVER: OIL DISTRIBUTOR.....$ 29.97
9.43
TRUCK DRIVER: DUMP.....$ 24.50
2.72
TRAFFIC CONTROL.....$ 19.24
2.58
POWER EQUIPMENT OPERATOR: SCRAPER.....$ 26.29
5.90
POWER EQUIPMENT OPERATOR: PAVER/SPREADER/FINISH
EQUIPMENT (ASPHALT, AGGREGATE, & CONCRETE).....$ 31.47
0.00
POWER EQUIPMENT OPERATOR: OILER.....$ 31.86
12.12
POWER EQUIPMENT OPERATOR: MOTOR GRADER/BLADE.....$ 30.13
5.81

POWER EQUIPMENT OPERATOR: MILLING MACHINE.....$ 29.25
7.45
POWER EQUIPMENT OPERATOR: MECHANIC.....$ 31.86
12.12
POWER EQUIPMENT OPERATOR: LOADER/FRONT END LOADER...$ 25.89
3.94
POWER EQUIPMENT OPERATOR: GRADE CHECKER.....$ 24.58
7.18
POWER EQUIPMENT OPERATOR: FORKLIFT.....$ 30.14
12.57
POWER EQUIPMENT OPERATOR: FIELD EQUIPMENT
SERVICEPERSON.....$ 35.44
11.45
POWER EQUIPMENT OPERATOR: EXCAVATOR/TRACKHOE.....$ 31.96
8.33
POWER EQUIPMENT OPERATOR: DRILL RIG/AUGER.....$ 31.64
0.00
POWER EQUIPMENT OPERATOR: CONCRETE SCREED.....$ 26.41
7.64
POWER EQUIPMENT OPERATOR: CONCRETE PUMP TRUCK.....$ 43.11
10.87
POWER EQUIPMENT OPERATOR: COMPACTOR/ROLLER.....$ 22.30
4.14
POWER EQUIPMENT OPERATOR: BROOM/SWEEPER.....$ 24.22
4.77
POWER EQUIPMENT OPERATOR: BOOM/CRANE TRUCK.....$ 36.99
12.37
POWER EQUIPMENT OPERATOR: BOBCAT/SKID STEER/SKID
LOADER.....$ 29.85
8.78
POWER EQUIPMENT OPERATOR: BACKHOE/BACKHOE & LOADER
COMBO/TRACK BACKHOE.....$ 26.16
6.19
PAINTER: SIGN AND DISPLAY ERECTOR.....$ 19.84
4.73
PAINTER: PAVEMENT MARKING.....$ 27.76
6.34
LABORER: PIPELAYER.....$ 26.36
7.09
LABORER: MASON TENDER.....$ 26.48
7.09
LABORER: LANDSCAPE LABORER.....$ 19.44
0.00
LABORER: GUARDRAIL INSTALLER.....$ 19.01
2.99
LABORER: GENERAL.....$ 23.96
2.07

LABORER: FENCE ERECTOR.....$ 22.00
4.03
LABORER: CONCRETE SAW (HAND HELD/WALK BEHIND).....$ 25.22
5.08
LABORER: ASPHALT, INCLUDES RAKER, SHOVELER,
SPREADER AND DISTRIBUTOR.....$ 23.85
7.97
IRONWORKER.....$ 32.00
17.54
ELECTRICIAN.....$ 28.71
7.58
CEMENT MASON/CONCRETE FINISHER.....$ 26.96
6.45
CARPENTER: FORMWORK CONCRETE.....$ 29.34
7.09
CARPENTER.....$ 28.08
12.74

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at
https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts

regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", "SA", or "SC" denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for

those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ?SU? identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ?SA? identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were

adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative

Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"General Decision Number: AZ20260038 05/18/2026

State: Arizona

Construction Types: Building

Counties: Arizona Counties of
Cochise

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

BRAZ0003-001 07/01/2024

	Rates	Fringes
BRICKLAYER	$ 32.29	9.97

CARP1912-001 07/01/2025

	Rates	Fringes
CARPENTER	$ 33.19	19.20

ELEC0570-001 06/01/2025

	Rates	Fringes
ELECTRICIAN (EXCLUDES LOW VOLTAGE WIRING)	$ 33.00	13.04

ENGI0428-016 06/01/2023

	Rates	Fringes

POWER EQUIPMENT OPERATOR: CRANE.....$ 36.04
13.52
POWER EQUIPMENT OPERATOR: BULLDOZER.....$ 31.69
13.52

IRON0075-007 08/01/2025

Rates
Fringes
IRONWORKER, STRUCTURAL.....$ 33.00
19.91

PLUM0469-009 07/01/2025

Rates
Fringes
PIPEFITTER.....$ 51.15
21.00

SHEE0359-001 07/01/2025

Rates
Fringes
SHEET METAL WORKER.....$ 49.39
19.86

SUAZ2019-001 06/12/2023

Rates
Fringes
TILE SETTER.....$ 21.50
0.00
PLUMBER.....$ 28.51
0.00
PAINTER.....$ 15.00
0.00
OPERATOR: ROLLER.....$ 23.62
6.44
OPERATOR: LOADER.....$ 15.00
4.15
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE.....$ 19.58
3.79
LABORER: PIPELAYER.....$ 16.77
1.05
LABORER: MASON TENDER - CEMENT/CONCRETE.....$ 19.79
0.00
LABORER: COMMON OR GENERAL.....$ 12.00
0.00

IRONWORKER, REINFORCING.....$ 22.04
0.00
ELECTRICIAN (LOW VOLTAGE WIRING).....$ 26.16
9.91
DRYWALL FINISHER/TAPER.....$ 22.47
0.00
CEMENT MASON/CONCRETE FINISHER.....$ 21.00
0.00

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
==========
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Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

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Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to

reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ?SU? identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ?SA? identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter

d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

ARIZONA DEPARTMENT OF TRANSPORTATION
PROJECT DELIVERY AND OPERATIONS DIVISION
CONTRACTS AND SPECIFICATIONS GROUP

BID SCHEDULE

CONTRACT # 2026051

TRACS No.	Project No.	Item	County	District	Gross Length	Net Length	Prepared By:
010 CH 383 F072801C	010-F-(238)T	104462	COCHISE	SOUTHEAST	0.3		Brandon Campbell

Highway Termini	Location	Work Description
• BENSON -STEINS PASS HWY (I-10)	• San Simon Port of Entry	• SITE IMPROVEMENTS

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
2010011	CLEARING AND GRUBBING	ACRE	1		
2020021	REMOVAL OF CONCRETE CURB AND GUTTER	L.FT.	1,764		
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ.YD.	1,525		
2020030	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT (COMPACTED AC MILLINGS DRIVEWAY)	SQ.YD.	47		
2020031	REMOVAL OF PORTLAND CEMENT CONCRETE PAVEMENT	SQ.YD.	5,507		
2020041	REMOVAL OF PIPE	L.FT.	82		
2020050	REMOVE (MISC. ITEMS)	L.SUM	1		
2020052	REMOVE (BARRIER CURB)	L.FT.	28		
2020055	REMOVE AND SALVAGE (VIDEO SURVEILLANCE SYSTEM)	L.SUM	1		
2020071	REMOVE GUARD RAIL	L.FT.	153		
2020101	REMOVE FENCE	L.FT.	1,013		
2020118	REMOVE (CATCH BASIN)	EACH	3		
2020120	REMOVE (SLOTTED DRAIN)	L.FT.	21		
2020154	REMOVE (12' X 20' SCALE PIT AND SCALE)	L.SUM	1		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
2020155	REMOVE (SIGNS)	EACH	12		
2020157	REMOVE (PULL BOX)	EACH	5		
2020175	REMOVAL OF LIGHT POLES (ASSEMBLIES)	EACH	3		
2020366	REMOVE LEAD-BASED PAINT MATERIALS	L.SUM	1		
2020370	DISPOSE OF LEAD-BASED PAINT MATERIALS (FORCE ACCOUNT)	L.SUM	1	$3,500.00	$3,500.00
2020400	REMOVE AND RELOCATE (STORAGE CONTAINER)	EACH	2		
2030301	ROADWAY EXCAVATION	CU.YD.	546		
2030401	DRAINAGE EXCAVATION	CU.YD.	53		
3030022	AGGREGATE BASE, CLASS 2	CU.YD.	505		
4010019	PORTLAND CEMENT CONCRETE PAVEMENT (12" DOWELED)	SQ.YD.	5,728		
4010306	LOAD TRANSFER DOWEL ASSEMBLY (6-FT)	EACH	67		
4010308	LOAD TRANSFER DOWEL ASSEMBLY (8-FT)	EACH	206		
4010310	LOAD TRANSFER DOWEL ASSEMBLY (10-FT)	EACH	147		
4010312	LOAD TRANSFER DOWEL ASSEMBLY (12-FT)	EACH	14		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
4010314	LOAD TRANSFER DOWEL ASSEMBLY (14-FT)	EACH	28		
4010316	LOAD TRANSFER DOWEL ASSEMBLY (2-FT)	EACH	6		
4010318	LOAD TRANSFER DOWEL ASSEMBLY (4-FT)	EACH	9		
4026002	JOINT AND CRACK REPAIR (SEALING)	L.FT.	9,584		
4090004	ASPHALTIC CONCRETE (MISCELLANEOUS STRUCTURAL) (3/4")(FOR PCCP BASE)	TON	116		
4090005	ASPHALTIC CONCRETE (MISCELLANEOUS STRUCTURAL) (SPECIAL MIX)(3/4")	TON	470		
5010107	PIPE, CORRUGATED METAL, SLOTTED, 18"	L.FT.	53		
5011014	PIPE, REINFORCED CONCRETE, CLASS IV, 18"	L.FT.	520		
5030070	CONCRETE CATCH BASIN (C-15.30) SINGLE, H=8' OR LESS	EACH	1		
5030142	CONCRETE CATCH BASIN (MEDIAN) (C-15.80)	EACH	1		
5050001	MANHOLE (C-18.10) (NO. 1) (FOR PIPES 6" TO 36")	EACH	1		
6060076	FOUNDATION FOR BRIDGE SIGN STRUCTURE (SD9.20, TYPE 2F)	EACH	2		
6060301	RELOCATE EXISTING BRIDGE SIGN STRUCTURE	L.SUM	1		
6070038	SLIP BASE	EACH	15		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
6070048	FOUNDATION FOR SQUARE TUBE POST	EACH	16		
6070054	SIGN POST (PERFORATED) (2 S)	L.FT.	11		
6070057	SIGN POST (PERFORATED) (2 1/2 T)	L.FT.	188		
6080005	REGULATORY, WARNING, OR MARKER SIGN PANEL	SQ.FT.	80		
6080018	EXTRUDED ALUMINUM SIGN PANEL	SQ.FT.	203		
6080025	FLAT SHEET ALUMINUM SIGN PANEL	SQ.FT.	42		
6080105	RELOCATE SIGNS	L.SUM	1		
7015032	TEMPORARY PREFORMED MARKING (TYPE II, TAPE LINE)	L.FT.	3,000		
7015052	OBLITERATE PAVEMENT MARKING (STRIPE)	L.FT.	13,170		
7016030	BARRICADE (TYPE 1, TYPE 2, VERT.PANEL, TUBULAR MARKER)	EACH-DAY	70,090		
7016031	BARRICADE (TYPE 3, HIGH LEVEL FLAG TREE)	EACH-DAY	18,270		
7016033	PORTABLE SIGN STAND (SPRING TYPE)	EACH-DAY	10,770		
7016035	WARNING LIGHT (TYPE A)	EACH-DAY	12,980		
7016037	WARNING LIGHT (TYPE C)	EACH-DAY	70,090		

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
7016039	EMBEDDED SIGN POST	EACH-DAY	4,410		
7016051	TEMPORARY SIGN (LESS THAN 10 S.F.)	EACH-DAY	3,870		
7016052	TEMPORARY SIGN (10 S.F. OR MORE)	EACH-DAY	9,100		
7016067	CHANGEABLE MESSAGE BOARD (CONTRACTOR FURNISHED)	EACH-DAY	882		
7040005	PAVEMENT MARKING (WHITE EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	17,221		
7040006	PAVEMENT MARKING (YELLOW EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	980		
7040072	PAVEMENT MARKING (TRANSVERSE) (THERMOPLASTIC) (ALKYD) (0.090")	L.FT.	545		
7040073	PAVEMENT LEGEND (EXTRUDED THERMOPLASTIC) (ALKYD) (0.090")	EACH	2		
7040074	PAVEMENT SYMBOL (EXTRUDED THERMOPLASTIC) (ALKYD) (0.090")	EACH	14		
7042031	PRIMER-SEALER FOR PCCP THERMOPLASTIC STRIPING	L.FT.	11,240		
7042036	PRIMER-SEALER FOR PCCP THERMOPLASTIC SYMBOL/LEGEND	EACH	15		
7042051	REMOVAL OF CURING COMPOUND FOR STRIPING	L.FT.	6,780		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
7042056	REMOVAL OF CURING COMPOUND FOR SYMBOL/LEGEND	EACH	4		
7080201	WATERBORNE-TYPE I PAVEMENT MARKING (PAINTED) (WHITE)	L.FT.	440		
7080202	WATERBORNE-TYPE I PAVEMENT MARKING (PAINTED) (YELLOW)	L.FT.	100		
7080204	WATERBORNE-TYPE I PAVEMENT MARKING (PAINTED SYMBOL)	EACH	1		
7310070	POLE (TYPE G) (STANDARD BASE)	EACH	3		
7310195	POST (PEDESTRIAN PUSH BUTTON)	EACH	1		
7310201	BREAKAWAY BASE FOR LIGHTING POLES (OVER 30')	EACH	3		
7310260	POLE FOUNDATION (TYPE G) (STANDARD BASE)	EACH	10		
7310390	PEDESTRIAN PUSH BUTTON POST FOUNDATION	EACH	1		
7310551	MAST ARM (20 FT.) (STRAIGHT OR TAPERED)	EACH	3		
7310832	RELOCATE EXISTING LIGHT POLES	EACH	7		
7320030	ELECTRICAL CONDUIT (1") (PVC)	L.FT.	150		
7320050	ELECTRICAL CONDUIT (2") (PVC)	L.FT.	5,675		
7320055	ELECTRICAL CONDUIT (2") (PVC) (DIRECTIONAL DRILL)	L.FT.	460		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
7320073	ELECTRICAL CONDUIT (2 - 3") (PVC)	L.FT.	60		
7320130	ELECTRICAL CONDUIT (2") (RIGID METAL)	L.FT.	315		
7320291	ELECTRICAL CONDUIT (2 -2 " PVC)	L.FT.	260		
7320420	PULL BOX (NO. 7)	EACH	9		
7320450	PULL BOX (NO. 7) (FMS)	EACH	11		
7320455	PULL BOX (NO. 9)	EACH	2		
7320456	PULL BOX (4B)	EACH	7		
7320500	CONDUCTOR (NO. 12)	L.FT.	300		
7320520	CONDUCTOR (NO. 8)	L.FT.	900		
7320530	CONDUCTOR (NO. 6)	L.FT.	13,750		
7320540	CONDUCTOR (NO. 4)	L.FT.	1,590		
7320585	CONDUCTOR (INSULATED BOND) (NO. 12)	L.FT.	150		
7320586	CONDUCTOR (INSULATED BOND)(NO. 8)	L.FT.	240		
7320590	CONDUCTOR (INSULATED BOND) (NO. 6)	L.FT.	2,835		
7320595	CONDUCTOR (INSULATED BOND) (NO. 4)	L.FT.	800		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
7320740	REMOVAL OF EXISTING CONDUCTORS	L.FT.	2,550		
7320765	SINGLE MODE FIBER OPTIC CABLE (12 FIBERS)	L.FT.	350		
7320788	SINGLE MODE FIBER OPTIC CABLE (6 FIBERS)	L.FT.	2,430		
7340100	CONTROL CABINET	EACH	1		
7340101	CONTROL CABINET (POLE MOUNTED)	EACH	4		
7340103	CONTROL CABINET (WALL MOUNTED)	EACH	1		
7340105	CONTROL CABINET FOUNDATION	EACH	1		
7360110	LUMINAIRE (HORIZONTAL MOUNT)(INSTALL ONLY)	EACH	3		
7370410	ELECTRICAL SYSTEM (LANE CONTROL SIGNAL SYSTEM)	L.SUM	1		
7370452	MISCELLANEOUS ELECTRICAL (VIDEO SURVEILLANCE SYSTEM)	L.SUM	1		
7370455	MISCELLANEOUS ELECTRICAL (LIGHTING RECORD DRAWINGS)	L.SUM	1		
8050003	SEEDING (CLASS II)	ACRE	1		
8080028	BACKFLOW PREVENTION UNIT (PRESSURE 1 1/2")	EACH	1		
8080394	PIPE (PVC) (4") (SCHEDULE 40)	L.FT.	370		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
8080424	PIPE (COPPER) (1 1/2")	L.FT.	390		
8080696	CONCRETE PIPE PLUG (C-13.76)	EACH	1		
8081116	ABANDON WATER LINE	EACH	2		
8101018	EROSION CONTROL (STABILIZED CONSTRUCTION ENTRANCE/EXIT GRAVEL PADS)	SQ.YD.	200		
8101021	EROSION CONTROL (WATTLES) (9")	L.FT.	1,317		
9010001	MOBILIZATION	L.SUM	1		
9020002	CHAIN LINK FENCE, TYPE 1 (48")	L.FT.	255		
9020004	CHAIN LINK FENCE, TYPE 1 (72")	L.FT.	267		
9020112	CHAIN LINK FENCE GATE, TYPE 1 (72") (OVER 13' TO 18' WIDE)	EACH	2		
9020129	CHAIN LINK FENCE GATE (26' ACCESS CONTROL GATE, KEY CARD CONTROLLED)	EACH	1		
9050005	GUARD RAIL, W-BEAM, SINGLE FACE (MASH)	L.FT.	101		
9080001	CONCRETE CURB (C-05.10) (TYPE A)	L.FT.	918		
9080105	CONCRETE CURB, PRECAST (MAG DET. 150)	L.FT.	180		
9080201	CONCRETE SIDEWALK (C-05.20)	SQ.FT.	3,216		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
9080295	CONCRETE SIDEWALK RAMP	SQ.FT.	132		
9240023	FORCE ACCOUNT WORK (ELECTRICAL PANEL, SSVE INSTALL)	L.SUM	1	$2,500.00	$2,500.00
9240050	MISCELLANEOUS WORK (WELL SITE RELOCATION AND CONNECTION)	L.SUM	1		
9240052	MISCELLANEOUS WORK (ABANDON EXISTING WELL STRUCTURE)	L.SUM	1		
9240053	MISCELLANEOUS WORK (GRINDER LIFT STATION INSTALLATION)	L.SUM	1		
9240054	MISCELLANEOUS WORK (DRY WELL STRUCTURE INSTALLATION)	L.SUM	1		
9240055	MISCELLANEOUS WORK (ABANDON EXISTING SANITARY SEWER)	L.SUM	1		
9240057	MISCELLANEOUS WORK (WELL INSTALLATION)	L.SUM	1		
9240058	MISCELLANEOUS WORK (HAZARDOUS MATERIALS SPILL CONTAINMENT BASIN)	L.SUM	1		
9240060	MISCELLANEOUS WORK (COALESCING PLATE WATER-OIL SEPARATOR)	L.SUM	1		
9240061	MISCELLANEOUS WORK (LIGHTNING PROTECTION SYSTEM)	L.SUM	1		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
9240063	MISCELLANEOUS WORK (TRUCK WEIGH SCALE – ARCHITECTURAL & STRUCTURAL)	L.SUM	1		
9240064	MISCELLANEOUS WORK (TRUCK WEIGH SCALE – PLUMBING)	L.SUM	1		
9240065	MISCELLANEOUS WORK (TRUCK WEIGH SCALE – ELECTRICAL)	L.SUM	1		
9240066	MISCELLANEOUS WORK (ADMINISTRATION BUILDING – ARCHITECTUAL & STRUCTURAL)	L.SUM	1		
9240067	MISCELLANEOUS WORK (ADMINISTRATION BUILDING – MECHANICAL)	L.SUM	1		
9240068	MISCELLANEOUS WORK (ADMINISTRATION BUILDING – PLUMBING)	L.SUM	1		
9240069	MISCELLANEOUS WORK (ADMINISTRATION BUILDING – ELECTRICAL)	L.SUM	1		
9240070	MISCELLANEOUS WORK (ITS RECORD DRAWINGS)	L.SUM	1		
9240071	MISCELLANEOUS WORK (INSPECTION BUILDING – ARCHITECTUAL & STRUCTURAL)	L.SUM	1		
9240072	MISCELLANEOUS WORK (INSPECTION BUILDING – MECHANICAL)	L.SUM	1		
9240073	MISCELLANEOUS WORK (INSPECTION BUILDING – PLUMBING)	L.SUM	1		

BID SCHEDULE

010 CH 383 F072801C

Item No.	Item Description	Unit	Quantity	Unit Price	Extended Amount
9240074	MISCELLANEOUS WORK (INSPECTION BUILDING – ELECTRICAL)	L.SUM	1		
9240111	MISCELLANEOUS WORK (REMOVE AND RELOCATE TEMPORARY CONCRETE BARRIER)	L.FT.	1,067		
9240112	MISCELLANEOUS WORK (HDPE FORCE MAIN AND STEEL CASING INSTALLATION)	L.FT.	320		
9240119	MISCELLANEOUS WORK (PIPE PENETRATION)	EACH	1		
9240170	CONTRACTOR QUALITY CONTROL	L.SUM	1		
9240181	MISCELLANEOUS WORK (CONTROL OF NOXIOUS PLANTS) (MANUAL/MECHANICAL METHODS)	SQ.YD.	530		
9240182	MISCELLANEOUS WORK (CONTROL OF NOXIOUS PLANTS) (HERBICIDE)	SQ.YD.	530		
9250001	CONSTRUCTION SURVEYING AND LAYOUT	L.SUM	1		

BID TOTAL :

PROPOSAL

TO THE ARIZONA DEPARTMENT OF TRANSPORTATION:

Gentlemen:

The following Proposal is made for constructing project

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

in the State of Arizona.

The following Proposal is made on behalf of _____

_____ and no others.
(NAME OF COMPANY, FIRM, OR CORPORATION)

The undersigned hereby certifies that (s)he has been duly authorized to submit a proposal on behalf of the company, firm, or corporation mentioned above; and further certifies, pursuant to Subsection 112(c) of Title 23, United States Code and Title 44, Chapter 10, Article 1 of the Arizona Revised Statutes, that neither (s)he nor anyone associated with the company, firm, or corporation mentioned above has, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such project and furthermore that no member or employee of the Arizona Department of Transportation is personally or financially interested, directly or indirectly, in the Proposal, or in any purchase or sale of any materials or supplies for the work to which it relates, or in any portion of the profits thereof.

The undersigned certifies that the approved Plans, Standard Specifications, Special Provisions and forms of Contract and Bond authorized by the Arizona Department of Transportation and constituting essential parts of this proposal, have been carefully examined, and also that the site of the work has been personally inspected. The undersigned declares that the amount and nature of the work to be done is understood and that at no time will misunderstanding of the Plans, Specifications, Special Provisions, or conditions to be overcome, be plead. On the basis of Plans, Specifications, Special Provisions, and the forms of Contract and Bond proposed for use, the undersigned proposes to furnish all the necessary equipment, materials, machinery, tools, apparatus, and other means of construction, and labor to do all the work in the manner specified, and to accept, as full compensation therefor, the sum of the various products obtained by multiplying each unit price, herein bid for the work or materials, by the quantity thereof actually incorporated in the complete project, as determined by the State Engineer. The undersigned understands that the quantities mentioned herein are approximate only and are subject to increase or decrease and hereby proposes to perform all quantities of work as either increased or decreased, in accordance with the provisions of the Specifications, at the unit price bid in the Bidding Schedule.

The undersigned further proposes to perform all extra work that may be required on the basis provided in the Specifications and to give such work personal attention and to secure economical performance.

The undersigned further proposes to execute the Contract Agreement and furnish satisfactory Bond within ten calendar days from the date of Notice of Award, time being of the essence. The undersigned further proposes to begin work as specified in the contract attached hereto, and to complete the work on or before expiration of the contract time as defined in the Specifications, and maintain at all times a Payment Bond and a Performance Bond, approved by the State Engineer, in an amount equal to one hundred (100) percent of the total bid. These bonds shall serve not only to guarantee the completion of the work on the part of the undersigned, but also to guarantee the excellence of both workmanship and material and the payment of all obligations incurred, until the work is finally accepted and the provisions of the Plans, Standard Specifications and Special Provisions fulfilled.

The undersigned hereby agrees to provide an electronic Proposal Guaranty in the amount and character named in the Advertisement for Bids. The Proposal Guaranty is submitted as a guaranty of the good faith of the bidder, and that the bidder will enter into written contract, as provided, to do the work, if successful in securing the award thereof, and it is hereby agreed that if at any time other than as provided in the Proposal there should be failure on the part of the undersigned to execute the Contract and furnish satisfactory Bond as herein provided, the State of Arizona, in either of such events, shall be entitled and is hereby given the right to retain the said Proposal Guaranty as liquidated damages.

If by a Corporation:

(Seal)

Corporate Name: _____

Corporate Mailing Address: _____ Zip Code: _____

Incorporated under the laws of the State of: _____

By (Signature): _____ Date: _____

President: _____

Secretary: _____

Treasurer: _____

If by a Firm or Partnership:

Firm or Partnership Mailing Name: _____

Firm or Partnership Address: _____

By (Signature): _____ Date: _____

Name and Address of Each Member: _____

_____

_____

_____

_____

If by an Individual:

Signature: _____ Date: _____

Mailing Address: _____

ARIZONA DEPARTMENT OF TRANSPORTATION

SURETY (BID) BOND

(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS, THAT _____

_____

as Principal, hereinafter called the Principal, and _____

_____

a corporation duly organized under the laws of the state of _____ hereinafter called the Surety, holding a certificate of authority to transact surety business in this State issued by the Director of the Department of Insurance, are held and firmly bound unto the Arizona Department of Transportation, as Obligee, hereinafter called the Obligee, in the sum of Ten Percent (10%) of the amount of the bid of Principal, submitted by Principal to the Arizona Department of Transportation for the work described below, for the payment of which sum well and truly to be made, the said Principal and the said Surety bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal is herewith submitting its proposal for TRACS/Project No.

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

NOW THEREFORE, if the Obligee, acting by and through its Transportation board, shall accept the proposal of the Principal and the Principal shall enter into contract with the Obligee in accordance with the terms of such proposal, and give such bonds and certificates of insurance as may be specified in the contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter into such contract and give such bonds and certificates of insurance, if the Principal shall pay to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which the obligee may in good faith contract with another party to perform the work covered by the proposal then this obligation is void. Otherwise it remains in full force and effect.

IN WITNESS WHEREOF, we hereunto set our hands and seals:

_____	_____
Principal	Surety
_____	_____
By	By Attorney-in-Fact
_____	_____
Title	Address Attorney-in-Fact
	Subscribed and sworn before me this _____ day of _____, 20 _____.
	My Commission expires: _____
	_____
R9/13	Notary Public

CERTIFICATION WITH REGARD TO THE PERFORMANCE OF PREVIOUS CONTRACTS OR SUBCONTRACTS SUBJECT TO THE EQUAL OPPORTUNITY CLAUSE AND THE FILING OF REQUIRED REPORTS
APRIL, 1969

The bidder _____, proposed subcontractor _____, hereby certifies that it has _____, has not _____, participated in a previous contract or subcontract subject to the equal opportunity clause, as required by Executive Orders 10925, 11114, or 11246, and that it has _____, has not _____, filed with the Joint Reporting committee, the Director of the Office of Federal Contract Compliance, a Federal Government contracting or administering agency or the former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements.

_____
(Company)

By: _____

_____
(Title)

Date: _____

Note: The above certification is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-1.7b (1),) and must be submitted by bidders and proposed subcontractors only in connection with contracts and subcontracts which are subject to the equal opportunity clause. Contracts and subcontracts which are exempt from the equal opportunity clause are set forth in 41 CFR 60-1.5 (Generally only contracts or subcontracts of $10,000 or under are exempt.)

Currently, Standard Form 100 (EEO-1) is the only report required by the Executive Orders or their implementing regulations.

Information concerning Standard Form 100 (EEO-1) is available from:

Joint Reporting Committee
P.O. Box 19100
Washington, D.C. 20036-9100

Proposed prime contractors and subcontractors who have participated in a previous contract or subcontract subject to the Executive Orders and have not filed the required reports should note that 41 CFR 60-1.7(b)(1) prevents the award of contracts and subcontracts unless such contractor submits a report covering the delinquent period or such other period specified by the Federal Highway Administration or by the Director, Office of Federal Contract Compliance, U.S. Department of Labor.

CERTIFICATION WITH RESPECT TO THE

RECEIPT OF ADDENDA

In the submission of a bid and by the signing of the Proposal, this will certify that the following numbered addenda issued on this project have been brought to my personal attention and furthermore that I understand and agree that those will be made a part of the Contract.

Addendum No. _____, _____, _____, _____, _____

_____
PRINT NAME OF CONTRACTOR

_____
SIGNATURE

_____
TITLE

_____
DATE

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

REVISED 05/02

ARIZONA DEPARTMENT OF TRANSPORTATION

PARTICIPATION IN BOYCOTT OF ISRAEL CERTIFICATION FORM

Unless and until the District Court's injunction in Jordahl is stayed or lifted, the Anti-Israel Boycott Provision (A.R.S. § 35-393.0l(A)) is unenforceable and the State will take no action to enforce it. This attachment (Participation in Boycott of Israel) is no longer a mandatory part of the offer. Offers will not be evaluated based on whether this certification has been completed.

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

This Certification is required in response to legislation enacted to prohibit the State from contracting with companies currently engaged in a boycott of Israel. To ensure compliance with A.R.S. §35-393.01, this form must be completed and returned with the bid. The bidder understands that this response will become public record and may be subject to publicinspection.

As defined by A.R.S. §35-393.01:

1. "Boycott" means engaging in a refusal to deal, terminating business activities or performing other actions that are intended to limit commercial relations with Israel or with persons or entities doing business in Israel or in territories controlled by Israel, if those actions are taken either:
   (a) In compliance with or adherence to calls for a boycott of Israel other than those boycotts to which 50 United States Code section 4607(c) applies.
   (b) In a manner that discriminates on the basis of nationality, national origin or religion and that is not based on a valid business reason.
2. "Company" means a sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, Limited Liability Company or other entity or business association, and includes a wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate.
3. "Direct holdings" means all publicly traded securities of a company that are held directly by the state treasurer or a retirement system in an actively managed account or fund in which the retirement system owns all shares or interests.
4. "Indirect holdings" means all securities of a company that are held in an account or fund, including a mutual fund, that is managed by one or more persons who are not employed by the state treasurer or a retirement system, if the state treasurer or retirement system owns shares or interests either:
   (a) Together with other investors that are not subject to this section.
   (b) That are held in an index fund.
5. “Public entity" means this State, a political subdivision of this STATE or an agency, board, commission or department of this state or a political subdivision of this state.
6. “Public fund" means the state treasurer or a retirement system.
7. "Restricted companies" means companies that boycott Israel.
8. "Retirement system" means a retirement plan or system that is established by or pursuant to title38.

All Bidders must select one of thefollowing:

_____**The bidder does not participate in, and agrees not to participate in during the term of the contract a boycott of Israel in accordance with A.R.S. §35-393.01.**

_____The bidder **does** participate in a boycott of Israel as defined by A.R.S. §35-393.01.

By submitting this response, the bidder agrees to indemnify and hold the State, its agents and employees, harmless from any claims or causes of action relating to the State’s action based upon reliance on the above representations, including the payment of all costs and attorney fees incurred by the State in defending such an action.

Company Name	Signature of Person Authorized to Sign
Address	Printed Name
City State Zip	Title

ARIZONA DEPARTMENT OF TRANSPORTATION

Forced Labor of Ethnic Uyghurs Ban Certification Form

Forced Labor of Ethnic Uyghurs Ban

Please note that if any of the following apply to the Contractor, then the bidder shall select the "Exempt Contractor" option below:

- Contractor is a sole proprietorship;
- Contractor has fewer than ten (10) employees; OR
- Contractor is a non-profit organization.

010 CH 383 F072801C 010-F(238)T
BENSON-STEINS PASS HIGHWAY (I-10)
(SAN SIMON PORTY OF ENTRY)

Pursuant to A.R.S. § 35-394, written certification is required to show that the company entering into a contract with a public entity does not use the forced labor, or use any contractors, subcontractors or suppliers that use the forced labor or any goods or services produced by the forced labor, of ethnic Uyghurs in the People's Republic of China.

Under A.R.S. §35-394:

1. "Company" means an organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, limited liability company or other entity or business association, including a wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate, that engages in for-profit activity and that has ten or more full-time employees.

2. "Public entity" means this State, a political subdivision of this State or an agency, board, commission or department of this State or a political subdivision of this State.

In compliance with A.R.S. §§ 35-394 et seq., all bidders must select <u>one</u> of the following:

☐	The bidder **<u>does not</u>** use, and agrees not to use during the term of the contract, any of the following: • Forced labor of ethnic Uyghurs in the People's Republic of China; • Any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China; or • Any Contractors, Subcontractors, or suppliers that use the forced labor or any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China.
☐	The bidder **<u>does</u>** participate in use of Forced Uyghurs Labor as described in A.R.S. § 35-394.
☐	**Exempt Contractor.** Select all statements that applies to this Contractor: ☐ Contractor is a sole proprietorship; ☐ Contractor has fewer than ten (10) employees; and/or ☐ Contractor is a non-profit organization.

Company Name

Signature of Person Authorized to Sign

Address

Printed Name

City State Zip

Title