PLASTER SYSTEMS EIFS CLADDING

GENERAL

This section deals with the supply and fixing of Plaster Systems Graphex Standard or Graphex Solid Plaster System insulated exterior wall cladding system based on NEOPOR EPS sheets fixed to timber/metal framing with a drained cavity.

Building code compliance

1.2 DURABILITY

The work covered by this part of the specification has been designed and constructed to achieve a minimum durability of 15 years. Refer to the following:

BRANZ BRANZ Appraisal Certificate No. 633 (2009) Graphex Cavity System.

Appraisal Certificate No. 553 (2007) Graphex Cavity Based Solid

Plaster System

1.3 ON GOING MAINTENANCE INSTRUCTIONS

Provide ongoing maintenance instructions required to meet the performance requirements of the NZBC B2 Durability.

Documents

1.4 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 1170.2 Structural design actions - Wind actions

AS 1366.3 Rigid cellular plastics sheets for thermal insulation - Rigid cellular

polystyrene - Moulded (RC/PS - M)

AS 1366.4 Rigid cellular plastics sheets for thermal insulation - Rigid cellular

polystyrene - Extruded (RC/PS - E)

AS 3566 Self-drilling screws for the building and construction industries

NZS 3604 Timber framed buildings

NZS 4203 General structural design and design loadings for buildings

NZBC B2 Durability

NZBC E2/AS1 External moisture

BRANZ Appraisal Certificate No. 633 (2009) Graphex Cavity System.

BRANZ Appraisal Certificate No. 553 (2007) Graphex Cavity Based Solid

Plaster system

Documents listed above and cited in the clauses that follow are part of this specification. However, this specification takes precedence in the event of it being at variance with the cited document.

1.5 MANUFACTURER'S DOCUMENTS

Plaster Systems documents relating to work in this section are:

Plaster Systems Product Manual

Materials and execution to **Plaster Systems** specification except where varied by this specification and supported by architectural detailing.

Copies of the above literature are available from

Web:

www.plastersystems.co.nz

Telephone: Facsimile:

0800 114400 09 444 9561

1.6 ABBREVIATIONS

The following abbreviations are used throughout this part of the specification:

EIFS EPS Exterior Insulation and Finish Systems
NEOPOR Expanded Polystyrene Sheet

MPNZA

Master Painters New Zealand Association

WANZ WIS

Window Association of New Zealand Window installation system

1.7 NO SUBSTITUTIONS

Substitutions are not permitted to any specified Plaster Systems plaster render system.

1.8 QUALIFICATIONS

Use only applicators that are approved to apply the **Plaster Systems** plaster render systems.

Documentation

1.9 FINISH SAMPLE

If requested submit one 300 mm x 300 mm panel of the selected finish texture and colour for approval. Obtain signature of acceptance on sample and return to the approved applicator.

1.10 MAINTENANCE INSTRUCTIONS

Provide Plaster Systems Plastercare maintenance instructions before practical completion of the contract for issuing to the building owner.

1.11 PRODUCER STATEMENT

Provide a producer statement compiled by the approved installer in the form as required by the Building Consent Authority.

1.12 HEALTH AND SAFETY

Refer to the requirements of the Health and Safety in Employment Act and OSH: Refer guidelines for the provision of facilities and general safety in the construction industry. If the elimination or isolation of potential hazards is not possible then minimise hazards in this work on site by using the proper equipment and techniques as required in the MPNZA Painters hazard handbook. Supply protective clothing and equipment. Inform employees and others on site of the hazards and put into place procedures for dealing with emergencies. Obtain from **Plaster Systems** the material safety data sheets for each product. Keep sheets on site and comply with the required safety procedures.

Warranties

1.13 MANUFACTURERS WARRANTY

Warrant this part of the work under normal environmental and use conditions against failure of materials and execution. The plaster system is warranted as follows:

Materials:

15 years from date of practical completion issued by Plaster Systems.

Execution:

5 years from date of practical completion issued by an Approved

Installer.

Performance

1.14 PERFORMANCE

Accept responsibility for the structural and weather-tight performance of the exterior render application.

1.15 PROTECTION OF NEW PLASTER

Confirm the protection systems to be applied to fresh plaster coats. Plastering not to begin until render systems are confirmed.

1.16 INSPECTIONS

Allow to inspect the whole of the work at each stage. Determine a programme for inspections including notification when each part and stage of the work is ready for inspection prior to the work commencing.

1.17 FIXINGS, WIND

Design and use the fixings appropriate for the wind zone (R) and topographical classification (T) of this site and building height; as required by NZS 3604 and the wind loads on various wall areas as given by NZS 4203 or AS/NZS 1170.

2. PRODUCTS & MATERIALS

Materials

0.4	OD THE DELLAR AGE GOAT DELIGIT	-
2.1	OR THERMABASE COAT RENDE	\sim

Factory-mixed render coating specially blended acrylic modified cement based plaster compound.

2.2 EZYTEX FINISHING PLASTER, POLYMER MODIFIED

Factory-mixed polymer modified cement based finishing plaster.

2.3 PAINT

100% acrylic paint system that is compatible with cement based plaster and suitable for textured surfaces.

Components

2.4 EPS SHEET FOR EIFS CLADDING

NEOPOR: 40 mm thick EPS sheet to AS1366.3 class H.

Sheet quality to comply with AS 1366 Rigid cellular plastic sheets for thermal insulation – Rigid cellular polystyrene.

2.5 EXTERIOR WALL CAVITY BATTENS

Plaster Systems peel 'n' stick vented poly battens, 50 x 20 mm thick.

2.6 FLASHINGS AND ACCESSORIES

Proprietary profiles made from rigid uPVC for head, sill, and jamb flashings, corner beads, cavity vent strip (base bead), Z flashings and horizontal and vertical control joint flashings for exterior applications.

2.7 EXTERIOR CAVITY BASE CLOSURE MOULDING

Plaster Systems uPVC punched base vented bead.

ACCESSORIES

3.1 FIXINGS, TIMBER

40 mm system:

90 mm x 3.6 mm hot dipped galvanized flat head nails with either a 22 mm or 4 mm diameter plastic washers.

3.2 FIXINGS, STEEL

40 mm system:

75 mm x 8 m exterior grade self tapping steel screws with 40 mm diameter plastic washers.

Screws to comply with AS 3566 class 3 in corrosion zones 1, 2, and 3 and corrosion class 4 screws in corrosion zones 1, 2, 3, and 4 as defined by NZS 3604, used with 40 mm diameter washers.

3.3 REINFORCING MESH

Mesh alkali-resistant fibreglass woven reinforcing mesh.

3.4 SEALANTS

Paintable neutral cure silicone in accordance with **Manufacturers** specifications and set against backer rods where necessary.

3.5 ADHESIVE

Solvent free PVC construction adhesive that is compatible with EPS and in accordance with **Manufacturers** specifications.

4. EXECUTION & CONDITIONS

Conditions

4.1 DELIVERY

Keep plaster products dry in transit. Take delivery of plaster products dry and undamaged. Reject all damaged materials.

4.2 STORAGE

Deliver all materials in original unopened packaging with labels intact. Provide dry storage on site, stack carefully, protect from mechanical damage. Keep bagged render off concrete surfaces.

4.3 PLASTERING CONDITIONS

Carry out plastering to Plaster Systems specification under conditions which will not adversely affect the finished work.

4.4 PROTECT

Before application of plaster, apply masking film and tape to all joinery, pipes, roofs and all areas likely to be marked by the plaster. Use drop cloths and ground covers to keep the working areas clean. Clean off droppings onto finished work immediately.

4.5 SUBSTRATE

Do not commence work until openings and apertures have been cut, pipes, fixtures, fixing pads and plugs have been fixed and flashings and other preparations are complete. All defects in substrate must be rectified prior to application of plaster coatings. Ensure that backgrounds and adjoining surfaces are, after the preparation called for in this section, is of the required standard by **SPECIFIED**.

4.6 FLASHING AND DETAILING

Comply with **NZ Building Code** penetration flashing guidelines. Carry out to the required standard of execution to ensure water does not penetrate.

4.7 CONFIRM LAYOUT

Before commencing work confirm the layout of expansion joints and other visual detailing of the finished work.

Application

4.8 PENETRATIONS

Confirm that exterior wall openings have been prepared ready for the installation of all window and door frames and other penetrations through the cladding. Required preparatory work includes the following:

- wall cladding underlay/building wrap to openings finished and dressed off with flexible flashing tape ready for the installation of window and door frames and other penetrations.
- Installation of window and door joinery.
- Installation of flashings (those required to be installed prior to installation of penetrating elements).
- Where electrical cables pass through cladding, put into conduit to ensure that there is no direct contact with the polystyrene.

4.9 CAVITY BATTENS

Fix self adhesive vented poly battens full length to studs to achieve a 20 mm minimum thickness drained cavity to NZBC E2/AS1: 9.0 Wall claddings. The battens are fixed by the cladding fixings which will penetrate the wall framing studs over the building wrap. Seal the top of the cavity. Horizontal cavity battens must be no longer than 100 mm. Use cavity spacers where fixing is required between cavity battens. Fix additional battens to internal and external corners and around openings to **Plaster Systems** standard details.

4.10 PENETRATION FLASHINGS

Fix in place required uPVC trims, profiles flashings and control joints. Seal service penetrations such as piping and light fittings.

4.11 FLASHING AND ACCESSORIES

Fit flashings to jambs and sill on recessed joinery using **Plaster Systems** proprietary flashings. Reinforce external corners and bottom edges of Neopor EPS sheets with

uPVC angles and channel extrusions. Fit joinery heads with a head flashing (if not protected by boxed eaves or other protection).

4.12 NEOPOR EPS, NAILED TO CAVITY BATTENS

Butt-joint, continuously support all edges and nail with heads flush, the Neopor EPS sheet to **Plaster Systems** details. Install vermin-proof punched **Plaster Systems** base bead at base of polystyrene sheets.

4.13 MOVEMENT CONTROL JOINTS

Incorporate in accordance with the design information supplied by **Plaster Systems**. Control joints to be positioned over solid timber backing and shall be provided on all walls over 20 metres in length or over 7 metres high, at abutments to different cladding types, where cladding covers structural materials, and over a movement joint in the underlying framing. Confirm locations in writing to the owner before work commences.

4.14 FINISHING

Refer to SELECTIONS for type and colour.

4.15 OR THERMABASE RENDER

Apply first base render coat 10 mm thick minimum followed by 3 mm thick minimum second mesh coat of render with fibreglass mesh embedded into wet plaster. Overlap each successive length of mesh by 50 mm minimum. To opening reveals mesh over the uPVC flashings. Apply diagonal reinforcement strips at all corners of windows, doors and other exterior openings.

4.16 POLYMER MODIFIED FINISH

Apply the coating of the selected texture, to the **Plaster Systems** recommended techniques and thicknesses.

4.17 ACRYLIC COATING FINISHES

Apply the coating of the selected texture, to the **Coating Manufactures** recommended techniques and thicknesses.

4.18 CURE FINISHES

Cure and protect from rapid drying in accordance with the **Plaster Systems** requirements.

4.19 PAINT FINISH

Apply two or three coats of 100% acrylic paint to exterior plastered surfaces. Allow a minimum of 3 days for the cement plaster to dry before the application of the paint system.

Completion

4.20 CLEANING

Remove debris, unused materials and elements from the site relating to the plaster system application. Replace damaged, cracked or marked elements. Leave the whole of this work to the required standard.

4.21 FINAL INSPECTION

A final inspection by the approved installer of the entire finished cladding to take place immediately after completion of the wall cladding work and any defects or subsequent damage made good immediately.

GIB® EzyBrace[™] FP for GIB® EzyBrace[™] Systems, 2009



GIB® Wall Bracing Calcul	ation Sheet A	1		single storey	V03/09
Job Details		-10000000000000000000000000000000000000			
Name	Ward				
Street and Number	35 Kotare St	reet	Job numbe	2690	
Lot and DP Number	Lot 1 DP 409	453			
City/Town/District	Waikanae		Area 1		
Designer	Allan Pulleng	er			
Company Name	Designscape				
Date	31/05/2011				
		Sele	ct GIB® Lining	10 mm GIB® Plasterboard	
Building Specification			Option		
Number of storeys	single	V			
Floor Loading	2kPa	∇			
Foundation Type	slab				
				Complete Single Floor	
	Single Floor			Column only	
Cladding Weight	light	\sim			
Roof Weight	light	\sim		· V	
Room in Roof Space	no			M.	
Roof Pitch (degrees)	30			15	
Roof height above eaves (m)	3.0			1.0	
Building height to apex (m)	6.0				
Ground to lower floor level (m)	0.2				
				2000	
Stud Height (m)	2.4				
Building Length (m)	12.0				
Building Width (m)	6.4				
Building Plan Area (m2)	777				

Wind Zone	Very High		Earthquake Zone
Select by Building	Consent Authority May	0	A
or Preference	Very High		
Region	Preference selected		Consult GIB® EzyBrace™ Systems, 2009
Terrain	Preference selected		for Wind Zone definitions
Exposure	Preference selected	~	
Topography	Preference selected	$\overline{\mathbf{v}}$	

Bracing Units required for Wind

Demand W	(BU)	
		Walls single
along	slab	793
across	slab	1521

Bracing U	nits required for Earthquake	
Demand a	long / across E (BU)	
	Walls	
	single	
slab	276	

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GIB® EzyBraceTM FP for GIB® EzyBraceTM Systems, 2009



Along									
Braci	ng Line				ents provid	ed		Wind	Earthq
1	2	3	4	6	5	7	8	9W	10EQ
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved
Α	enter	1	3		2.4	GS1(10)	GIB®	207	165
	not enough	2	0.8		2.4	GS2(10)	GIB®	60	56
line totals		3							
W	267	4							
EQ	221	5							
В	enter	1	2.4		2.4	GS2(10)	GIB®	216	192
	not enough	2	1.2		2.4	GS1(10)	GIB®	83	66
line totals	1	3	0.8		2.4	GS1(10)	GIB®	53	44
W	352	4							
EQ	302	5							
С	enter	1	1.2		2.4	GS1(10)	GIB®	83	66
	not enough	2	1.2		2.4	GS1(10)	GIB®	83	66
line totals		3	1.2		2.4	GS1(10)	GIB®	83	66
W	248	4							
EQ	198	5							
D	enter	1							
		2							
line totals		3							
W		4				12 21			
EQ		5							
E	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
F	enter	1					13		-
V.		2							
line totals	ME I	3							
W		4						110.00	
EQ		5							
G	enter	1						1	
		2							
line totals		3							
W		4							
EQ		5							
H	enter	1					1.5		
		2							
ine totals		3							
W		4						100	
EQ		5							100
	Wallboards L		-2009. All rio	hts reserved				Wind	Eartho
Totals Ach		Achieved/E		W	109%	EQ	261%	867	721
Concrete S		. IOI IIO VOU/L	Jilliana	.,,	10070		20170	OK	OK
	uired (from	D						793	276

GIB® EzyBraceTM FP for GIB® EzyBraceTM Systems, 2009



Across									
Braci	ng Line		Bi	racing Elem				Wind	Earthq.
1	2	3	4	6	5	7	8	9W	10EQ
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved
M	enter	1	0.8		2.4	BL1(10)	GIB®	102	89
	not enough	2	0.9		2.4	BL1(10)	GIB®	116	99
line totals		3							
W	218	4						-	
EQ	187	. 5							
N	enter	1	0.9		2.4	BL1(10)	GIB®	116	99
	not enough	2	1.9		2.4	BL1(10)	GIB®	264	190
line totals		3	1.6		2.4	GS1(10)	GIB®	110	88
W	558	4	1		2.4	GS1(10)	GIB®	68	55
EQ	432	5						1.00	
0	enter	1	1.5		2.4	BL1(10)	GIB®	203	155
	not enough	2	0.69		2.4	BL1(10)	GIB®	87	77
line totals	1 1	3							
W	291	4							
EQ	232	5							
Р	enter	1	1.3		2.4	BL1(10)	GIB®	173	137
	not enough	2	2.2		2.4	BL1(10)	GIB®	306	220
line totals	- 7	3							
W	479	4					1-		
EQ	357	5							
Q	enter	1							-
	1 11	2							
line totals		3							-
W		4						-	
EQ		5							1
R	enter	1							
		2							
line totals		3		*					
W		4							
EQ S	antes	5						-	
3	enter	1							+
KARIB		2		-				+	
line totals		3		-				-	+
W		5		- V			_		+
EQ T	enter	1							10000
	enter				1			-	
P 1		2							
line totals		3							
W		5							
EQ	Mallha and 1		2000 4"	this recent				Mind	Enetho
	Wallboards L	Achieved/I		W W		EQ	1270/	Wind 1545	Earthq 1208
Totals Act		Achieved/I	Demand	VV	102%	EQ	437%		
Concrete		Demand)						0K	276

GIB® EzyBrace[™] FP for GIB® EzyBrace[™] Systems, 2009



GIB® Wall Bracing Calcula	ation Sheet	A		single storey	V03/0
Job Details					
Name	Ward				
Street and Number	356 Kotare		Job numbe	2690	
Lot and DP Number	Lot 1 DP 40	09453			
City/Town/District	Waikanae		Area 2		
Designer	Allan Puller	nger			
Company Name	Designscap	ре			
Date	31/05/201	1			- p-a
		Sele	ct GIB® Lining	10 mm GIB® Plasterboard	
Building Specification	_	1	Option		(1) (1) (1) (1)
Number of storeys	single				
Floor Loading	2kPa				
Foundation Type	slab				
	S. C 1			Complete Single Floor	
	Single Floo	or		Column only	
Cladding Weight	light				
Roof Weight	light			***	
Room in Roof Space	no				
Roof Pitch (degrees)	30			15	
Roof height above eaves (m)	3.0			1.0	
Building height to apex (m)	6.0				
Ground to lower floor level (m)	0.2				
Stud Height (m)	2.4				
Building Length (m)	13.5				
Building Width (m)	5.1				
Building Plan Area (m2)	104				

Wind Zone	Very High		Earthquake Zone			
Select by Building	Consent Authority May	0	A -			
or Preference	Very High	7				
Region	Preference selected	7	Consult GIB® EzyBrace™ Systems, 2009			
Terrain	Preference selected	~	for Wind Zone definitions			
Exposure	Preference selected	~				
Topography	Preference selected	7				

Bracing Units required for Wind

Demand W	(BU)	
9-9-1		Walls single
along	slab	658
across	slab	1693

Bracing Units required for Earthquake

Demand al	long / acr	oss E (BU)
100 40 100	Walls	*
	single	
slab	374	

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GIB® EzyBraceTM FP for GIB® EzyBraceTM Systems, 2009



Along	all Bracing					Upper Wall			
	ng Line		Bi	racing Elem	ents provid	led		Wind	Earthq.
1	2	3	4	6	5	7	8	9W	10EQ
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved
Α	enter	1	1.2		2.4	GS1(10)	GIB®	83	66
	not enough	2	1.2		2.4	GS2(10)	GIB®	90	84
line totals		3	0.6	45	2.4	GS1(10)	GIB®	27	23
W	228	4	0.6	45	2.4	GS1(10)	GIB®	27	23
EQ	197	5							
В	enter	1	1.8		2.4	BL1(10)	GIB®	250	180
	not enough	2	1.5		2.4	GS1(10)	GIB®	104	83
line totals		3							
W	354	4							MALE
EQ	263	5							
С	enter	1	1		2.4	portal	Steel	170	170
	not enough	2							
line totals		3							
W	170	4							
EQ	170	5							
D	enter	1							
		2	C 200-1						1000
line totals		3							
W		4							100
EQ		5							
Е	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
F	enter	1			(F 5 8)	10000			
		2		14-3-3					
line totals		3		V Table					
W		4		s0)					I AL
EQ		5							1
G	enter	1							
		2							
line totals		3							
W		4							
EQ		5							
Н	enter	1			0.5				Marie Pro-
		2					7		
line totals		3			A - 13				
W		4						12.00	1
EQ		5			1				Lame
	Wallboards L		9-2009. All ric	thts reserved	· · · · · · · · · · · · · · · · · · ·			Wind	Earthq
Totals Ach		Achieved/[W	114%	EQ	168%	751	629
Concrete			an entre					OK.	OK
	quired (from	Domand)						658	374

GIB® EzyBraceTM FP for GIB® EzyBraceTM Systems, 2009



Across									
Bracii	ng Line			racing Elem	ents provid			Wind	Earthq
1	2	3	4	6	5	7	8	9W	10EQ
Line Label	Minimum BUs Req/Ach	Bracing Element No.	Available Wall Length L (m)	Angle to Bracing line (degrees)	Element Height H (m)	Bracing Type	Supplier	BUs Achieved	BUs Achieved
M	enter	1	0.9	45	2.4	BL1(10)	GIB®	82	70
	not enough	2	1.2	45	2.4	BL1(10)	GIB®	112	90
line totals		3	1.2	45	2.4	BL1(10)	GIB®	112	90
W	306	4	1.00				CHA.		
EQ	250	5		16			1.00		
N	enter	1	2		2.4	BLG	GIB®	300	270
	not enough	2	0.8	45	2.4	BLG	GIB®	83	76
line totals		3							
W	383	4							
EQ	346	5	1.1						Y-1
0	enter	1	2.4	45	2.4	BLG	GIB®	255	229
	not enough	2	1.4		2.4	BL1(10)	GIB®	188	146
line totals		3							
W	443	4		11			1 1		
EQ	375	5					V		
P	enter	1	1.6	45	2.4	BLG	GIB®	170	153
	not enough	2	1.2		2.4	BLG	GIB®	180	162
line totals		3	0.8		2.4	BLG	GIB®	117	108
W	561	4	0.9	45	2.4	BLG	GIB®	94	86
EQ	509	5		11.12.01	STE AND	25 1 5 1	1333	12 (00)	
Q	enter	1		A			1		
		2					-		
line totals		3							
W		4					-		
EQ	4.	5							
R	enter	1		3000	(*** · · ·)		· ·	13 - 13	
×		2							1
line totals		. 3							1
W		4							
EQ		5		0.28			(6.5 E)	No.	
S	enter	1							
		2							
line totals	-	3		(= - T					
W		4		T			-		
EQ		5		1 1					-
T	enter	1	1						
	F 11-1	2			Y		5.77		(J.
ine totals		3				10.0			
W	100	4		0.00			15-38		
EQ	7.1	5							
	Wallboards L		-2009, All ria	hts reserved				Wind	Earthq
Totals Ach		Achieved/[W		EQ	396%	1693	1481
Concrete S				- 11			230,0	not enough	ОК
	uired (from	Demand)						1693	374

designscape

sharkbailted

298 rosetta road telephone 04 902 8528 allan pullenger

rea a.ipenz

Mr & Mrs	Ward
LINTELS	AND BEAMS

Job 2690

DATE

31/05/2011

BEAM NUMBER		Kitchen window	1
LOADING			
Span	L =	1.20	m
Load width (roof)		1.00	2 m
Load LL + DL		1.50	kpa
Load per metre	w =	1.50	kn/m
Point Load			
Point Load		5.00	kn
Distance	а	0.30	m
	Ь	0.90	m
BENDING MOMENT			
Bending moment is WL2/8	+Wab/L		
BM max		1.40	knm
BEAM SIZE	1	140 x 90 Timber	
Depth	D =	0.14	m
Width	W =	0.09	m
STRESS			
Fw = MY/I	Y =	0.07	
$I = BD^3/12$) =	0.00002058	m ⁴
	Fw	4745	kpa
DEFLECTION			
E		8000000	
Deflection is 5WL4 /384EI +			
PL ³ /48E1 [3a/L - 4(a/L) ³]		0.002	m
Allowable L/360		0.003	m
REACTION			
Load 1		2.15	KN
Load 2		4.65	kn
Take worst case		4.65	kn
Footing Size at 100 kpa		0.070	m ²
Each side Use 260 mm square side	es	0.26	m

BEAM NUMBER		Bed window	1
LOADING			
Span	L=	1.20	m
Load width (roof)		1.50	3 m
Load LL + DL		1.50	kpa
Load per metre	w =	2.25	kn/m
Point Load			
Point Load		42.00	kn
Distance	а	0.60	m
	ь	0.60	m
BENDING MOMENT			
Bending moment is WL2/8	+Wab/L		
BM max		13.01	knm
BEAM SIZE			
Steel 180 x 75 PFC 20.9			m
E		200000000	m
		0.0000141	- 135
DEFLECTION			
Deflection is 5WL4 /384EI+			
PL ³ /48E) [3a/L - 4(a/L) ³]		0.001	m
Allowable L/360		0.003	m
PAD AREA TO ENDS			
Load 1		22.35	kn
Load 2		22.35	kn
Take worst case		22.35	kn
Footing Size at 100 kpa		0.335	m^2
Each side		0.58	m
Use 580 mm square side	es.		955

BEAM NUMBER	Din	ing window	. 3
LOADING			
Span	L=	3.60	m
Load width (roof)		1.50	3 m
Load LL + DL		1.50	kpa
Load per metre	w =	2.25	kn/m
Point Load			
Point Load		5.00	kn
Distance	а	1.40	m
	ь	2.20	m
BENDING MOMENT			
Bending moment is WL2/8	+Wab/L		
BM max		7.92	knm

BEAM SIZE		
Steel 180 UB 22.2		m
E	20000000	m
1	0.0000153	
DEFLECTION		
Deflection is 5WL4 /384EI+		
PL3 /48EI [3a/L - 4(a/L)3]	0.003	m
Allowable L/360	0.010	m
PAD AREA TO ENDS		
Load 1	5.99	kn
Load 2	7.11	kn
Take worst case	7.11	kn
Footing Size at 100 kpa	0.107	m ²
Each side	0.33	m
Use 330 mm square sides		

BEAM NUMBER	0	arage Door	4
LOADING			
Span	L =	3.00	m
Load width (roof)		1.50	3 m
Load LL + DL		1.50	kpa
Load per metre	w =	2.25	kn/m
Point Load			
Point Load		7.00	kn
Distance	a	0.30	m
	ь	2.70	m
BENDING MOMENT			
Bending moment is WL2/8	+Wab/L		
BM max		4.42	knm
BEAM SIZE			
Steel 200 UB 29.8			m
E		200000000	m
I		0.00002887	
DEFLECTION			
Deflection is 5WL4 /384EI+			
PL3 /48EI [3a/L - 4(a/L)3]		0.003	m
Allowable L/360		0.008	m
PAD AREA TO ENDS	6		
Load 1		4.08	kn
Load 2		9.68	kn
Take worst case		9.68	kn
Footing Size at 100 kpa		0.145	m ²
Each side		0.38	m

BEAM NUMBER		Top chord portal	
LOADING			
Span	L =	4.6	m
Load width (roof)		4.1	8.2 m
Load LL + DL		1.5	kpa
Load per metre	w =	6.15	kn/m
BENDING MOMENT			
$BM = WL^2/8 \qquad M =$		16.27	knm
BEAM SIZE			
Steel 200 UB 29.8			
E		200000000	m
Par trade		0.00002887	
DEFLECTION			
Deflection is 5WL4 /384EI		0.006	m
Allowable L/360		0.013	m
PAD AREA TO ENDS			
End Reaction is LxW/2		14.15	kn
Footing size required using soil 100	O kpa	0.212	m ²
Each side	100	0.460	m
Pad 460 mm square sides			

BEAM NUMBER		Cantilever Section	(Portal let 5
the load to each leg is half	the bracing load		
From Bracing calc units req	uired	170	bu
Load		8.5	kn
LOADING			
Leg Length		2.40	m
Load per metre	w =	1.77	kn/m
BENDING MOME	NT		
BM = WL/2	M =	5.1	knm
BEAM SIZE			
125 x 6 SHS			
E		200000000	m
ſ		0.00000629	
DEFLECTION			
Deflection is WL3 /8EI		0.002	m
Allowable L/360		0.007	m
PAD AREA TO EI	NDS		
End Reaction is LxW/2	2	2.13	kn
Footing size required us	ing soil 100 kpa	0.032	m ²
Each side	^	0.180	m

Use 180 mm square sides

M12 Bolts withdrawal load	3.2	kn
M16 Bolts withdrawal load	4.3	kn

Use M12 2 number

BEAM NUMBER		oorch dining	6
LOADING			
Span	L =	5.50	m
Load width (roof)		1.25	2.5 m
Load LL + DL		1.50	kpa
Load per metre	w =	1.88	kn/m
BENDING MOMENT			
$BM = WL^2/8 \qquad M =$		7.09	knm
BEAM SIZE			
Steel 180 UB 22.2			
E		200000000	m
L		0.0000153	
DEFLECTION			
Deflection is 5WL4 /384EI		0.007	m
Allowable L/360		0.015	m
PAD AREA TO ENDS			
End Reaction is LxW/2		5.16	kn
Footing size required using soil 100	kpa	0.077	m ²
Each side		0.280	m
Pad 280 mm square sides			

FRONT ENTRY SAIL ROOF

Using NZS 3604 (conservative) determine concrete to hold down

Area of roof	6.6 m ²	
length	2.1 m	
width	3.2 m	
Posts end	(area)	1.65 m ²

POST FOOTING SIZE per NZS 3604

Concrete per 1 square metre roof	0.065 m ³
Base footing size	0.5 m ²
End post Require	0.11 m ³
Depth required end	0.43 m

Foo	ting	Size
1.00		0120

600 x 600 x 600

Wind Loading & Br	acing
-------------------	-------

V		50	m/sec
S1		1	
S2		0.88	
Vs		44	m/sec
$q = 0.613 \text{ Vs}^2$		1.186	kpa
Сре		-1	
Roof area to post		1.65	
F=Cpe * q * Area	(per post)	-2.0	kn

BEAM NUMBER	Car	ntilever Leg to sa	il roof
Load		1.96	kn
LOADING			
Leg Length		3.00	m
Load per metre	w =	0.33	kn/m
BENDING MOMENT			
BM = WL/2 M =	=0	1.47	knm
BEAM SIZE			
100 x 100 x 6 RHS			
E		200000000	m
I Land	0	.00000304	
DEFLECTION			
Deflection is WL3 /8EI		0.002	m
Allowable L/360		0.008	m
PAD AREA TO ENDS			
End Reaction is LxW/2		0.49	kn
M12 Bolts withdrawal load		3.2	kn
M16 Bolts withdrawal load		4.3	kn

SAIL ROOF BEAMS

Use M12

BEAM NUMBER	Ra	fter Support bear	m 7
LOADING			
Span	L=	1.8	m
Load width (roof)		1.55	3.1 m
Load LL + DL		1.50	kpa
Load per metre	w =	2.325	kn/m

number

BENDING MOME	NT	4/34	- Ca
$BM = WL^2/8$	M =	0.94	knm
BEAM SIZE		140 x 90 Timber	
Depth	D =	0.14	m
Width	W =	0.09	m
STRESS			
Fw = MY/I	Y =	0.07	m
$I = BD^3/12$	I =	0.00002058	m ⁴
	Fw	3197	kpa
DEFLECTION			
E		8000000	
Deflection is 5WL4 /38	4EI	0.002	m
Allowable L/360		0.005	m
REACTION			

2.09

Use Bowmac cyclone straps to hold down.

End Reaction is LxW/2

KN

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shark bait Itd

298 Rosetta Road Raumati phone 04 902 8528 or 025 420 486

Cantilever Pole Design

NAME

Ward House

LOCATION :

35b Kotare Street

JOB

2690

DATE

16/06/2011

unless otherwise stated no soil testing has been done

these calculations do not allow for permanent garden watering systems

IIO2	DARAN	METERS

wall soil type		clay	
soil (wall)	ф	25	0
wall slope	α	94.3	0
back slope	β	5	0
wall friction	δ	16.67	0
active coefft	Ка	0.355	
soil density	W	18	kN\m³
surcharge	S	3	kN\m²
soil (ftg.)	ф	35	0
passive coefft	Кр	7.073	
A DOMESTIC OF THE PARTY OF THE			

WALL PARAMETERS

Wall Height	Н	1.1	m
Pole spacing	S	1	m

DESIGN ACTIONS

live load factor		1.6	
design bending moment for each pole	M*	2.6	kNm
design shear force for each pole	V*	7.2	kN
overturning moment	Movt		

BENDING

pole diameter	D	150	mm
timber strength reduction factor	ф	0.8	
duration of load factor	k ₁	0.6	
shaving & trimming factor	K ₂₀	0.85	
presevative treatment factor	K ₂₁	0.9	
wet use conditions factor	K ₂₂	1	
bending stress	fb	38	Mpa
section modulus	Z	331340	mm ³
design strength	φMn	4.6	kNm

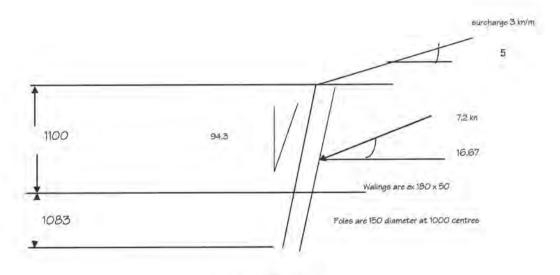
SHEAR

pole diameter	D	150 mm
timber strength reduction factor	ф	0.8
duration of load factor	K ₁	0.6
shaving & trimming factor	K ₂₀	0.85
presevative treatment factor	K ₂₁	0.9

Cantilever post wall 2690.xlsm

wet use conditions factor	K ₂₂	1	
shear stress	fc	3.1	Mpa
shear area	As	14726	mm
design strength	φVn	16.8	kN
EMBEDMENT DEPTH			
hole diameter	D	0.4	m
embedment depth		1.1	m
soil strength reduction factor	ф	0.5	
soil pressure	S	26.6	kPa
Passive Force	Pa	6.39	
	а	0.00	m
	У	0.37	m
	C Y	47.5	
	Y	1.1	m
Embedment depth	Н	1.1	m
WALING SIZE			
For Depth		1.1	m
Waling Thickness		0.05	m
Waling depth		0.18	m
Waling Force	κα*ψ*δ	1.26	kn/m
Moment Max	WL^2/8	0.16	knm
Programme Tourist	bd^3/12	1.88E-06	
Stress in Waling	FW MY/I	2107	kpa

Waling size 180 by 50



Foundation is 400 mm diameter

DIAGRAM OF WALL

2690

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298 rosetta road telephone 04 902 8528



allan pullenger

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Nard House		
	::::::::::::::::::::::::::::::::::::::	
NTERNAL CONCRETI		
		4 * * * * * * * * * * * * * * * * * * *

DATE	31/05/2011		
Seismic Load			
Seismic	40		
Siesmic load	2.00	kn	
Wall Design			
Load	2.00	kpa	
Height Wall	2.40	m	
Thickness wall	0.16	m	
Density	24.00	kn/m ³	
Width Base	0.80	m	
Thickness Base	0.30	m	
Density Base	24.00	kn/m ³	
Determination by Moments			
Base moments	2.30	knm	
Stem Moments	6.64	knm	
Total Restoring Moments	8.94	knm	
Overturning	5.76	knm	
FOS	1.55		

STEM STEEL W	ALL		2800	
LOADING				
Span	L=		2.40	m
Load width			0.5	1 m
Load LL + DL			2.00	kpa
Load per metre	W =		1.00	kn/m
BENDING MOME	ENT			
BM = WL/2	M =		2.88	knm
DATA				
Width		Ь		0.5 m
Depth				0.16 m
Span				2.4 m
steel cover				0.04 m

fc		7000
fs	grade 300	175000
J		0.849
K		0.453
W		1.00 kn/m
M	WL/2	2.88 knm
d min	sqr(2*M/fckjb	0.065 m
d actual		0.120 m
Area of steel		
As =	m/fsjd	161.53 mm ²
Steel size		12.00 mm
Area of rod		113.10 mm ²
At centres		0.60 m
Area		188.50 mm ²
Use D12 at 600 centres		
STIRRUPS		
Area of steel required is .25% csa		200.00 mm ²
Steel size		12.00
Area of rod		113.10 mm ²
At centres		0.45
Area		251.33 mm ²
		201.00 11111
Use D12 at 450 centres		

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shark balt itd

exterior

298 rosetta road phone 04 902 8528 or 027 442 0486 ullan pullenger rea alpenz certeTn

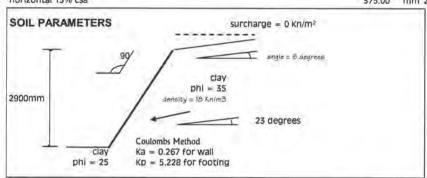
CONCRETE BLOCK RETAINING WALL

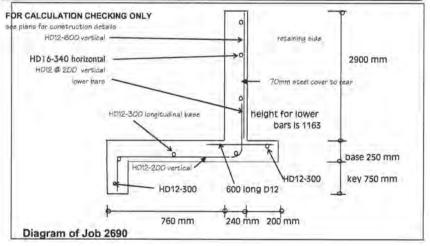
CLIENT : Ward House

NUMBER : 2690 DATE : 31/05/2011

Unless stated else where, :	oil test	ing has not been done, an	d soil assumed at 100 kpa			
WALL PARAMETER	RS		SOIL PARAMETER	S		
Retaining Height mm	H =	2900	soil type		clay	
Wall Height mm	HI	2900	soil (wall)	Ø	35.00	degrees
Key Depth mm	k =	750	wall slope alpha	ha =	90.00	degrees
wall thickness mm	t =	240	back slope beta	ta =	8.00	degrees
footing length mm	1 =	1200	wall frictn del	ta =	23.33	degrees
footing depth mm	d =	250	active coefft	Ka =	0.27	0.267
footing behind stem "	rb =	200	soil density Ds	11	18.00	kn/m3
wall density Kn/m3	DW =	18	surcharge	S =	0.00	Kn/m²
Floor length mm	fl =	0	footing soil type		clay	
Base Friction is tan (phi)	n =	0.47	soll (ftg.) p	ni =	25.00	degrees
Loading on top wall kn/s		0	passive coefft (coulom)	Vn -	5.23	5.228
			passive eperit (coulding	PP -	5.25	3.220
REINFORCING PAR	CAME	IERS	0.000 (4.500)		400	
Bottom third of Wall			Upper 2/3 Wall		Base	
cover to reinforcing	mm	70	80		75.00	
meter of reinforcing Di	mm	12	12		12.00	
spacing of reinforcing	mm	200	600		200.00	
Concrete F'C	MPa	12				
strength redn factor Ph	j.	0.85				
steel strength Fy	MPa	500				
maximum steel centres			720	mm		
ensure stem has minim				mm		
STEEL PLACEMEN		and the state of				
location	grade	diameter	spacing		notation	
location	grade	diameter	spacing		Hotation	
steel reduction	HD	12	600		HD12-600	
					HD12-200	
upper vertical	HD	12	200			
horiz in wall	HD	16	340		HD16-340	
horiz in footing	HD	12	450		HD12-450	
Base steel area vertical	HD	12	200		HD12-200	
horiz in base	HD	12	300		HD12-300	
height reduction		966			966mm	
side cover		70			70mm	
bot cover		75			75mm cov	/er
WALL STRENGTH		ar a service and a service				1.05
wall soil force		$FS = Ka*Ds*H^2*0.5*si$	The state of the s	=	18.61	Kn
wall surcharge fce		FSS = Ka*5*H*sin(alph	ia-delta)	=	0.00	kn
factored wall fce		Fu = (Fs + Fss) * 1.6		=	29.78	Kn
wall soil mmt		Ms = Fs + H + 0.33		=	17.81	Kn/m
wall scharge mmt		Mss = Fss * H * 0.5		=	0.00	Kn/m
design moment		Mu = (Ms + Mss) + 1.6	R	=	28.50	Kn/m
reinforcing area		As = Dr2 * Pi / 4 * 5		=	565.49	mm ²
effective depth		de = t - c - Dr/2		=	164.00	mm
dependable moment		Mdep = Phi*As*Fy			50.00	re-level
		*(de - As*Fy/(2*.8)	5*F'C*1000)	=	36.08	Kn/m
OVERTURNING						
OVERTURNING wall weight		WW = (H1+h) * t * D	w	+	15.77	Kn
Carlo at many and an extension of the first		WW = (H1+h) * t * D' Wf = I * d * DW	w	=	15.77 5.40	Kn Kn
wall weight			w			
wall weight footing weight		Wf = I * d * DW Wh = H * b * Ds		# #	5.40	Kn
wall weight footing weight heel soil wt		Wf = I * d * DW Wh = H * b * Ds	k)2*.5 + Ka*S*(H+d+k))		5.40	Kn
wall weight footing weight heel soil wt		Wf = I * d * DW Wh = H * b * DS FW = (Ka*Ds*(H+d+	k)2*.5 + Ka*S*(H+d+k))		5.40 10.44	Kn Kn
wall weight footing weight heel soil wt wall friction		Wf = I * d * DW Wh = H * b * DS FW = (Ka*DS*(H+d+ tan(delta)*cos(alp	k) ² *.5 + Ka*S*(H+d+k)) ha-delta)	=	5.40 10.44 6.26	Kn Kn
wall weight footing weight heel soll wt wall friction Key weight	t	Wf = I*d*DW Wh = H*b*DS FW = (Ka*DS*(H+d+ tan(delta)*cos(alp KW = K*t*DW	k) ^{2*} .5 + Ka*S*(H+d+k)) na-delta) + FW + KW	=	5.40 10.44 6.26 3.24	Kn Kn
wall weight footing weight heel soil wt wall friction Key weight total vertical load	t	Wf = I * d * DW Wh = H * b * DS FW = (Ka*DS*(H+d+ tan(delta)*cos(a)p KW = K * t *DW Ft = WW + WF + Wh Mot = Ka*DS*(H+d)*3	k) ^{2*} .5 + Ka*S*(H+d+k)) ha-delta) + Fw + Kw \$*0.17*sin(alpha-delta)	=	5.40 10.44 6.26 3.24 41.11	Kn Kn Kn
wall weight footing weight heel soll wt wall friction key weight total vertical load toe bottom OT momen		Wf = I* d * DW Wh = H * b * DS FW = (Ka*Ds*(H+d+ tan(delta)*cos(alp KW = K * t * DW Ft = WW + WF + Wh	k/2*.5 + Ka*S*(H+d+k/) ha-delta) + Fw + Kw 5*0.17*sin(alpha-delta) sin(alpha-delta)	= =	5.40 10.44 6.26 3.24	Kn Kn
wall weight footing weight heel soil wt wall friction Key weight total vertical load		$ \begin{aligned} Wf &= I * d * DW \\ Wh &= H * b * DS \\ FW &= (Ka*DS*(H+d+d+da)(de)(ta)*cos(a)(ta) \\ KW &= K * t * DW \\ Ft &= WW + WF + Wh \\ MOT &= Ka*DS*(H+d)^2 \\ + Ka*S*(H+d)^2 * 0.5* \\ MIT &= WW*(I-(D+UZ)) \end{aligned} $	k) ^{2*} .5 + Ka*S*(H+d+k)) ha-delta) + Fw + Kw 5*0.17*sin(alpha-delta) sin(alpha-delta) + + Wf*1/2	= =	5.40 10.44 6.26 3.24 41.11 23.10	Kn Kn Kn
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome		$ \begin{aligned} Wf &= I * d * DW \\ Wh &= H * b * DS \\ FW &= (Ka*DS*(H+d+d+da)(de)(ta)*cos(a)(ta) \\ KW &= K * t * DW \\ Ft &= WW + WF + Wh \\ MOT &= Ka*DS*(H+d)^2 \\ + Ka*S*(H+d)^2 * 0.5* \\ MIT &= WW*(I-(D+UZ)) \end{aligned} $	k/2*.5 + Ka*S*(H+d+k/) ha-delta) + Fw + Kw 5*0.17*sin(alpha-delta) sin(alpha-delta)	1111111	5.40 10.44 6.26 3.24 41.11 23.10 2.00	Kn Kn Kn Kn
wall weight footing weight heel soil wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome		$ \begin{aligned} Wf &= I * d * DW \\ Wh &= H * b * DS \\ FW &= (Ka*DS*(H+d+tan(delta)*cos(alp)) \\ KW &= K * t * DW \\ Ft &= WW + WF + Wh \\ MOT &= Ka*DS*(H+d)*2 \\ + Ka*S*(H+d)*2*0.5* \\ MIT &= WW*(I-b/2) - FV \\ + Wh*(I-b/2) - FV \end{aligned} $	k) ^{2*} .5 + Ka*S*(H+d+k)) wha-delta) + FW + KW **0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2))		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.69	Kn Kn Kn Kn Kn/m
wall weight footing weight heel soil wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty		Wf = I* d* DW Wh = H* b* DS FW = (Ka*DS*(H+d+d+tan(delta)*cos(a)p KW = K* t*DW Ft = WW + WF + Wh Mot = Ka*DS*(H+d)*2 + Ka*S*(H+d)*2+0,5*(Mr = WW*(I-b/2)) + Wh*(I-b/2) - FV FSO = Mr / Mot e = I/2 - (Mr - Mot) / F	k) ^{2*} .5 + Ka*S*(H+d+k)) wha-delta) + FW + KW **0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2))		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97	Kn Kn Kn Kn
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure		Wf = I * d * DW Wh = H * b * DS FW = (Ka*DS*(H+d+ tan(delta)*cos(alp KW = k * t * DW Ft = WW + Wf + Wh Mot = Ka*DS*(H+d)^2 + Ka*S*(H+d)^2*0.5* Mr = WW*(I - (b+t/2)) + Wh*(I - b/2) - FV FSO = Mr / Mot	k) ^{2*} .5 + Ka*S*(H+d+k)) wha-delta) + FW + KW **0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2))		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.68 214.15	Kn Kn Kn Kn/m Kn/m
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure SLIDING		Wf = I* d* DW Wh = H* b* DS FW = (Ka*DS*(H+d+tan(delta)*cos(a)p KW = K* t*DW FT = WW + WF + Wh MOT = Ka*DS*(H+d)*3 + Ka*S*(H+d)*3 + WA*(I - (D+D/2)) FV = WW*(I - (D+D/2)) FSD = MT / MOT E = 1/2 - (MT - MOT)/ Ffb = 2*FT/(3(1/2-e))	k/2*.5 + Ka*S*(H+d+k)) wha-delta) + FW + KW (*0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2)) t		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.68 214.15	Kn Kn Kn Kn/m Kn/m
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure		$ \begin{aligned} Wf &= I * d * DW \\ Wh &= H * b * DS \\ FW &= (Ka*DS*(H+d+d+tan(delta)*cos(alp) \\ KW &= K * t * DW \\ Ft &= WW + WF + Wh \\ MOt &= Ka*DS*(H+d)*2 \\ + Ka*S*(H+d)*2 + Ka*S*(H+d)*2 \\ + Wh*(I-b/2) - FV \\ FSO &= Mr / MOt \\ e &= I/2 - (Mr - Mot) / F \\ fb &= 2 * FT/(3(I/2-e)) \end{aligned} $	k) ^{2*} .5 + Ka*S*(H+d+k)) wha-delta) + FW + KW **0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2))		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.69 214.15 71.03	Kn Kn Kn Kn/m Kn/m mm kPa
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure SLIDING		Wf = I* d* DW Wh = H* b* DS FW = (Ka*DS*(H+d+tan(delta)*cos(a)p KW = K* t*DW FT = WW + WF + Wh MOT = Ka*DS*(H+d)*3 + Ka*S*(H+d)*3 + WA*(I - (D+D/2)) FV = WW*(I - (D+D/2)) FSD = MT / MOT E = 1/2 - (MT - MOT)/ Ffb = 2*FT/(3(1/2-e))	k/2*.5 + Ka*S*(H+d+k)) wha-delta) + FW + KW (*0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2)) t		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.68 214.15	Kn Kn Kn Kn/m Kn/m
wall weight footing weight heel soil wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure SLIDING Sliding force		Wf = I* d* DW Wh = H* b* DS FW = (Ka*DS*(H+d+ tan(delta)*cos(alp KW = K* t* DW Ft = WW + Wf + Wh MOt = Ka*DS*(H+d)*2 + Ka*S*(H+d)*2.5* Mr = WW*(I-(b+t/2)) + Wh*(I-b/2)-FV FSO = Mr / Mot e = I/2-(Mr-Mot)/F fb = 2*Ft/(3(I/2-e)) FSI = (Ka*DS*(H+d+k)*3(I)/2 + Ka*S*(I)/2 + Ka*S*(I)/	k/2*.5 + Ka*S*(H+d+k)) wha-delta) + FW + KW (*0.17*sin(alpha-delta) sin(alpha-delta) + Wf*1/2 v*I + KW *(L-(b+t/2)) t		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.69 214.15 71.03	Kn Kn Kn Kn/m Kn/m mm kpa
wall weight footing weight heel soll wt wall friction Key weight total vertical load toe bottom OT moment toe bottom REST mome FOS overturning eccentricty bearing pressure SLIDING		$ \begin{aligned} Wf &= I * d * DW \\ Wh &= H * b * DS \\ FW &= (Ka*DS*(H+d+d+tan(delta)*cos(alp) \\ KW &= K * t * DW \\ Ft &= WW + WF + Wh \\ MOt &= Ka*DS*(H+d)*2 \\ + Ka*S*(H+d)*2 + Ka*S*(H+d)*2 \\ + Wh*(I-b/2) - FV \\ FSO &= Mr / MOt \\ e &= I/2 - (Mr - Mot) / F \\ fb &= 2 * FT/(3(I/2-e)) \end{aligned} $	k) ^{2*} .5 + Ka*S*(H+d+k)) wha-delta) + FW + KW s*0.17*sin(alpha-delta) sin(alpha-delta) + Wf*l/2 v*I + KW *(L-(b+t/2)) t b) ^{2*} .5 + Ka*S*(H+d+k))		5.40 10.44 6.26 3.24 41.11 23.10 2.00 38.97 1.69 214.15 71.03	Kn Kn Kn Kn/m Kn/m mm kPa

sliding REST	Fr = Ff + FK + SI + SR + UW	=	66.23	Кп
FOS sliding	FSS = Fr / FSI	=	1.97	
Slab sliding resistance slab	SR = fl + Dw + .1 + n		0.00	
Plus upper section of wall not retaining soil	Hd is non retaining section of wall UW=Hd*t*Dw*n		0.00	
Steel Reduction	ow-na c bw n		0.00	
Take top 2/3 of wall H1	2/3 * H or H - steel lap		1934.00	
Find Ld	70 * b*d		32.49	
effective depth	e		164.00	
Flexure Distance				
Allerta e deserva	H1-(Ld-e)		1737.00	
Bottom rod length	& lap length		1163.00	2.2
wall soil force	Fs = Ka*Ds*H ² *0.5*sin(alpha-delta)	-	6.68	Kn
wall surcharge fce	Fss = Ka*S*H*sin(alpha-delta)	-	0.00	Kn
factored wall fce	Fu = (FS + FSS) * 1.6	=	10.68	Kn
wall soll mmt	Ms = Fs * H * 0.33	=	3.83	Kn/m
wall scharge mmt	Mss = Fss * H * 0.5	=	0.00	Kn/m
design moment	MU = (MS + MSS) * 1.6	=	6.12	Kn/m
reinforcing area	$AS = Dr^2 * Pi / 4 * s$		188.50	mm ²
effective depth	de = t-c-Dr/2		154.00	
dependable moment	Mdep = Phi*As*Fy			Name of the last
William.	*(de - As*Fy/(2*.85*F'c*1000)		11.97	Kn/m
BASE				
Pressures	See Fb		71.03	kpa
BASE STEEL AREA				
Vertical Steel	From bottom of wall		565.49	mm^2
norizontal 15% csa			375.00	mm*2







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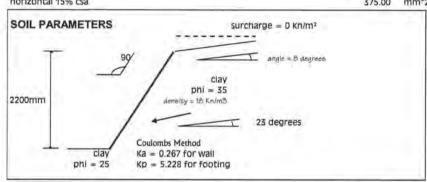
CONCRETE BLOCK RETAINING WALL

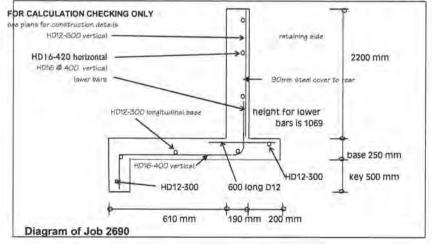
CLIENT : Ward House exterior

NUMBER : 2690 DATE : 31/05/2011

Walls are not designed for						
Unless stated else where, s	oil test	ing has not been done, ar	nd soil assumed at 100 kpa			
			SOIL PARAMETER	C		
WALL PARAMETER		400-400		3		
Retaining Height mm	H =	2200	soil type		clay	
Wall Height mm	H1	2200	soil (wall)	Ø	35.00	degrees
Key Depth mm	K =	500	wall slope alpha	ha =	90.00	degrees
wall thickness mm	1 =	190	back slope beta	ta =	8.00	degrees
footing length mm	1 =	1000	wall frictn del	ta =	23.33	degrees
		7.7.7				
footing depth mm	d =	250	active coefft	Ka =	0.27	0.267
footing behind stem m	b =	200	soil density Ds	· ·	18.00	Kn/m3
	DW =	18	surcharge	S =	0.00	Kn/m²
				3 =		KIMI
Floor length mm	fl =	0	footing soil type		clay	
Base Friction is tan (phi)	n =	0.47	soil (ftg.) p	hi =	25.00	degrees
						the second second second
Loading on top wall kn/	r SI=	0	passive coefft (coulom	r Kb =	5.23	5,228
REINFORCING PAR	AME	TERS				
			Upper 2/3 Wall		Base	
Bottom third of Wall						
cover to reinforcing	mm	90	90		75.00	
meter of reinforcing Di	mm	16	12		16.00	
	mm		600		400.00	
spacing of reinforcing		400	500		400.00	
Concrete F'C	MPa	12				
strength redn factor Ph	1	0.85				
steel strength Fy	MPa	500				
Selection of the control of the cont			570	mm		
maximum steel centres						
ensure stem has minim	nm lab	distance for bottom t	960	mm		
STEEL PLACEMEN	T					
location	gradi	diameter	spacing		notation	
location	graul	ulailletei	spacing		Hotation	
					White State of	
steel reduction	HD	12	600		HD12-600	
upper vertical	HD	16	400		HD16-400	
120 pt 21 12 pt 12 12 12 12 12 12 12 12 12 12 12 12 12					HD16-420	
horiz in wall	HD	16	420			
horiz in footing	HD	12	450		HD12-450	
Base steel area vertical	HD	16	400		HD16-400	
noriz in base	HD	12	300		HD12-300	
A Committee of the Comm	HD		300			
height reduction		960			960mm	
side cover		90			90mm	
bot cover		75			75mm cov	/er
462,42001						
MINI OTOTAL						
WALL STRENGTH						
wall soil force		FS = Ka*Ds*H2*0.5*s	in(alpha-delta)	=	10.71	Kn
wall surcharge fce		FSS = Ka*S*H*sin(alp)	na-delta)	=	0.00	Kn
factored wall fce		Fu = (Fs + Fss) + 1.6	3.34	=	17.14	Kn
					7.78	Kn/m
wall soil mmt		MS = FS " H " 0.33		=		
wall scharge mmt		MSS = FSS * H * 0.5		=	0.00	kn/m
design moment		Mu = (Ms + Mss) * 1.6	5	=	12.44	Kn/m
reinforcing area		As = Dr2 * Pi / 4 * S		-	502.65	mm ^z
effective depth		$de = t \cdot c \cdot Dr/2$		-	92.00	mm
Service Service Services				_	52,00	in state
dependable moment		Mdep = Phi*As*Fy	Carrier Control		42.22	Market 1
		*Ide - As*Fy/(2*.8	5"F'C"1000)	=	17.02	Kn/m
OVERTURNING						
		MAN - 1417 - 101 - 1- 1- 10	NAZ		9.23	Кп
wall weight		WW = (H1+h) * t * D	W	_		
footing weight		$Wf = 1 \cdot d \cdot DW$		=	4.50	Kn
heel soil wt		Wh = H * b * Ds		=	7.92	Kn
wall friction		FW = (Ka*Ds*(H+d+	k)2+.5 + Ka+S+(H+d+k)			
and the same of		tan(delta)*cos(a)		=	3.58	Кп
Keywelght			and the same of	9	1.71	176.0
Key weight		KW = k * t *DW				1000
total vertical load		Ft = WW + Wf + Wf		=	26.95	Kn
toe bottom OT momen	t	Mot = Ka*Ds*(H+d)*	3*0.17*sin(alpha-delta)			
and the same of th		+ Ka*S*(H+d)2*0.5*	sin(alpha-delta)	=	10.87	Kn/m
toe bottom REST mome	nt	$Mr = WW^*(I - (b + t/2))$			2.00	17 77 70
The porton kear mone	316			-		Vn/m
11.5			N*1 + KW * (L-(b+t/2))	=	20.68	Kn/m
FOS overturning		FSO = Mr/Mot		=	1.90	
eccentricty		e = 1/2 - (Mr - Mot)/ F	t	=	136.09	mm
bearing pressure		fb = Ft/I + 6*Ft*e/F		=	48.95	kPa
		1917 9 14 90				
SLIDING						
Sliding force		FSI = (Ka*Ds*(H+d+k	02*.5 + Ka*S*(H+d+K))			
THE PROPERTY OF		*sin(alpha-delta)		*	19.26	Kn
		an installed the section.				763
Continu Deletion		Ch t tentell			10 57	Vin
footing friction		Ff = Ft * tan(phi)	144	-	12.57	Kn
key soll force		$Fk = Kp*Ds*(k+d)^2$	0.5	=	26.47	Kn

Fr = Ff + Fk + Sl + SR + UW	=	39.04	кп
FSS = Fr / FSI	-	2.03	
SR=fl * Dw * .1 * n		0.00	
Hd is non retaining section of wall UW=Hd*t*Dw*n		0,00	
		A	
		1240.00	
70 * b*d		16.49	
e		92.00	
H1-(Ld-e)		1131.00	
& lap length		1069.00	
Fs = Ka*Ds*H2*0.5*sin(alpha-delta)	=	2.83	Kn
Fss = Ka*S*H*sin(alpha-delta)	=	0.00	Kn
FU = (FS + FSS) * 1.6	=	4.53	kn
A CONTRACTOR OF THE CONTRACTOR	-	1.06	Kn/m
	=		kn/m
	-		Kn/m
The state of the s		100000	mm ²
T T T T T T T T T T T T T T T T T T T		94.00	
		202	None P
"(de - AS" Fy/(2",85" F"C" 1000)		7,16	Kn/m
40.00			A
See FD		48.95	kpa
From bottom of wall		502.65	mm^2
		375.00	mm ⁻²
	FSS = Fr / FsI SR = fi * Dw * .1 * n Hd Is non retaining section of wall UW = Hd*t*Dw*n 2/3 * H	FSS = Fr / FSI = SR = fi * Dw * .1 * n Hd Is non retaining section of wall UW = Hd*t*Dw*n 2/3 * H or H - steel lap 70 * b*d e H1-(Ld-e) & lap length FS = Ka*Ds*H2*0.5*sin(alpha-delta) = FSS = Ka*S*H*sin(alpha-delta) = FU = (FS + FSS) * 1.6 MS = FS * H * 0.33 MSS = FSS * H * 0.5 MU = (MS + MSS) * 1.6 AS = Dr2* PI / 4 * S de = t - C - Dr/2 Mdep = Phi*As*Fy	FSs = Fr / Fsl = 2.03 SR = fl * DW * .1 * n







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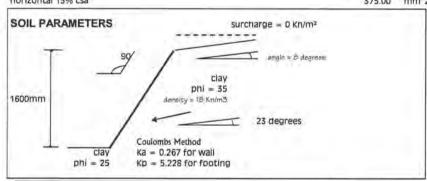
CONCRETE BLOCK RETAINING WALL

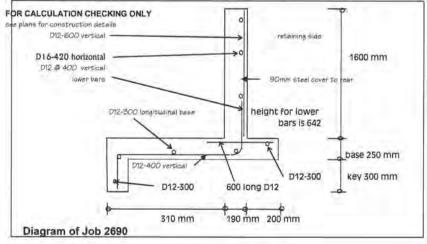
CLIENT : Ward House NUMBER : 2690 exterior

: 2690 DATE 31/05/2011

Unless stated else where,	oil testing	has not been done	, and soil assumed at 100 kpa				
WALL PARAMETER	N 24 MILES		SOIL PARAMETER				
Retaining Height mm	H =	1600	soil type		clay		
	H1	1600	soil (wall)	Ø	35.00	degrees	
Key Depth mm	k =	300	wall slope alpha	ha =	1.6.4.1.1.1.1	degrees	
wall thickness mm	t =	190	back slope beta	ta =	8.00	degrees	
footing length mm	=	700	wall frictn del	ta =	23.33	degrees	
footing depth mm	d =	250	active coefft	Ka =	0.27	0.267	
footing behind stem m	1 b =	200	soil density Ds	П	18.00	Kn/m3	
wall density Kn/m3	DW =	18	surcharge	5 =	0.00	Kn/m²	
Floor length mm	f) =	0	footing soil type		clay		
Base Friction is tan (phi)		0.47	soll (ftg.) p	hi =	25.00	degrees	
		1.7	passive coefft (coulom			5.228	
Loading on top wall kn/		0	passive coeffic (coulding	r Kb =	5.23	3.228	
REINFORCING PAR	RAMETE	RS			100		
Bottom third of Wall			Upper 2/3 Wall		Base		
cover to reinforcing	mm	90	90		75.00		
meter of reinforcing Di	mm .	12	12		12.00		
spacing of reinforcing	mm	400	600		400.00		
concrete F'c	MPa	12					
strength redn factor Ph	1	0.85					
steel strength Fy	MPa	300					
maximum steel centres	is 3 time	s wall thickness	570	mm			
ensure stem has minim				mm			
STEEL PLACEMEN			10.2				
location	grade	diameter	spacing		notation		
location	graur	ulatheter	spacing		Hotation		
steel reduction	D	12	600		D12-600		
steel reduction					D12-400		
upper vertical	D	12	400		D16-420		
horiz in wali	D	16	420				
horiz in footing	D	12	450		D12-450		
Base steel area vertical	D	12	400		D12-400		
horiz in base	D	12	300		D12-300		
height reduction		533			533mm		
side cover		90			90mm		
bot cover		75			75mm co	/er	
The second second							
WALL STRENGTH							
wall soil force	FS	= Ka*Ds*H2*0.5	i*sin(a)pha-delta)	=	5.67	Kn	
wall surcharge fce		s = Ka*S*H*sin(a		=	0.00	Kn	
factored wall fce		1 = (FS + FSS) * 1		=	9.07	Kn	
wall soil mmt	M			=	2.99	Kn/m	
wall scharge mmt		SS = FSS * H * 0.5		=	0.00	Kn/m	
design moment		U = (MS + MSS) *		=	4.79	Kn/m	
reinforcing area		= Dr2 * P1/4 * :	S	=	282,74	mm ²	
effective depth		t = t - c - Dr/2		=	94.00	mm	
dependable moment	M	dep = Phi*As*Fy			6 10	Vinte	
Charles Carried		*(de - As*Fy/(2)	.85*F'C*1000)	=	6.48	Kn/m	
OVERTURNING					200		
wall weight	W	W = (H1+h) * t	* DW	=	6.50	Kn	
footing weight	W	f = 1 * d * DW		=	3.15	Kn	
heel soil wt	W	h = H * b * Ds		=	5.76	Kn	
wall friction	FV		d+k)2*.5 + Ka*5*(H+d+k)				
		tanidelta)*cosi	alpha-delta)	=	1.90	Kn	
Key weight		V = K * t * DW		=	1.03		
total vertical load		= WW + Wf +		-	18.34	Kn	
toe bottom or momen			d)^3*0.17*sin(alpha-delta)				
			.5*sin(alpha-delta)	=	4.68	Kn/m	
toe bottom REST mome	ent Mi	$r = WW^*(I - (b + t)$			2.00	0.00	
			FW*1 + KW *(L-(b+t/2))	=	8.94	kn/m	
FOS overturning		o = Mr/Mot	Co.C.	=	1.91		
eccentricty		= 1/2 - (Mr - Mot		=	117.80	mm	
bearing pressure	fb	= 2*Ft/(3(I/2-e))	=	52,65	kPa	
SLIDING							
Sliding force	FS	1 = (Ka*D5*(H+d	+ k)2*.5 + Ka*5*(H+d+k))				
4 -4 - 1 // 1 // 1		*sin(alpha-delt		= 1	10.23	Kn	
footing friction		= Ft * tan(phi)	2.54.2	=	8.55	Kn	
key soil force	FK	= Kp*Ds* (k+d	12 * 0.5	=	14.23	Kn	

sliding REST	$F\Gamma = Ff + Fk + Sl + SR + UW$	-	22.79	Kn
FOS sliding	FSS = Fr / FSI	-	2,23	
Slab sliding resistance slab	SR = fl * DW * .1 * n		0.00	
Plus upper section of wall not retaining soil	Hd is non retaining section of wall UW=Hd*t*DW*n		0.00	
Steel Reduction				
Take top 2/3 of wall H1	2/3 * H or H - steel lap		1067.00	
Find Ld	70 * b*d		14.19	
effective depth	e		94.00	
Flexure Distance	H1-(Ld-e)		958.00	
Bottom rod length	& lap length		642.00	
wall soil force	$Fs = Ka*Ds*H^2*0.5*sin(alpha-delta)$	-	2.03	Kn
wall surcharge fce	Fss = Ka*S*H*sin(alpha-delta)		0.00	Kn
factored wall fce	Fu = (Fs + Fss) * 1.6	=	3.25	Kn
wall soil mmt	Ms = Fs * H * 0.33	=	0.64	Kn/m
wall scharge mmt	Mss = Fss * H * 0.5	=	0.00	Kn/m
design moment	MU = (MS + MSS) * 1.6	=	1.03	Kn/m
reinforcing area	As = Dr2 * Pi / 4 * s		188.50	mm ²
effective depth	$de = t \cdot c \cdot Dr/2$		94.00	
dependable moment	Mdep = Phi*As*Fy *(de - As*Fy/(2*.85*F'c*1000)		4.38	Kn/m
BASE	Ide - AS FY/12 .65 FC 1000/		4.30	KII/III
	Des EN		22.4	4000
Pressures	See Fb		52.65	kpa
BASE STEEL AREA				
Vertical Steel	From bottom of wall		282.74	mm^2
horizontal 15% csa			375.00	mm^2





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CONCRETE BLOCK RETAINING WALL

CLIENT

Ward House

exterior

NUMBER

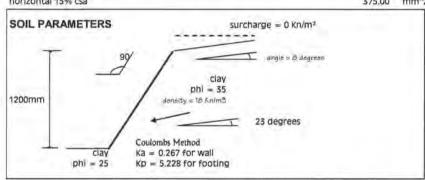
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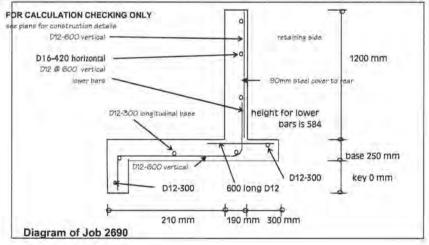
DATE

31/05/2011

Unless stated else where,	soil test	ing has not been done, a	nd soil assumed at 100 kpa			
WALL PARAMETER	RS		SOIL PARAMETER	S		
Retaining Height mm	H =	1200	soil type		clay	
Wall Height mm	H1	1200	soil (wall)	Ø	35.00	degrees
Key Depth mm	K =	0	wali slope alpha	ha =	90.00	degrees
Wall thickness mm	t =	190	back slope beta	ta =	8.00	degrees
	1 =	700	wall frictn del	ta =	23.33	degrees
		0.5	STORY CONTRACTOR OF THE STORY			
footing depth mm	d =	250	active coefft	Ka =	0.27	0.26
COLUMN STATES STATES AND STATES A	m b =	300	soil density Ds	μ	18.00	Kn/m3
wall density Kn/m2	DW =	18	surcharge	S =	0.00	Kn/m²
Floor length mm	fl =	0	footing soil type		clay	
Base Friction is tan (phi)	n =	0.47	soll (ftg.) p	ni =	25.00	degrees
Loading on top wall kn/	n Si =	0	passive coefft (coulom	t Kp =	5.23	5.22
REINFORCING PAR	RAMET	TERS				
Bottom third of Wall	.,	2.62	Upper 2/3 Wall		Base	
cover to reinforcing	mm	90	90		75.00	
meter of reinforcing Di		12	12		12.00	
spacing of reinforcing	mm	600	600		600.00	
Concrete F'c	MPa	12	555		000,00	
strength redn factor Ph		0.85				
steel strength Fy	MPa	300				
maximum steel centres			570	mm		
ensure stem has minim		TA STORY OF MEDICAL STREET, ST		mm		
STEEL PLACEMEN	-	distance for buttorn	400	11110		
location		diameter	oppoint		notation	
location	grade	diameter	spacing		notation	
steel reduction	D	12	600		D12-600	
upper vertical	D	12	600		D12-600	
noriz in wall	D	16	420		D16-420	
horiz in footing	D	12	450		D12-450	
Base steel area vertical	D	12			D12-430	
horiz in base	D	12	600		D12-300	
height reduction	D.		300		480mm	
side cover		480 90			90mm	
		75			75mm co	vor
bot cover		./5			/Simili Co	VCI
WALL STRENGTH						
wall soil force		Fs = Ka*Ds*H2*0.5*s	in/alpha delta)	2	3.19	Kn
wall surcharge fce		FSS = Ka*S*H*sin(alp)	and the second second		0.00	Kn
factored wall fce		Fu = (Fs + Fss) * 1.6	na detea	-	5.10	Kn
wall soil mmt		MS = FS * H * 0.33			1.26	Kn/m
wall scharge mmt		MSS = FSS * H * 0.5		-	0.00	Kn/m
design moment		Mu = (Ms + Mss) * 1.6	3	=	2.02	Kn/m
reinforcing area		As = Dr2 * Pi / 4 * S		-	188.50	mm²
effective depth		de = t-c-Dr/2		=	94.00	mm
dependable moment		Mdep = Phi*As*Fy			7.110	36113
		"(de - As"Fy/(2".8	5*F'C*1000)	=	4.38	Kn/m
OVERTURNING						
wall weight		Ww = (H1+h) * t * D	w	-	4.10	Kn
footing weight		Wf = 1+ d + DW		-	3.15	Kn
heel soll wt		Wh = H + b + Ds		-	6,48	kn
wall friction			K)2".5 + Ka"5"(H+d+K))			
		tan(delta)*cos(a)p		=	0.87	Kn.
Key weight		KW = K * t *DW		=	0.00	
total vertical load	- 4	Ft = WW + Wf + Wr	+ FW + KW	=	14.60	Kn
toe bottom OT moment	t I	$Mot = Ka^*Ds^*(H+d)^*$	3*0.17*sin(alpha-delta)			
		+ Ka*S*(H+d)2*0.5*	sin(alpha-delta)	= 7	2.25	Kn/m
toe bottom REST mome	ent i	Wr = WW'(1-(b+t/2))) + Wf*1/2		2.00	
			V*I +KW *(L-(b+t/2))	=	6.52	Kn/m
FOS overturning		PSO = Mr/Mot		=	2.90	
eccentricty		e = 1/2 - (Mr - Mot)/F	2	=	57.48	mm
bearing pressure	3	fb = Ft/I + 6"Ft"e/I3		= 1	31.13	kPa
SLIDING						
Sliding force		FSI = (Ka*Ds*(H+0+)	()2".5 + Ka"S"(H+0+K))			
THE PARTY OF THE P		*sin(alpha-delta)		= .	4.65	Kn
		A CONTRACTOR				
footing friction		Ff = Ft * tan(phi)		= -	6.81	Kn
key soli force	1	FK = Kp*Ds* (K+d)2	0.5	= 1	2.94	Kn
KCY SOII TOICE						

sliding REST		Fr = Ff + Fk + Sl + SR + UW	-	9.75	Kn
FOS sliding		FSS = Fr / FSI	-	2.10	
Slab sliding resistance slab		SR = fl + Dw + .1 + n		0.00	
Plus upper section of not retaining soil	wall	Hd is non retaining section of wall UW = Hd*t*DW*n		0.00	
Steel Reduction					
Take top 2/3 of wall Find Ld	H1	2/3 * H or H - steel lap 70 * b d		720.00 9.58	
effective depth		e		94.00	
Flexure Distance		H1-(Ld-e)		616.00	
Bottom rod length		& lap length		584.00	
wall soil force		Fs = Ka*Ds*H2*0.5*sin(alpha-delta)	9.1	D.84	Kn
wall surcharge fce		Fss = Ka*S*H*sin(alpha-delta)	=	0.00	Kn
factored wall fce		FU = (FS + FSS) * 1.6	= -	1.34	Kn
wall soil mmt		MS = FS * H * 0.33	=	0.17	Kn/m
wall scharge mmt		Mss = Fss * H * 0.5	= 1	0.00	Kn/m
design moment:		Mu = (Ms + Mss) * 1.6	-	0.27	Kn/m
reinforcing area		$AS = Dr^2 \cdot Pi / 4 \cdot 5$		188.50	mm ²
effective depth		de = t - c - Dr/2		94.00	
dependable moment		Mdep = Phi*As*Fy *(de - As*Fy/(2*.85*F'c*1000)		4.38	Kn/m
BASE					
Pressures		See Fb		31.13	kpa
BASE STEEL AREA					
Vertical Steel		From bottom of wall		188.50	mm*2
horizontal 15% csa				375.00	mm^2







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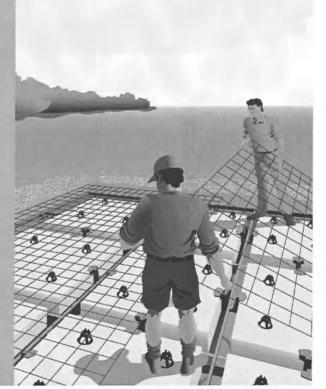
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RibRaft[™]

FIRTH
TECHNICAL
SOLUTIONS





Firth Industries' RibRaft Floor System is accredited by the Building Industry Authority as complying with certain provisions of the New Zealand Building Code. The Authority's accreditation is binding on territorial authorities and building certifiers.



FIRTH RIBRAFT FLOOR SYSTEM MANUAL

MAY 2000

Lee page 3

Attack Log Boilers









- Natural draught cast iron or fan-flued gasification boilers
- Highly efficient
- Large firebox capacity
- Over-heating protection



LIVE LIKE IT'S SUMMER ALL YEAR ROUND

Solid Fuel Boilers





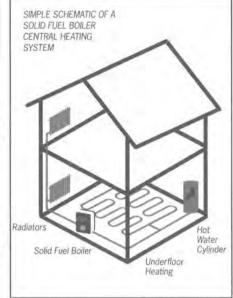
Log Boilers for Central Heating Systems

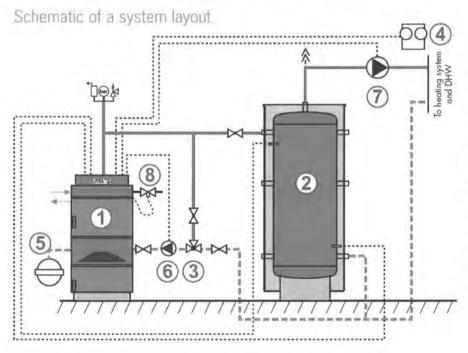
These boilers combine the high level of comfort and control with the use of a free renewable fuel. You can heat all of your house or business, your hot water cylinder and even a pool. In order to minimise user input and maximise boiler life we highly recommend careful design of a boiler system consisting of:

Log boiler

- Buffer tank or accumulator.
- Return temperature thermostatic valve
- Insulated flue or chimney
- Thermal protection cooling circuit

Systems with these boilers are 10% to 30% more fuel efficient with a buffer tank which allows the boiler to run continuously at high output to avoid part load inefficiencies and potentially tar & condensation damage from running at low temperatures. Alternatively boilers can be continually stoked to maintain heat output, but running at part load is not recommended for long periods of time.



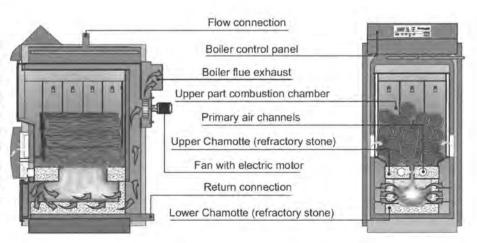


To the left is a suggested schematic diagram for a solid fuel boiler. For an unvented (pressurised) system a thermal safety valve must be installed.

- 1. Log boiler
- 2.Accumulation tank
- 3. Three way thermostatic valve
- 4. Room Thermostat
- 5. Expansion Vessel
- 6. Boiler Pump
- 7. Circulation Pump
- 8. Thermal Safety Valve

How Gasification works

The primary combustion of the wood fuel is only partial due to a limited oxygen supply to the primary combustion zone, this produces heat to drive off volatile gases and also produces partly combusted gases. The partly combusted gases and volatiles from the wood are drawn down through a grate and then fully combusted with a fresh air supply in the secondary combustion zone, below the grate. The charcoal left above the grate eventually burns out to ash and falls down through the grate.



Solid Fuel Boilers





Attack Log Boilers

There are two choices of boiler, either a natural draught cast iron boiler, or a fan-flued gasification boiler.

Cast iron boilers are cheaper, being less complex, but are still very efficient.

Features:

- 5 year guarantee on the heat exchanger due to their extra low temperature corrosion resistance*
- Thermostatic air regulation to regulate heating circuit temperature
- Large fire box for reduced loading frequency
- External overheating protection can be supplied

The boiler needs filling with logs on top of some form of kindling or fire lighter. They are then lit manually using a match or blow-torch. Once the boiler is up to temperature it heats the house and can be topped up with fuel or left to burn out.

Ash will need to be removed periodically. Use of clean bark free wood fuel will reduce the amount of ash formed.

This boiler can be used for thermosyphon systems but will work much better with a pumped system that will require power.

Gasification Boilers

Gasification boilers with a combustion fan have a high level of control, a large firebox, are clean burning and have integral automatic overheating protection.



Features

- Large fire box for reduced loading frequency.
- High level of control over combustion to ensure minimum heating system and flue temperatures are maintained for longer boiler life.
- Fan automatically stops when boiler up to working temperature.
- Boiler automatically shuts down when the fuel is used instead of burning out at low temperatures.
- Boiler body made from 6mm steel plate.
- Contains integral heat exchanger cooling coil to protect against overheating.

The boiler needs filling with logs on top of some form of kindling or fire lighter. They are then lit manually using a match or blow-torch. Once the boiler is up to temperature it heats the house and can be topped up with fuel or left to burn out. This boiler can regulate the temperature of the boiler and heating system by control of the fan and an air damper.

The wood fuel in a gasification boiler releases volatile gases that are then mixed with air for complete combustion. Gasification is used as it is cleaner and more efficient than traditional wood burning appliances.



Fue

Both types of boiler will burn wood fuel but the gasification boiler is designed to be run only on wood fuel. Preferably this wood should be dried to 20% or less moisture content. Higher moisture content will reduce the heat output from the boiler.

It is better to split the wood and cut it to the maximum length that will fit in the firebox and try to minimise the air spaces when loading the boiler. The natural draught cast iron boiler will also run on coal.

Atmospheric Cast Iron Solid Fuel Boilers - Efficiency 78 - 82% ATTACK FD

	FD26	FD32	FD36	FD42
Heat Output	10 - 20 kW	13 - 25 kW	15 - 30 kW	17 - 34 kW
Fuel Capacity (litres)	34	42.5	51	60
Weight (kg)	245	280	315	350
Flue Diameter (mm)	150	150	150	150
Size (H x W x D)	1001 x 470 x 555	1001 x 470 x 655	1001 x 470 x 755	1001 x 470 x 855

Fan Flued Gasification Log Boilers - Efficiency 86% ATTACK DP

	DP25-P	DP35-P	DP45-P	DP75-P
Heat Output*	10 - 25 kW	14 - 35 kW	18 - 45 kW	30 - 75 kW
Fuel Capacity (litres)	105	145	185	350
Weight (kg)	350	390	420	650
Flue Diameter (mm)	152	152	152	219
Size (H x W x D)	1100 x 600 x 1150	1100 x 600 x 1250	1100 x 600 x 1350	1350 x 750 x 1600

^{*}Heat output will be less then stated if the moisture content is above 20%.

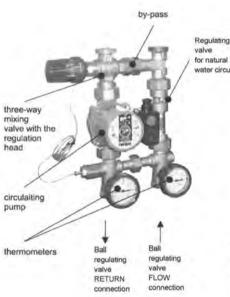
Solid Fuel Boilers



Solid Fuel Boiler Temperature Maintenance

All solid fuel boiler systems are designed to keep the boiler hot, usually between 55°C to 65°C to avoid the formation of tar and corrosive condensation.

We recommend the Regumat Attack-Oventrop pump station specifically designed to re-circulate water back through the boiler until it reaches 60°C. Once the boiler reaches that temperature the heat can be sent to the load whilst still maintaining the boiler temperature at 60°C.



Insulated Flues

Insulated flues are important for solid fuel boilers to ensure sufficient draught and reduce deposition of soot in the flue. The flues should not be smaller than the flue outlet on the boiler and the final height depends on the diameter of the flue.

General guidelines for flue height

Section, square or circular	Minimum Height		
200 x 200 mm	7m		
200 mm diameter	8m		
150 x 150 mm	11m		
160 mm diameter	12m		

The inner flue should always be made of stainless steel to prevent corrosion. Insulated flues need to be ordered with the boiler.



Buffer Tanks

Sometimes known as accumulators, these tanks generally hold large volumes of hot water and are used as heat stores. Having a heat store between the boiler and the heat load allows the boiler to run at optimal settings for efficiency and clean burning, even if the load is small or varying.

The heating system and other loads see the buffer tank as the heat source, allowing a mismatch between boiler output and heat load.

Often the buffer tank is sized to hold enough heat for a days heating so that it only has to heated up once a day; and if the boiler is big enough that too only needs filling once a day.

Buffer tank size depends on the size of house and how energy efficient it is, typically between 1000 to 2000 litres.

Buffer tanks can be supplied with integral heat exchange coil for a secondary heat source such as solar or a back-up diesel boiler for example. Buffer tanks come with a 100mm insulating jacket.

Thermal Safety and Boiler Protection

With all solid fuel boilers there is a danger that if the system gets too hot the boiler will be damaged. With a sealed system safety valves will dump water but that will not be replaced and there is a danger of running dry.

The Attack boilers employ a cooling coil system with a mechanical thermostatic valve which opens at 97°C to allow cool water to cool down the boiler heat exchanger.

In the gasification boiler the cool water, which could be mains water, is run through a heat exchange coil inside the boiler's heat exchanger. This cools down the boiler to prevent possible heat damage.

The natural draught boiler uses an external tank to achieve the same cooling process. This tank needs to be ordered with the boiler.



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20 500 056	20,000	646,67				20 500 080	517,41	,	20 500 096	95,510	20 500 075	20 500 134	50,88	20 500 135	62,54	159.46			20 500 060	83,33	30.89	20120	,								1			20 500 070	329,60	329.60	20 500 071	238,92	20 500 074	28,92	197.11			1	20 500 093	70,54		,
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20 400 056	20 400,33	560,39				20 400 080	445,66		20 400 096 A79 22	110,23	20 400 075	20 350 134	42,98	20 350 135	54,06	145,37			20 400 060	59,38	30.89						55 000 115 93,70				1			20 400 070	305,43	305.43	20 400 071	217,23	20 400 074	27,173	179.24			,	20 400 093	59,49		
20 350 056	20 350 157	359,55	20 350 055	82,35	20 350 081	750.055.05	344,93		20 350 096	213,11	20 350 075					80,98	20 350 082	25,50	20 350 060	41,11	27.68								20 350 133 69 98	20 350 035	91,33	50 350 031	- 100	20 350 070	259,39	259.39	20 350 071	197,48	20 350 074	191,48	162.94	20 350 067	335,41	380 068	20 350 093	37,10	,	
20 300 056	20,000	276,66	20 300 055	81,82	20 300 081	20 300 057	299,62		20 300 096	20100	20 300 075		3	135		70,44	20 300 082	23,62	20 300 060	28,58	27.68	20 300 112	19,01	960	960	74			20 300 133 60 85	20 300 035	91,33	20 300 031	20,00	20 300 070	20,300,023	228.08	20 300 071	169,26	20 300 074	30,200	117.50	20 300 067	297,80	347 99	20.300.093	33,33		
20 250 056	20 250 157	199,35	20 250 055	74,77	20 250 081	20 250 057	293,48	92.28	20 250 096	27,000	20 250 075	20 180 134	28,83	20 180 135	37,58	61,25	20 250 082	21,74	20 250 060	18,12	22.12	20 250 112	17,97	20 300 098	20 300 (1 250,74			20 250 133 52 96	20 250 035	66,04	20 250 031	70, 12	20 250 070	750,88	172.32	20 250 071	105,84	20 250 074	20,250,06	66'96	20 250 067	223,11	26, 250	20 250 093	26,72		
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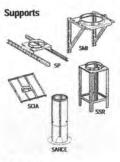


Code : 20 130 065
Range Diameter Part number

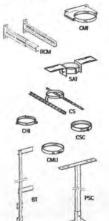
Reference : SAT Rafter support

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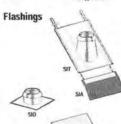
Range reference



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Stainless st. wall	SMI TZ	20 080 056	20 100 056	20 130 056	20 150 056	20 180 056	20 200 056	
support 5-20 cm		104,48	104,48	109,34	115,07	131,22	138,13	
Adjustable wall	SMR 40 TZ	20 080 157	20 100 157	20 130 157	20 150 157	20 180 157	20 200 157	
support 20-40 cm		126,38	126,38	131,21	138,09	157,46	165,75	
Galv. wall	SM TZ	20 080 055	20 100 055	20 130 055	20 150 055	20 180 055	20 200 055	
support 5-20 cm		43,99	43,99	45,13	47,30	51,52	59,59	
Joist support	SP TZ	20 080 081	20 100 081	20 130 081	20 150 081	20 180 081	20 200 081	
		25,99	26,29	26,81	27,28	27,85	28,69	
Adjustable floor	SSR TZ	20 080 057	20 100 057	20 130 057	20 150 057	20 180 057	20 200 057	
support		257,16	257,16	265,59	265,59	278,15	284,54	
Upper flue	SCIA TZ		201101	20 130 256	20 150 256	20 180 256	20 200 256	
support		-		76,03	78,42	83.00	86,47	
	SARCE TI	20 080 096	20 100 096	20 130 096	20 150 096	20 180 096	20 200 096	
drain plug	-500551010	244,63	252,36	260,05	269,08	277,02	284,92	
man prog		211,00	202,00	200,00	200,00	211,02	204,32	
Wall bracket	CMI TZ	20 080 075	20 100 075	20 130 075	20 150 075	20 180 075	20 200 075	
	Sim in it.	21,03	21,59	22,53	23,27	25,74	26,26	
Extending arms for	DCM-05-20 77	21,00	21,00		30 134		180 134	
wall bracket 5-20 cm	FOLIN GOTED III IE				,98			
Extending arms for	RCM 20-40 TZ	-			30 135		8,83	
wall bracket 20-40 cm	RUM 20-40 12				.51		180 135	
Rafter support	CAT TT	20 080 065	20 100 065	20 130 065	20 150 065	20 180 065	7,58 20 200 065	
reases support	SAI IZ	41,46	43,01	45,63	47.91			
Floor guide	CC TI	20 080 082	20 100 082			52,32	55,65	
rioor guide	LS - 11			20 130 082	20 150 082	20 180 082	20 200 082	
	OH TI	17,46	18,12	18,80	19,51	20,22	20,90	
Support band	CHI 12	20 080 060	20 100 060	20 130 060	20 150 060	20 180 060	20 200 060	
Secretary and		17,84	18,24	18,74	19,92	20,59	21,21	
Suspension band	CSC TZ	20 080 059	20 100 059	20 130 059	20 150 059	20 180 059	20 200 059	
for headers		19,98	19,98	20,29	20,29	20,29	20,29	
	CMU TZ	20 080 112	20 100 112	20 130 112	20 150 112	20 180 112	20 200 112	
looking band		14,80	15,11	15,60	16,09	16,54	17,51	
Mast H: 3000	BT 3M 300			20 300 098				
				668,52				
Mast H: 5000	BT 5M 300			20 300 099				
				1 250,74				
Header	PSC			55 000 115				
support				93,70				
Fire shield	PCF			20 130 133	20 150 133	20 180 133	20 200 133	
				35.17	39.07	42,99	47,22	
St. steel	PP(I) TI /PLA	20 080 035	20 100 035	20 130 035	20 150 035	20 180 035	20 200 035	
ceiling plate		46,83	47,49	47,84	47,94	48.28	65,71	
St. steel	PP(I) TI /MUR		10.000	20 130 031	20 150 031	20 180 031	20 200 031	
Wall plate		000	-	30,76	30,96	31,16	39,79	
400				00,70	00,00	31,10	30,73	
Flashing for tiles	SIT 30° T7	20 080 070	20 100 070	20 130 070	20 150 070	20 180 070	20 200 070	
15-30° including lead kit	340,44 (10,14)	128,35	141,77	142,19	142,19	148,06	150,88	
Flashing for tiles	SIT ASS. T7	20 080 073	20 100 073	20 130 073	20 150 073	20 180 073	20 200 073	
30-45° including lead hit	011 40 m. 12	147,34	162,18	162,60	162,60	169,50		
Flashing for states	SIA 30° T7	20 080 071	20 100 071	20 130 071	20 150 071	20 180 071	172,32	
15-30°	Jan du - a 1L	88,73	88.73	100,63			20 200 071	
Flashing for states	CIA AEC TZ				100,63	105,84	105,84	
The second secon	214 42 1L	20 080 074	20 100 074	20 130 074	20 150 074	20 180 074	20 200 074	
30-45°	CIO. TI	104,57	104,57	118,82	118,82	125,08	125,08	
Flat flashing	210 IL	20 080 079	20 100 079	20 130 079	20 150 079	20 180 079	20 200 079	
	PRV 404	79,26	79,26	87,97	87,97	96,99	96,99	
Lead flashing	SPL 30° TI	20 080 067	20 100 067	20 130 067	20 150 067	20 180 067	20 200 067	
45 to 20 t		720 07	120 07	142 ED	450 00	172 00	405 00	

Firechest support PE ... TI 20°20 plate TI 20 x 20 Firechest support PE ... TI-T 2020 Firechest support PE ... TI-T 2525 plate TI - T 25 x 25

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Firechest support PE ... TI-T 3040 plate TI – T 30 x 40

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for the other ranges as shown in table.

The calculation is made using the Therminox TI prices as a basis with +/- price difference

01/01/2007 - Prices in Euros, Ex-works Niort



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	21 250 003	21 300 003	21 350 003	21 400 003	21 450 003		
	112,79	147,59	165,25	182,24	198,21	20.0000	
	21 250 004	21 300 004	21 350 004	21 400 004	21 450 004	21 500 004	21 600 004
	149,25	195,84	213,24	262,29	281,14	300,67	365,27
	21 250 005	21 300 005	21 350 005	21 400 005	21 450 005	21 500 005	21 600 005
	216,39	279,71	330,80	422,94	439,53	457,99	540,14
	21 250 017	21 300 017	21 350 017				
	245,50	329,24	373,86			-	-
	21 250 027	21 300 027	21 350 027	21 400 027	21 450 027	21 500 027	21 600 027
	154,63	172,37	200,94	245,97	270,91	299,57	350,50
	21 250 044	21 300 044	21 350 044	21 400 044	21 450 044	21 500 044	21 600 044
	218,36	253,71	280,71	324,23	348,11	394,56	451,61
	21 250 030	21 300 030	2007.		- 10/11		,
	218,36	253,71		-	2		-
		235,53					
	21 250 008	21 300 008	21 350 008	21 400 008	21 450 008	21 500 008	21 600 008
	101,35	127,37	157,66	185,46	198,37	212,16	247,68
	21 250 001	21 300 001	21 350 001	21 400 001	21 450 001	21 500 001	21 600 001
	101,35	127,37	157,66	185,46	198,37	212,16	247,68
	21 250 011	21 300 011	21 350 011	21 400 011	21 450 011	21 500 011	21 600 011
	135,23	167,46	177,57	264,93	283,34	303,08	353,81
	21 250 021	21 300 021	21 350 021	21 400 021	21 450 021	21 500 021	21 600 021
	170,25	213,55	232,43	288,78	308,74	330,22	385,65
	21 250 031	21 300 031	21 350 031	21 400 031	21 450 031	21 500 031	21 600 031
	272,39	341,68	371,88	462,03	493,98	528,36	617,05
	21 250 550	21 200 000	21 250 050	21 400 050	21 450 050	21 500 050	25 500 050
	21 250 050	21 300 050	21 350 050		21 450 050	21 500 050	21 600 050
	261,05	382,64 21 300 051	412,19	539,62 21 400 051	631,45	725,16 21 500 051	832,64 21 600 051
	21 250 051 425,34	499,28	21 350 051 590,34	773,23	21 450 051 859,43	948,29	1090,93
	423,34	455,20	330,34	113,23	033,43	340,23	1030,33
	21 250 055	21 300 055	21 350 055	21 400 055	21 450 055	21 500 055	21 600 055
	322,62	384,41	519,78	659,24	745,83	832,69	924,03
			freight.		100	11-11	1000
	21 250 098	21 300 098					
	21 250 098 9,49	21 300 098 9,96	-	-	-	2.	i ë
			4	-	*	2.	-
	9,49	9,96		-	16		-
	9,49	9,96	71 350 005	33 400 005	21 450 000	71.500.005	21 000 000
	9,49	9,96	21 350 085	21 400 085	21 450 085	21 500 085	21 600 085
	9,49 21 250 085 151,51	9,96 21 300 085 196,03	21 350 085 224,44	262,98	288,63	314,24	21 600 085 418,91
	9,49 21 250 085 151,51 21 250 099	9,96 21 300 085 196,03 21 300 099	21 350 085 224,44 21 350 099	262,98 21 400 099	288,63 21 450 099	314,24 21 500 099	21 600 085 418,91 21 600 099
	9,49 21 250 085 151,51 21 250 099 53,43	9,96 21 300 085 196,03 21 300 099 67,53	21 350 085 224,44 21 350 099 69,36	262,98 21 400 099 81,01	288,63 21 450 099 84,91	314,24 21 500 099 88,80	21 600 085 418,91 21 600 099 96,82
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087	21 350 085 224,44 21 350 099 69,36 21 350 087	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89	262,98 21 400 099 81,01	288,63 21 450 099 84,91	314,24 21 500 099 88,80	21 600 085 418,91 21 600 099 96,82
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 13 890 21 300 088 159,72	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037	21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94	262,98 21 400 099 81,01 21 400 087	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087	314,24 21 500 099 88,80 21 500 087	21 600 085 418,91 21 600 099 96,82 21 600 087
n	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1 0: top - 2 0: 1	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 7 Ø: top - 2 Ø: 12 350 80,64	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 21 350 038 227,90 21 350 038 21 350 038 21 350 038	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 7 Ø: top - 2 Ø: 12 350 80,64	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 33 105,55	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 to be indicated: 21 300 75,40 21 300 303 112,90	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 21 350 80,64 21 350 303 117,17	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 - - - 21 450 87,08 21 450 303 126,60	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 to be indicated: 21 300 333 112,90 21 300 303	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 - - - 21 450 87,08 21 450 303 126,60 21 450 304 139,28 21 450 315	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 20 be indicated: 21 300 303 112,90 21 300 304 117,17	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1 0: top - 2= 0: 1 21 350 80,64 21 350 303 117,17 21 350 304 121,91 21 350 315 21 350 314	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 - - 21 450 87,08 21 450 303 126,60 21 450 304 139,28	314,24 21 500 099 88,80 21 500 087 225,65	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
aan	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 314 21 250 313	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 to be indicated : 21 300 75,40 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 21 350 80,64 21 350 303 117,17 21 350 304 121,91 21 350 314 21 350 314 21 350 313	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
	9,49 21 250 085 151,51 21 250 099 53,43 21 250 087 74,14 21 250 088 85,28 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 315 21 250 314	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 038 206,95 to be indicated: 21 300. 75,40 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1 0: top - 2= 0: 1 21 350 80,64 21 350 303 117,17 21 350 304 121,91 21 350 315 21 350 314	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 - - - 21 450 87,08 21 450 303 126,60 21 450 304 139,28 21 450 315 21 450 314	314,24 21 500 099 88,80 21 500 087 225,65 - - 21 500 90,43 21 500 303 139,28	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
ın	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 314 21 250 313 97,93	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 to be indicated : 21 300 75,40 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 7 Ø: top - 2 Ø: 1 21 350 303 117,17 21 350 304 121,91 21 350 315 21 350 314 21 350 314 21 350 314	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 999 84,91 21 450 887 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 21 500 90,43 21 500 303 139,28 21 500 315 21 500 314 21 500 313 126,60	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79 21 600 99,49 21 600 315 21 600 314 21 600 313 139,28
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 313 97,93 21 250 090	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 038 206,95 to be indicated: 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313 105,55	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1 0: top - 2= 0: 1: 2: 350 80,64 21 350 303 117,17 21 350 304 121,91 21 350 314 21 350 313 112,90 21 350 090	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 - - - 21 450 87,08 21 450 303 126,60 21 450 304 139,28 21 450 315 21 450 313 121,91 21 450 090	314,24 21 500 099 88,80 21 500 087 225,65 21 500 90,43 21 500 303 139,28 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79 21 600 99,49 21 600 315 21 600 314 21 600 313 139,28 21 600 090
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 038 189,38 21 250 33 105,55 21 250 304 112,90 21 250 315 21 250 313 97,93 21 250 090 85,89	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 083 159,72 21 300 033 206,95 to be indicated: 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 315 21 300 315 21 300 90 87,96	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 038 227,90 1 0: top - 2= 0: 1 21 350 303 117,17 21 350 303 117,17 21 350 304 121,91 21 350 315 21 350 314 21 350 313 112,90 21 350 090 90,60	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 21 500 90,43 21 500 303 139,28 21 500 315 21 500 313 126,60 21 500 090 100,86	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 313 97,93 21 250 090	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 038 206,95 to be indicated: 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313 105,55	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1 0: top - 2= 0: 1: 2: 350 80,64 21 350 303 117,17 21 350 304 121,91 21 350 314 21 350 313 112,90 21 350 090	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 - - - 21 450 87,08 21 450 303 126,60 21 450 304 139,28 21 450 315 21 450 313 121,91 21 450 090	314,24 21 500 099 88,80 21 500 087 225,65 21 500 90,43 21 500 303 139,28 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313 21 500 313	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79 21 600 99,49 21 600 315 21 600 314 21 600 313 139,28 21 600 090
n	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 313 97,93 21 250 090 85,89 21 250 089	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 206,95 206,95 206,95 207,000 207,	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 099 53,43 21 250 088 85,28 21 250 038 187,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 315 21 250 314 21 250 313 97,93 21 250 090 85,89 21 250 089 91,98	9,96 21 300 085 196,03 21 300 089 67,53 21 300 088 159,72 21 300 038 206,95 21 300 338 206,95 21 300 303 112,90 21 300 303 112,90 21 300 315 21 300 315 21 300 315 21 300 315 21 300 315 21 300 316 21 300 399 87,96 21 300 089 93,78	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 7 Ø: top - 2 Ø: 1 21 350 303 117,17 21 350 304 121,91 21 350 315 21 350 314 21 350 313 112,90 21 350 090 90,60 21 350 089 97,64	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 99 84,91 21 450 887 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 225,65 21 500 303 139,28 21 500 315 21 500 314 21 500 313 126,60 21 500 090 100,86 21 500 089 137,58	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79 21 600 99,49 21 600 315 21 600 314 21 600 313 139,28 21 600 090 110,62 21 600 089 147,17
aan	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 313 97,93 21 250 089 91,98 21 250 091 91,98 21 250 091	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313 105,55 21 300 090 87,96 21 300 089 93,78 21 300 091	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 038 223,94 21 350 038 227,90 21 350 80,64 21 350 303 117,17 21 350 314 21 350 314 21 350 313 112,90 21 350 089 97,64 21 350 091 97,64 21 350 091	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 193,45 21 450 303 126,60 21 450 304 139,28 21 450 315 21 450 313 121,91 21 450 090 97,21 21 450 099 134,04 21 450 019 134,04 21 450 019	314,24 21 500 099 88,80 21 500 087 225,65 	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79
an	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 315 21 250 314 21 250 313 97,93 21 250 090 85,89 21 250 099 91,98 21 250 019 91,98 21 250 091 52,29	9,96 21 300 085 196,03 21 300 089 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 206,95 206,95 207,000 207,	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 037 203,94 21 350 038 227,90 1	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 	314,24 21 500 099 88,80 21 500 087 225,65 225,65 21 500 303 139,28 21 500 315 21 500 314 21 500 313 126,60 21 500 090 100,86 21 500 099 137,58 21 500 091 137,58 21 500 091 97,89	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79 21 600 99,49 21 600 315 21 600 314 21 600 313 139,28 21 600 090 110,62 21 600 089 147,17 21 600 019 147,17 21 600 019 147,17 21 600 091 107,48
aan	9,49 21 250 085 151,51 21 250 089 53,43 21 250 087 74,14 21 250 088 85,28 21 250 037 167,68 21 250 038 189,38 d range of products 21 250 69,96 21 250 303 105,55 21 250 304 112,90 21 250 314 21 250 313 97,93 21 250 089 91,98 21 250 091 91,98 21 250 091	9,96 21 300 085 196,03 21 300 099 67,53 21 300 087 138,90 21 300 088 159,72 21 300 037 182,96 21 300 038 206,95 21 300 303 112,90 21 300 304 117,17 21 300 315 21 300 314 21 300 313 105,55 21 300 090 87,96 21 300 089 93,78 21 300 091	21 350 085 224,44 21 350 099 69,36 21 350 087 141,89 21 350 088 163,19 21 350 038 223,94 21 350 038 227,90 21 350 80,64 21 350 303 117,17 21 350 314 21 350 314 21 350 313 112,90 21 350 089 97,64 21 350 091 97,64 21 350 091	262,98 21 400 099 81,01 21 400 087 161,25	288,63 21 450 099 84,91 21 450 087 193,45 193,45 21 450 303 126,60 21 450 304 139,28 21 450 315 21 450 313 121,91 21 450 090 97,21 21 450 099 134,04 21 450 019 134,04 21 450 019	314,24 21 500 099 88,80 21 500 087 225,65 	21 600 085 418,91 21 600 099 96,82 21 600 087 303,79

199,29 21 200 027

Code: 21 130 002

Reference : ED 100-... TI
Straight Leright Inside damete: reference

	Times		0/8)	T-000	4 10	1.180	£ (2)
Straight lengths	10 cm ED 1	100 TI	21 080 002	21 100 002	21 130 002	21 150 002	21 180 002
			41,13	46,38	51,72	56,45	64,33
	25 cm ED 2	250 Ti	21 080 003	21 100 003	21 130 003	21 150 003	21 180 003
			53,63	60,36	67,09	73,44	84,67
	45 cm ED 4	450, TI	21 080 004	21 100 004	21 130 004	21 150 004	21 180 004
			65,11	75,96	86,81	96,11	111,25
	95 cm ED 1	1000 TI	21 080 005	21 100 005	21 130 005	21 150 005	21 180 005
			88,45	103,31	118,17	134,30	156,91
	115 cm ED 1	1200 TI	2012	The second second	21 130 017	21 150 017	21 180 017
					134,16	152,43	178,10
# # #		20.70 71	21 202 227	22 100 007	01 100 007		24 402 403
Adjustable lengths	20 to 30 cm ER 2	20-30 11	21 080 027	21 100 027	21 130 027	21 150 027	21 180 027
	T 250		74,36	80,90	87,51	93,86	112,06
	30 to 45 cm ER 3	30-45 11	21 080 044	21 100 044	21 130 044	21 150 044	21 180 044
	T 250		84,30	91,80	99,10	135,69	158,39
	35 to 45 cm ER 3	35-45 TIHT	21 080 030	21 100 030	21 130 030	21 150 030	21 180 030
	T 450		84,30	91,80	99,10	135,69	158,39
Elbows	5° EC	5TI	21 080 008	21 100 008	21 130 008	21 150 008	21 180 008
			56,34	59,51	62,59	65,30	72,46
	15° EC 1	15 TI	21 080 001	21 100 001	21 130 001	21 150 001	21 180 001
			56,34	59.51	62,59	65,30	72,46
	30° EC 3	30 TI	21 080 011	21 100 011	21 130 011	21 150 011	21 180 011
	30 000		78,95	83.34	87,72	91,31	104,12
	45° EC 4	45 TI	21 080 021	21 100 021	21 130 021	21 150 021	21 180 021
	,10	10 11 11	91,79	96,62	101,98	109,22	126,67
	90° EC 9	00. TI	21 080 031	21 100 031	21 130 031	21 150 031	21 180 031
	30 100	36F 11	146,51	154,84	163,18	174,76	202,66
						200	
Tees 😭 😭	90° T 90	1 TI	21 080 050	21 100 050	21 130 050	21 150 050	21 180 050
	1000-0-0		129,54	141,01	152,41	162,53	192,98
1/17	135° T 13	35 TI	21 080 051	21 100 051	21 130 051	21 150 051	21 180 051
9			222,78	242,45	261,99	286,07	329,96
Inspection	EDT	V TI	21 080 055	21 100 055	21 130 055	21 150 055	21 180 055
lengths	-	2-90	181,59	194,19	213,04	233,98	256,41
Seals	iDi	12	21 080 098	21 100 098	21 130 098	21 150 098	21 180 098
	200		5,67	8,03	8,35	8,54	8,82

Common accessories TI - TR - ZI - ZR

Tops	Cone top CFI TI	21 080 085	21 100 085	21 130 085	21 150 085	21 180 085	21 200 085	_
CD.		70,57	79,19	88,79	98,38	114,37	120,86	
M -	Weathering top FH TZ	21 080 099	21 100 099	21 130 099	21 150 099	21 180 099	21 200 099	
		46,33	47,19	48,05	49,27	50,46	51,05	
AH AH	Rain cap CPI TZ	21 080 087	21 100 087	21 130 087	21 150 087	21 180 087	21 200 087	
GI C		22,39	37,07	41,23	45,39	53,89	59,07	
8	Rain cap + CPOI TZ	21 080 088	21 100 088	21 130 088	21 150 088	21 180 088	21 200 088	
CPI	bird guard	48,37	53,73	58,75	64,59	70,80	77,63	
	Vented cap CAI TZ	21 080 037	21 100 037	21 130 037	21 150 037	21 180 037	21 200 037	
		99,60	103,18	108,82	115,35	133,15	141,28	
CPOI	Vented cap + CAOI TZ	21 080 038	21 100 038	21 130 038	21 150 038	21 180 038	21 200 038	
CAI	bird guard	142,10	146,75	152,39	161,46	170,82	180,07	
	(Ø and range of products to be	indicated : 1° Ø : 1	top - 2" Ø : bottom)					
Adaptors	Adaptor PTZ	21 080	21 100	21 130	21 150	21 180	21 200	
	to single wall	46,33		52,14	55,33	59,20	63,66	
	Reducer 1.0	21 080 303	21 100 303	21 130 303	21 150 303	21 180 303	21 200 303	
T U	20 max RCI J TZ	68,65	73,00	77,46	82,88	89,12	97,93	
P	20	00,00	21 100 304	21 130 304	21 150 304	21 180 304	21 200 304	
RCI	***	-	77,46	82,88	89,12	97,93	105,55	
	Increaser 10		21 100 313	21 130 314	21 150 315	21 180 315	21 200 315	
	36 max AIS 172-20	-	-	21 130 313	21 150 314	21 180 314	21 200 314	
	30			21 100 010	21 150 313	21 180 313	21 200 313	
AIS	-		68,65	73,00	77,46	82,88	89,12	
			55,05	70,00	11,40	02,00	00,12	
Plugs	Drain plug CE TZ	21 080 090	21 100 090	21 130 090	21 150 090	21 180 090	21 200 090	
Plugs 📦		37,15	42.70	48.54	53,78	66.06	72.03	
CE C	Side drain CEPL TZ	21 080 089	21 100 089	21 130 089	21 150 089	21 180 089	21 200 089	
	plug	71,62	73,29	74.74	76.46	81,08	82,89	
H-H-H	Drain plug EEC TI	21 080 019	21 100 019	21 130 019	21 150 019	21 180 019	21 200 019	
QPI.	(for header)	70,99	72,85	74,74	76.46	81,08	82,89	
EEC	Base TI TZ	21 080 091	21 100 091	21 130 091	21 150 091	21 180 091	21 200 091	
8	plug	31,72	33.39	35.05	36,77	41,39	43,21	
	Test point EPMF TI	21 080 020	21 100 020	21 130 020	21 150 020	21 180 020	21 200 020	
TI EPMF	section	70,99	72,85	74,74	76,46	81,08	82,89	
	23.77	,00	100			5.,00	02,00	

01/01/2007 - Prices in Euros, Ex-works Niort



To calculate the offset

- · Choose the required angle and select the right column.
- · Add the offset of the elbows (D) to the straight lengths (D1) to get the required offset.
- · Add values H to H1 to know the height of the installation once set.
- · Check whether you have enough room for the installation as quoted.

Real offset and height of set of elbows by angles



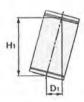


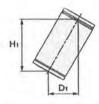


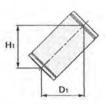


	1000							
	D	н	D	н	D	н	D	Н
Ø 80	34,7	265,6	67,4	252,10	123,6	299	330,7	330,7
Ø 100	34,7	265,6	67,4	252,10	116,6	281,8	341,7	341,7
Ø 130	34,2	259,5	79,0	294,8	131,5	317,5	397	397
Ø 150	35,5	269,3	83,0	309,8	140,0	338,0	421	421
Ø 180	36,2	275,2	86,5	322,8	147,8	356,8	457	457
Ø 200	37,0	281,1	89,5	334,0	153,2	396,8	485	485
Ø 250	38,6	292,9	96,0	358,3	168,3	406,3	503	503
Ø 300	40,4	306,7	102,5	382,6	182,4	440,4	539	539
Ø 350	40,1	304,7	106,0	395,6	193,4	466,9	585	585
Ø 400	59,3	450,2	134,0	500,1	239,7	578,7	635	635
Ø 450	60,3	458,0	140,5	524,4	254,5	614,5	683	683
Ø 500	62,9	447,7	147,5	550,5	269,4	650,4	731	731
Ø 600	66,5	505,2	160,5	599,0	298,4	720,4	839	839

Real offset and height of straight lengths by angles





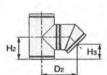


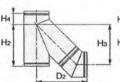
	D1	H1
ED 100	25,9	96,6
ED 250	64,7	241,5
ED 450	116,5	434,7
D 1000	245,9	917,6
D 1200	297,6	1110,8

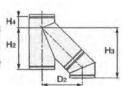
D1	H1
50,0	86,6
125,0	216,5
225,0	389,7
475,0	822,7
575.0	995.9

D1	H1
70,7	70,7
176,8	176,8
318,2	318,2
671,7	671,7
813,2	813,2

Real measures / Dimensions of set of tee and elbow





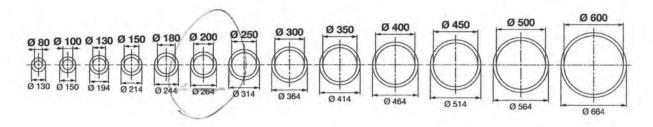


	H2	D2	НЗ	H2	D2	НЗ	H4	H2	D2	НЗ	H4
Ø 80	132	255,8	62,2	250	315	216,8	100	250	216,6	315,4	100
Ø 100	142	265,8	72,2	250	306,7	213,3	100	250	213,2	306,8	100
Ø 130	230	303,6	166,4	350	435,6	348,6	100	350	348,6	438,6	100
Ø 150	230	329,4	162,1	350	438,9	342,9	100	350	342,9	438,9	100
Ø 180	230	351,3	158,2	450	538,8	437,3	100	450	437,3	538,8	100
Ø 200	230	367,7	155,4	434	523,5	418,0	116	434	418,0	523,5	116
Ø 250	230	411,0	148,0	534	623,0	507,0	116	534	507,0	623,0	116
Ø 300	280	453,1	190,9	554	643,6	517,6	146	554	517,6	643,6	146
Ø 350	280	490,7	183,8	654	739,5	603,5	146	654	603,5	739,5	146
Ø 400	312	590,0	193,9	639	761,7	594,7	211	639	594,7	761,7	211
Ø 450	337	638,0	211,5	689	811,4	633,9	211	689	633,9	811,4	211
Ø 500	362	675,9	229,0	764	886,6	698,6	236	764	698,6	886,6	236
Ø 600	412	760,9	264,6	864	986,7	778,2	236	864	778,2	986,7	236





Technical features of the Therminox TI and ZI range



Inner Ø 150 600 500 Outer Ø 130 150 194 214 244 264 314 364 464 514 564 664

Inner wall Material

AISI 316L stainless steel

Thickness 4/10 5/10

Outer wall

THERMINOX TI/THERMINOX TR AISI 304 stainless steel or equivalent

THERMINOX ZI/THERMINOX ZR ALUZINC +

Thickness 4/10 5/10 6/10

Insulation

in m2 °k/W by 200°C

THERMINOX TI/THERMINOX ZI High pressure injected mineral wool

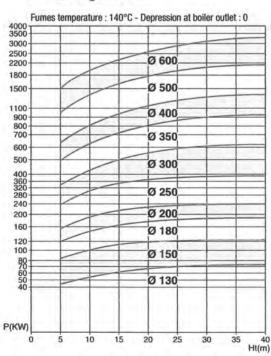
THERMINOX TR/THERMINOX ZR Air gap
Thickness 30 mm

Thickness
Thermal resistance TI/ZI

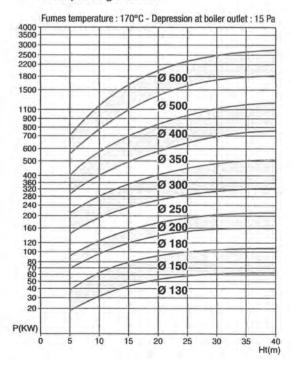
0,45 0,45 0,533 0,531 0,529 0,529 0,528 0,527 0,527 0,527 0,527 0,527 0,527

Gas boilers : calculation chart

Pressurised gas boilers



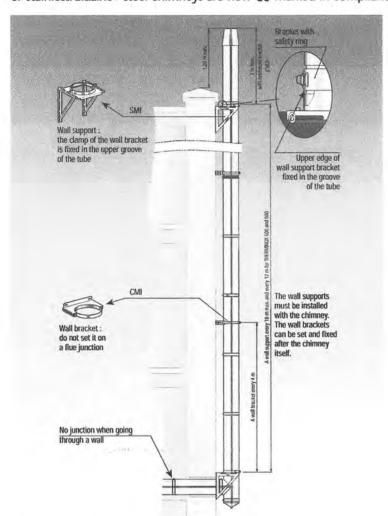
Atmospheric gas boilers



Multi-fuel chimneys, twin wall, mineral wool or air gap insulation Therminox

Therminox TI and ZI flues are suitable for the evacuation of fumes from any gas, oil, wood and coal-fired atmospheric appliances. With seal they can also be used under positive pressure.

Incorporating a 30 mm thick insulation of high-density pressure injected mineral fibre, these twin wall stainless steel or stainless/aluzinc+ steel chimneys are now C€ marked in compliance with EN 1856-1.



For gas boilers, we also offer :

- · Therminox TR,
- · Therminox ZR,

where the insulation is ensured by an air gap between the walls.

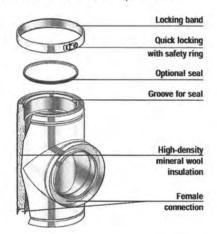
External appearance :

- · RAL colour finishes available.
- Non overlapping locking band integrated in the diameter.

Safety:

· Stainless steel 316L inner wall.

Detailed sketch of the product



2004 the European Standard EN 1856-1 "Requirements for metal chimneys, Part 1: System chimney products" was published. The table below shows the designations of the Therminox range, according to this standard. Do not hesitate to contact us if you have any questions about this standard. CHIMNEY EN 1856-1: Cert. 0071-CPD-0011 (TI/ZI) and 0012 (TR/ZR).

	Normal operating temperature	Pressure level	Resistance to condensate	Corrosion resistance	Inner wall	Thermal performance
0071		N1 : negative pressure P1 : positive pressure (up to 200 Pa)	W = wet (condensation)	Inner wall material V2L50 = Mat. Nr 1.4404 (AISI 316L) VmL20 = Mat. Nr 1.4301 (AISI 304)	0.4 mm	G: sootfire resistant Distance to combustible mat. 50 mm min. O: not for sootfire resistant use Distance to combustible mat. 20 mm min.
TI/ZI without seal	450 °C	N1	W	V2L50	040	G 50
TI/ZI without seal	250 °C	N1	W	V2L50	040	O 20*
TI/ZI with seal	250 °C	P1	W	V2L50	040	O 20
TR/ZR without seal	160 °C	N1	W	VmL20	040	O 20*
TR/ZR with seal	160 °C	P1	W	VmL20	040	O 20

^{*} For horizontal use with condensates, even for negative pressure chimneys, use the silicone lip seal.



JPRAIN 4 MP \$767-00.

APPLICATIONS

Ideal for one or multiple tap outlets to your garden, toilet and laundry, the Grundfos JPRain range offers a reliable solution to help you utilise your collected rainwater in the best possible way.

FEATURES

- · 3 models: JPRain, JPRain MP, JPRain PT
- · Self priming from bore and rainwater tank
- Strong suction capacity
- · Automatic on/off switch
- · Built in thermal protection
- · Suitable for above or underground rainwater tanks
- · Handles small sandy impurities with ease

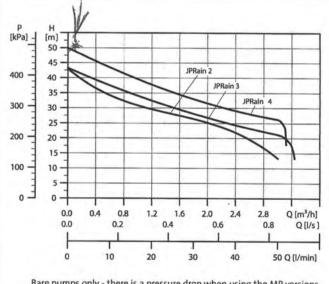
CONSTRUCTION

- · Technopolymer pump body
- · Carbon/ceramic mechanical seal
- · AISI 304 stainless steel shaft
- 1 x 240V, IP44 motor
- · Insulation Class F, with built-in overload protection

PERFORMANCE

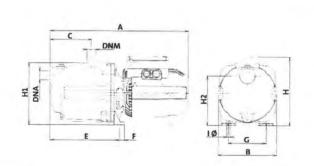
	Disc	harge Pre	ssure (kP	a/psi) - ba	sed on ze	ero suctio	n lift		
	150	200	250	300	350	400	500		
	22	29	36	44	51	58	72		
Pumps	Output (I/min)								
JPRain 2 PT08	46	39	30		- 4	-	1.4		
JPRain 3 PT18	-	58	40	29	-	-	-		
JPRain 4 PT18			58	44	29	-	-		
JPRain 2 MP	40	34	26	-					
JPRain 3 MP	-	51	35	26	-				
JPRain 4 MP	-	2.1	51	39	26	4	-		

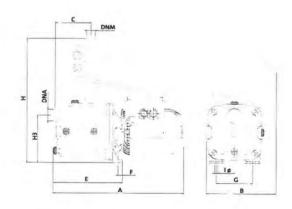
As a guide 1 tap A = 10 litres per minute • 1 sprinkler A = 15 litres per minute



Bare pumps only - there is a pressure drop when using the MP versions.

DIMENSIONS





TECHNICAL FEATURES

JPRain The JPRain without any automatic controllers will operate manually by switching the pump on and off at the power point.

Pump type						Dimens	ions (mm)					
JPRain 2	A	A1	В	C	F	-	1					
	410	390	178	122	102		G	H	H3	lo	DNA	Dav.
JPRain 3	410	390	1999		192	14	111	200	144	9		DN/
PRain 4		390	178	122	192	14	111	200		9	Rp 1	Rp
r Kalli 4	429	409	178	122	107			200	144	9	Rp 1	Rp:
			1/0	122	197	14	111	213	144	0	Rp1	Rp

JPRain MP The JPRain MP is a complete system which automatically switches on and off according to demand. The controller also has dry run protection to stop the pump if the tank runs dry. When small system leaks are present the MP will prevent cycling of the pump.

Pump type	-				D	imensions (m	m)				
JPRain 2 MP	A	В	C	E	F	G					
	410	212	122	192	14		lø	Н	H3	DNA	DNA
PRain 3 MP	410	212	122	192		111	9	360	144	Rp 1	Rp:
PRain 4 MP	429	212			14	111	9	360	144	77.1	
		212	122	197	14	111	9	360		Rp 1	Rp 1
			122	197	14	111	9	360	144	Rp1	

JPRain PT The JPRain PT fitted with a pressure switch and tank will start and stop automatically when a tap is opened or closed. The system will draw water from the pressure tank first when only a small amount of water is needed. JPRain PT is supplied with a non-return valve which is to be fitted to the pump inlet.

Pump type		1	1			imensions (m	im)		The state of		
PRain 2 PT	A	В	C	E	F	G		T			0
PRain 3 PT	410	212	122	192	14	111	lø .	Н	H3	DNA	DNI
	410	212	122	192			9	570	144	Rp 1	Rp:
PRain 4 PT	429	212	122		14	111	9	570	144	Rp1	
			122	197	14	111	q	570	144	"bī	Rp :

Pump type	Voltage (V)	P,	P ₂	P ₂	le Canaci		** .	
		Max [kW]	[kW]	[hp]	[A]	Capac [µF]	Vc	
JPRain 2	1 x 240	0.72	0.44	0.6	3.12		-	
JPRain 3	1 x 240	0.85	0.60	1.00		12.5	450	
JPRain 4	1 × 240		0.60	0.8	3.4	12.5	450	
	1 x 240	1.13	0.75	1.0	4.7	16.0	450	



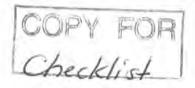




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31 Aug-11 Tony Ward 35D Kotare St Waikane



Dear Tony

Re: MHO PKK A 742 -746 & MHO PKK B 743 - 747
Proposed Earthworks and Buildings to be erected under the lines

We refer to your email to Colin Larsen of 15/8/11 regarding changes to the original house propsed previously to be erected under two Transpowers spans and proposed earthworks near two of Transpowers poles.

This letter is to advise you that United Group has considered the proposed works as described in Designscape's drawing 0000-01 sheets 1-2 and your letter attached to your email of 15/8/11. United Group has carried out a site visit on the 28 June 2010 and performed a number of clearance calculations between:

- 1. Your proposed house roof and Transpower's conductors
- 2. Your proposed chimney and Transpower's conductors
- 3. Your proposed shed and Transpower's conductors

From your letter we understand that the finished floor level of your proposed house is 83.5m and that the proposed height of the house roof directly below the conductors is 5.57 m. In addition the height of a chimney of 3m above the roof and 3 m from the side of the nearest conductor. Provided none of these dimensions change United Group confirms that the vertical distance of 6.6 m beneath the B line(closest line of the two lines) is greater than 4.5 m the distance set out in Table 3, section 3 of the New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP34:2001). In addition the distance from the B line to the top of the proposed chimney of 5.9 m is greater than 3 m the distance set out in Table 3, section 3 of NZECP34.

From Designscape's drawing 0000-01 sheet 2 we understand that the finished floor level of your proposed garage will be 87.5 m and that the proposed heights of the garage roof of 3.2m to the ridge, 2.4 m to the edge. Provided none of these dimensions change United Group **confirms** that the distance of 6.2 m from the B line (closest line of the two lines) to the nearest edge of the proposed garage is greater than the distance set out in Table 3, section 3 of NZECP34.

Excavation Works

MHO PKK A Pole 744: The proposed excavation complies with the requirements of NZECP34:2001 and with the Transpower requirements.

MHO PKK B Pole 745: The proposed excavation complies with the requirements of NZECP34:2001 and with the Transpower requirements.

Consequently we confirm that all the work proposed complies with the requirements of NZECP34.

No further action is required by you to comply with NZECP 34:2001. However, please ensure that all parties working on the site are notified of the proximity of the conductors. If the proposed work changes so that any of the distances relevant to NZECP34:2001 also change, or you are unsure about the distances, please notify Transpower or us immediately.

You should be aware that you may also need to comply with other sections of NZECP34:2001 in relation to the proposed work, or other activities relating to the work (e.g. the operation of mobile plant). If you are unsure of your obligations under NZECP34:2001 regarding any activities please contact us or Transpower for further information.

Yours faithfully

Robert McGowan Senior Design Engineer

United Group Ltd

Cc

Mr J Wilson Transpower NZ Ltd P O Box 640 Palmerston North

Mr Brian Walburton Transpower NZ Ltd P O Box 1021 Wellington







Kāpiti Coast District Council

Private Bag 60 601 Paraparaumu 5254 New Zealand Tel (04) 296 4700 or 0800 486 486

Fax (04) 296 4830 =

kapiti.council@kapiticoast.govt.nz

www.kapiticoast.govt.nz

BC 110397

13 September 2011

Anthony & Lorna Ward 35B Kotare Street Waikanae



Dear Anthony & Lorna Ward

Kapiti Coast District Council (Council) is currently processing your application for Building Consent (BC 110397) and it has been determined that Development Contributions are chargeable under section 198 Local Government Act 2002.

With reference to BC 110397 for construction of a new dwelling, garage and retaining wall on excavation at 35B Kotare Street, Waikanae, a development contribution of \$ 1,478.70 is payable.

We enclose a copy of the Development Impact Fees brochure for your information. This sets out the schedule of fees payable.

A copy of our invoice is attached.

For your information: If the development contribution is not paid, -

- (a) The council may, under section 208(b) of the Local Government Act 2002, withhold the code compliance certificate that would be issued under section 95 of Building Act 2004.
- (b) The building consent authority, under section 94(4) of the Building Act 2004, must refuse to issue a code compliance certificate for the building work until it has received –
 - evidence that the development contribution has been paid or made by the owner to the Council; or
 - (ii) a copy of written evidence that the existing dwelling on the site has been demolished.









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(c) The Council may, under section 208(d) of the Local Government Act 2002, register the development contribution under the Statutory Land Charges Registration Act 1928 as a charge on the title of the land in respect of which the development contribution was required.

Yours sincerely

Janice Lee on behalf of Leigh Sage Building Control Manager

On behalf of Kapiti Coast District Council
13 September 2011

Received by Kapiti Coast District Council at Paraparaumu -2 SEP 2011 By Charlotte Fime 1318.



UGL Limit 2 Railway Aver PO Box 403 Upper h Welling New Zeals

Telephone: +64 4 527 28 Facsimile: +64 4 528 27

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31 Aug-11 Tony Ward 35D Kotare St Waikane

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Yours faithfully

Robert McGowan

Senior Design Engineer

United Group Ltd

Cc

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SPECIFICATION

FOR NEW HOUSE

00034

AT 35 B KOTARE STREET

FOR MR & MRS WARD

june 2011

job number 2690

prepared by DESIGNSCAPE shark bait ltd 298 rosetta road sunny raumati allan pullenger rea, a.lpenz certETn





PRELIMINARY AND GENERAL

PG 01 SCOPE

This specification covers the general on site construction of additions and alterations to the existing dwelling. The contract includes all construction including upgrading the foundations, together with finishing, but excluding painting, carpet, tiles, and curtains.

PG 02 CONTRACT DOCUMENTS

The provision of the following documents shall be included in and become part of this Contract:

- o The Tender Form.
- o The Contract Agreement Form.
- The General Conditions of Contract being NZS 3910: 1998 and any subsequent amendments.
- o This Specification.
- Any Written Notices to Tenderers recording Adjustments to Drawings and / or Specifications prior to signing of the Contract.
- o The following Drawings:
 - (i) 2090-01 all sheets

PG 03 INSPECTIONS

The engineer will inspect:

- 1) Test fill placed
- 2) Base steel to foundation retaining walls
- 3) Stem Steel
- 4) Pile holes to walls
- 5) Structural steel base
- 6) Structural steel in place

Inspections will be requested by the builder giving 24 to 48 hours notice. Inspections are required for the issuing of the PS4 showing compliance.

NOTE builder acts on behalf of the owner in requesting inspections.

PG 04 BUILDING ACT & CODE

Comply in all respect with the provisions of the NZ Building Act, The NZ Building Code and Approved Documents.

Unless specific design has been used, all works shall comply with NZS 3604: 1999 & amendments.

PG 05 BUILDING CONSENT & COMPLIANCE CERTIFICATES

The contractor will uplift the Building Consent, and pay all fees demanded. Liaise with Territorial Authority over inspections and issue of Building Compliance Certificate.

Provide all necessary Energy Compliance Certificates before building is certified practically complete.





PG 06 INSURANCES

The contractor will insure the contract works and existing buildings on site, with owner & Designscape included. Contractors shall effect Contractors Plant & Equipment insurance, Public Liability insurance and Vehicle Liability insurance.

PG 07 HEALTH & SAFETY IN EMPLOYMENT ACT

The Contractor and subcontractors shall meet all their obligations under the Health and Safety in Employment Act 1992 and take all practicable steps to ensure that employees, subcontractors and other persons are not harmed.

The Contractors shall provide all necessary safety equipment and enforce the use of such equipment by its employees. The Contractors failures to correct unsafe condition after notice thereof shall be grounds for an order to suspend the affected operations until the unsafe condition is corrected and, if the violation continues termination of this contract for such failure.

Neither the Employer or Engineer shall be responsible for supervising the implementation of the contractors safety program and neither the Employer or the Engineer shall have responsibility for the contractors or his subcontractors employee.

PG 08 NOMINATED SUBCONTRACTORS

Main contractor. Cox and Sweetman Builders Ltd . 37 Ihaka Street - Paraparaumu - 04 902 5618 contact Phil Cox

Aluminium joinery. Omega Aluminium Kapiti Ltd 151 Matai Rd – Raumati – 04 299 6152 contact Colin Harwood

Plumbing & under floor heating. Advanced Plumbing and Gas Services Ltd Epuni Lower Hutt – 04 577 3007 contact Scott Marriner.

Solar Heating. Solar Works Ltd . 6 Ocean Vista Lane – Paraparaumu – 0800 649 649 – contact Greg Winter.

Boiler – Central Heating New Zealand Ltd. 11 Parkhousr Road – Christchurch contact James Cuddihy 021 863 569

PG 09 GUARANTEES

Provide guarantees for Aluminium Joinery, Roofing and Floor Coverings as specified in those trades. Where the contract fails to specify the terms of the guarantee those terms shall be to the effect that the material or process shall withstand undue deterioration and perform the service intended.

Every guarantee shall be in favour of the Employer and shall be capable of being assigned by the Employer to any subsequent owner of the work before expiry of the period of each guarantee or warrantee. Written guarantees shall be made out on standard forms and shall be handed to the Engineer before final payment is authorized. The time of guarantee period shall continue from the date of practical completion of each unit.





PG 10 TEMPORARY SERVICES

- a) Electric power and water are available on site.
- b) Contractor to provide temporary toilets.
- c) Contractor to provide any telephone services he requires.

PG 11 SHEDS AND EQUIPMENT

Provide, erect and maintain as necessary, adequate sheds for the storage and protection of materials, and for the execution of work that may be fabricated or carried out of site

PG 12 FOREMAN, DRAWINGS AND SPECIFICATION

- a) The Contractor is to maintain a competent Foreman on site at all times during working hours throughout the contract.
- b) The Contractor shall keep on the job throughout the contract, a complete set of plans and specifications as well as all variation orders, instructions and drawings issued for this Contract. No sheets are to be removed from this set. Any subsequent drawings issues by the Engineer are to be securely attached to this set.
- This specification has been divided into trade sections for convenience and reference only, and it shall not be construed that each trade section is a complete and separate Contract. Whilst reasonable care has been taken to classify relevant items under each trade, no claims will be admitted from subcontractors for work not specifically mentioned in a trade section, but which is provided for (expressly or implied) elsewhere in the specification or shown on the drawings.
- d) Should there by any doubt or ambiguity as to the meaning of any portion of the drawings or specifications, the Contracting parties shall submit written particulars of such items with the tender so that any adjustments may be made before acceptance of a Tender.
- e) The Contractor shall be responsible for checking all dimensions for their respective works and any discrepancies referred to the Engineer before commencing work.

PG 13 ATTENDANCE ON SUB-CONTRACTORS

The contractor shall attend on all other subcontractors as required to ensure that all bolts. Sleeves and the like are accurately positioned, delivered and placed on time and shall obtain all drawings, templates, dimensions, etc. necessary to install or position any part of the contractors work as may be necessary to co-ordinate with other contracts.

PG 14 DAMAGE TO PROPERTY

The Contractor is to maintain and protect public property and that of drainage, electricity, highway, water and telephone authorities and that of similar undertakings, and is to make good or pay for the reinstatement of all damage thereto. Should any damage occur, the Contractor shall immediately take steps to minimise the damage or protect against further damage as may be instructed by the Engineer. Any such instructions given and carried out, shall in no way limit the Contractors liability. The re-instatement of repair of any damage shall be carried out by the contractor without any delay and to the instructions and entire satisfaction of the Engineer and/or the authorised agent of any affected parties.





PG 15 EXISTING SERVICES

It is the responsibility of the Contractor and respective Subcontractors to ascertain the location of all underground or overhead services. The location of services in the drawings is to be considered as a guide only.

PG 16 SERVICES LAYOUT

At the completion of the Contract, the Contractor shall deposit with the Engineer a scale plan showing the position of all underground services as laid. This shall include all services - water, gas, power, telephone, drainage.

The distance between points of inspection of access, and the final depths and inverts, shall be clearly shown. All fittings shall have two measurements taken and shown on plan from boundary pegs, corner of buildings or the like. The final payment certificate will not be issued until such fully completed plan has been received and approved by the Engineer.

PG 17 TEMPORARY FENCING

Provide temporary fencing around entire work area, to define contract site. Maintain during contact and remove on completion. Fence shall be 1200 mm high with posts at 2400 mm centres, a timber top rail and red PVC mesh infill.

PG 18 COMPLETION

At completion all plant, temporary services, surplus material etc. shall be removed from the site leaving the site clean and tidy condition.

CARPENTER

CA 01 TIMBER GENERAL

All timber shall be of the kind and grade specified and in accordance with NZS 3631 New Zealand Timber Grading Rules. Notwithstanding this, all timber shall be suitable for its purpose and shall not have defects likely to cause insufficient strength or durability. Finishing timbers shall be free defects, which will prevent at first class finish being obtained.

CA 02 TIMBER MOISTURE CONTENT

All finishing timbers sarking and strapping for linings shall be dried to a moisture content of from 12% tio16% based on oven dry weight and shall be kept dry at all times. Timber showing signs of faulty or excessive kiln drying may be rejected.

Framing timbers shall be kiln dry and have moisture content of from 20% to 24% before internal linings are applied.

Framing timbers exposed to view shall be dried to not more than 16% moisture content.

CA 03 TIMBER TREATMENT

All preservative treatment of timber shall be in accordance with the NZ TIMBER PRESERVATION COUNCIL SPECIFICATIONS. All invoices for treated timber delivered to the works shall have typed brand and plant registration number stated thereon. All treated timber delivered to the works and not bearing approved identification marks will be rejected.

All pine shall be anti sap stain dipped at the mill before treatment. Treated timbers for clear-finished work shall be free of dye staining after dressing.





CA 04 SCHEDULE OF TIMBER CLASSES AND GRADES

All timber shall comply with the following schedule unless otherwise approved by the Engineer. PINE means Radiata, Corsican or other exotic species as may be approved by the Engineer.

Wall, ceiling and roof framing shall be <u>Laser framing or Tasman Time Frame</u>, kiln dried with a moisture content of between 10% and 16%, H1.2.2 treated. Handle and erect in accordance with the manufacturer instructions using equivalent size members to No 1 Framing nominal sizes.

Timber used for exposed framing for finishing purposes (both exterior and interior) shall be chosen for good appearance and in particular free of spike knots and allowing only full intergrown knots up to 38 mm diameter.

All structural timber is MSG8

TIMBER SCHEDULE

Treatment	Species
H5	
H3.2	Pine
H1.2	Pine
H1.2	Pine
H3.2	Pine
H1.2	Pine
H1.2	Pine
H1.2	Pine
	H5 H3.2 H1.2 H1.2 H3.2 H1.2

CA 05 FINISH OF TIMBERS

Machine gauge all framing on four sides

Finishing timbers exposed to view or touch shall be sanded to produce smooth even surfaces free of defects and with arises removed. As the interior finishing timbers may be clear finished use only timbers, which will give a consistent finish throughout the contract.

CA 06 FASTENINGS

Framing nails shall be jolt head for native timbers and flat head for pine. Nails shall be sufficient lengths to penetrate the second or hold timber at least half their length. Note that NZS 3604 details many fixing lengths.

Exterior finish nails shall be galvanised and of length to penetrate at least twice the thickness of the facing timber. Nails 75 mm or less in length shall be brad head unless otherwise specified.

Interior finished nails shall be generally be brad head for fixing interior joinery and trim. Use panel pins for fixing fine moulds. Use galvanised Flathead nails for fixing plasterboards.

Bolts and screws shall be standard pattern. Use hot dip galvanised bolts and screws for external use and for floor, wall and roof framing. Use fixings for hardware to match the hardware. Note that stainless steel is required in coastal Zones.

Framing anchors shall be "TECO TRIP-L-GRIP or PRYDE MULTIGRIP" framing anchors fixed according to the manufacturer instructions.





CA 07 HARDWARE

Refer to HARDWARE and EQUIPMENT section in specification. Properly install all hardware and leave fully lubricated and in good working order. Remove and replace surface hardware to allow for painting work.

CA 08 WORK FOR OTHER TRADES

Cut away for, attend upon, and make good after all trades. Provide all necessary blocks and fixings for securing the work of all trades. Only the minimum necessary cutting checking or boring shall be done in structural timbers. Joists, rafters and the like shall be drilled only as allowed in NZS 3604. Do all setting out required by other trades.

CA 09 STANDARD OF WORKMANSHIP

All carpentry work shall be best trade practice and strongly and neatly put together. All finishing work shall be of first class appearance, tightly jointed, smooth dressed and sanded and free of roughness, splits, shakes checks, short grain or surface blemishes. Closely scribe wherever required. Allow proper clearance to all opening parts.

CA 10 PRIMING

All exterior woodwork shall be primed with an approved general purpose primer before it is fixed (refer to "Painting").

NOTE: Temporary weather scaling is not acceptable as a substitute for general purpose primer. Factory pre-priming is acceptable provided that all ends and other bare parts are site primed before fixing. All exteriors stained woodwork shall be primed with a stained oil finish before it is fixed. Priming shall be as follows:

- All faces, backs, edges, ends, joints and abutting surfaces of all exterior finish timbers including facings, fascias, barges, angle boxes, plinths and the like.
- b) All surfaces of timber exterior joinery including backs, edges, rebates, beads, sashes and doors, except where work is required to be varnished. Prime doors and sashes including top edges before banging, but after fitting. Prime all checking for butts, locks and similar.
- c) All exposed surfaces of plywood sheathing including edges, laps and rebates and back of sheet for a height of 200 mm above bottom edge.

Prime joinery after inspection by the Engineer and before installation. Protect all joinery under cover, from moisture and heat until primed and fitted to the works.

CA 11 FRAMING GENERALLY

Build all framing straight, true, rigid and securely jointed with all members in long lengths with joints made over bearing. Studs at 400 crs.

CA 12 WALL FRAMING

Construct wall framing as follows or as otherwise detailed with sheet or strap bracing where shown. Plates shall be 50 mm thick and of width equal to wall thickness as shown. Note double top plates to gable end walls.

Studs shall be 50, thick as for plates. Frame up walls with full height studs to top plates. Space studs in external walls at 400 mm centers with double studs in walls over 3000 mm high. In internal walls





space studs at 600 mm centers. Provide studs at wall junctions and for fixing the edges of all interior and exterior lining sheets.

Sill trimmers shall be 50 mm thick of width equal to wall thickness shown.

Lintels shall comply with NZS 3604.

Dwangs and blockings shall not be less that 100 mm x 50 mm cut in tight and well nailed at 600 mm centers for linings to walls and ceilings. Provide other dwangs and blockings to secure fittings and the work of other trades.

Sheet bracing wall panels - Note location of wall sheet bracing and fix end studs of braced panels

CA 13 ROOF TRUSSES

Roof trusses shall be generally as follows:

Proprietary Brand Timber Trusses shall be designed by a registered engineer and constructed by an approved manufacturer from machine gauged timber and galvanised steel toothed plate connectors. The design shall be for very high wind loading and include not only the trusses but also the truss supports, truss intersections and all associated fastenings. Provide Engineers certificate for the truss design. Where the drawings indicate overall dimensions of the trusses these shall be complied with.

CA 14 ROOF FRAMING

Purlins shall be set out as shown to comply with NZS 3604. Fix purlin to classroom trusses with 2 Pryda NPPC4 purlin cleats per purlin and to other trusses with Pryda CPH purlin straps. Where purlins support corrugated iron roofing, space members such that roofing sheets are fixed within 100 mm of the bottom edge.

Brace roof as shown with Pryda 25 mm z 0.8 mm high tensile strap braces with one tensioner per brace. Fix to top plates and every junction with rafters with 3-3.15 x 30 mm nails.

Diaphragm ceiling - construct to Winstone Braceline instruction booklet.

CA 15 BUILDING PAPER

Cover all the exterior walls with Watergate building paper. Fix with as per manufacturer instructions. Protect against damage during construction and repair any damage that does occur using new material. Fix to all exterior stud walls behind all types of wall sheathings. Lap joints 100 mm. Roof underlay is bituminous self supporting, thermacraft 215.

Lay under all roofing, at right angles to the direction of fall, overlapping not less that 100 mm and with end laps of at least 1 metre. Turn up against walls and upstands, extend over fascias into gutters and carry over ridges. On roofs with purlins, lay on galvanised wire netting stretched tight and stapled to purlins. Twist edges of netting together at joints. Netting shall be 50 mm mesh by 1 mm. Note, netting may be omitted if:" FLAMESTOP 660" is used provided that the roof framing supports it at 1200 mm centers max.

CA 16 INTERIOR LININGS

All Gibraltar board shall be fixed and stopped and shall be that produced by Winstone. No substitution is allowed.

Gibralter board ceiling lining shall be 9.5 mm thick Braceline. All joints shall be taped reinforced and stopped to level 5 finish.

Gibraltar board wall lining to all walls shall be 9.5 mm thick The Gibraltar board shall extend behind all fittings. Stop exposed joints and fixings to level 4 finish.





CA 17 INTERIOR TRIM

Provide and fix all trim required for interior finish. All work shall be neat and true to lines and with all joints tight. Mitre and scribe as necessary for a first class job.

All timber shall be dressed and sanded smooth before fixing and all arises shall be taken off. All work shall be free of rough patches, splits, hammer marks and similar defects and shall be securely fixed. All trim out of 75 mm or wider timber shall be run with a hollow back. Trim shall be consistent throughout the job. Architrave and capping shall be as detailed or consistent with the same where not shown. Return architrave trim along window sills. Architrave, skirting and dado caps shall be flush on the face, rebate and neatly pack wherever necessary to achieve this finish.

CA 18 SWITCHBOARD AND SIMILAR RECESSES

Trim for switchboard and meter board cabinet how and where directed by the electrician. Project linings full over trimming for finish under the cover plate of the switch board cabinets. Fit meter cabinets so that the flashing flanges are behind the wall sheathings.

CA 19 CEILING MANHOLES

Fit ceiling manholes where shown by owner. Trim opening with ex 25 mm timbers and fit melamine veneered particle board trapdoor.

METAL JOINERY

MJ 01 GENERAL

The metal joinery manufacturer shall supply all metal joinery etc. scheduled and detailed on the drawings, complete with all necessary hardware and operating mechanisms. Allow to attend the site to check all units are complete properly installed, weather tight and in full working order.

MJ 02 APPROVED MANUFACTURERS

Approved manufacturer: Omega Aluminium Kapiti Ltd.

Only one brand and/or window suite shall be used throughout the contract.

MJ 03 PERFORMANCE REQUIREMENTS OF JOINER

The manufacturer shall comply with the requirements of the specification and if required provide certified evidence that the performance of the joinery meets the specified requirements. All windows shall be designed to conform to NZS 4211:2008, for a very high wind zone with the following additional and specific requirements.

Minimum design wind pressure shall be 1.55 kpa

Torsional strength of sashes -Maximum deflection shall not exceed 25 mm when loaded with a force equivalent to 0.5 times the relevant operating force for sashes from table 3.

Overall strength and deflection - all members in the whole of each unit shall be designed to comply with the requirements of NZS 4203:1992.

The minimum acceptable level of air leakage shall be level 8.

Security - All windows shall be designed so as to positively lock in a closed position. Windows shall not be able to be fully or partly dismantled mechanically once installed, with all opening frames in a closed position.





MJ 04 MATERIALS

Aluminum The alloys shall be used as designated below.

Extrusions Shall be fabricated from alloy of designated 6063, complying with AS

1866.

Sheet sills, Flashings, Shall be fabricated from alloy designations 1200 or 3105

Couplings, and the like or 5005 or 5211, to AS 1734, of temper suitable for

the method of forming to be adopted.

Coating Shall be powder to colours as selected

Section thickness Not less than 2 mm except flanges, box sections, and

Perimeter frame, which shall not be less than 1.6 mm.

Flashings Shall be 0.8 mm and other sheet material shall be 1.5 mm.

Assembly fixings Shall be aluminum or 300 series stainless steel to part 4

If BS 970. All fixings exposed to view shall match the

Existing colour.

Stripping colour grey. Dry glazing gaskets and draft seals

Shall be black EPDN.

Jamb liners Shall be H1.2.2 treated finger jointed pine painted timber.

Sealants Shall be of material that so not react with aluminum,

aluminum finishes, glass or glazing materials.

Joints between frame components shall be sealed with synthetic rubber small joint sealant. Installation sealant shall be poly sulphide sealant of approved manufacturer.

MJ 05 GLAZING

Glazing shall be carried out in accordance with NZS 4223:2008, for VH wind, and double glazed. All door glazing shall be toughened glass.

MJ 06 HARDWARE

Where possible all hardware shall be factory fitted. Otherwise shall be factory drilled for site installation hardware. All hardware shall be screw fixed unless prior written approval for other fixing to be used is given. Hang awning sashes on suitable sized Interlock commercial grade aluminum awning friction stays. To each awning sash fit two Interlock Avon window fasteners and two Interlock Safety stays. Fit to sliding sashes approved fasteners to prevent sashes being lifted out of frames.

M] 07 FIXING/INSTALLATION

Fix all windows and doors into prepared openings. The exact dimensions of windows and doors shall be taken from the job by the manufacturer and where necessary, templates of openings shall be made to ensure proper shape and sizing. Windows shall not be forced into openings, which are out of square or too small. The openings shall show at least 3 mm tolerance all round. The window shall be secured at head, jamb and sill and care shall be taken to ensure that the windows are not distorted when fully fixed in place. The spacing of fixtures shall not be greater than 500 mm.

All on site assembly junctions required shall be specially designed and fabricated to ensure a continuous weather tight component. The junction between building fabric and window frames shall be sealed with polysulphide sealant. Application of the sealant shall strictly conform to the sealant



manufacturer recommendation and specifications. The sealant shall be coloured such that it will not stain the adjoining building fabric and will received paint without bleeding, not sag or run and will not set hard or dry under any conditions of local weather.

M₁ 08 GUARANTEE

On the completion of the building contract the window manufacturer shall provide a written guarantee made out in favour of the owner, for the whole of the work mentioned under this trade heading with regard to efficient working and weather tightness for a period of fifteen years from the date of completion of the unit.

ROOFING

RO 01 GENERAL

Provide and fix all roofing to buildings as shown on the drawings and specified in following clauses for the particular type of roofing required. All roofing shall be a first class job complete with all necessary accessories and flashings required. Roofing shall be correctly and adequately fixed to resist all weather conditions.

RO 02 GERARD ROOFING

Supply and fix Gerrard Milano Decramastic tiles to colour selected by owner. Lay roofing in level lines, and as per the manufacturers instructions.

RO 03 GUARANTEE

Provide 15 year written guarantee against fading and deterioration of finish, and the roof will be maintained in completely watertight condition for a period of 15 years. Any defects occurring during this period shall be made good at the Contractors expenses.

RO 04 SPOUTING

Spouting shall be of PVC Marley stormcloud or equal and shall be complete with all necessary brackets, ends, angles and outlets well made and glued. Spouting shall be in straight lines, fixed to even falls to downpipes and as high as practical on the fascias. Downpipes shall be of 80 mm diameter UPVC

ELECTRICAL WORK

EL 01 REGULATIONS

All electrical work shall comply with the Electrical Wiring Regulations 1976 and Amendments. Any conflict of the above with this specifications or drawings shall be referred to the Engineer before the work is done. Provide Electrical Energy Compliance Certificate on completion of each unit.

EL 02 WORKMANSHIP

All electrical work shall be done by registered electricians in accordance with the Electrical Wiring Regulations and best trade practice. Conceal all wiring within the structure as specified unless explicitly direction otherwise is given. Drill cable holes in timber framing on the centre line only of





members. Do not notch beams, joists and the like to keep drillings towards the ends of spans. Ensure that adequate cable supports, trimmings and chases are provided where needed for electrical work. Notching and horizontal runs within walls are not permitted.

POSITIONS OF OUTLETS EL 03

Outlets shall be generally positioned as given by owner. Neatly position outlets in straight lines, groups or symmetrical layouts as appropriate.

EL 04 MOUNTING HEIGHT

Light Switches

1000 mm above floor level

Socket-outlets (wall mounting) 500 mm above floor level or 200 m above benches.

Timer and Switch-pilots

1000 mm above floor

Distribution Boards

1800 mm above floor level

EL 05 EARTH BONDING

Bond all metal water pipes, sink bench tops, wastes and fitting to the earth bar of the nearest distribution board. Conceal bonding and cables within the structure.

EL 06 CABLING

Sub circuit wiring shall be plastic insulated and sheathed (TPS) unless otherwise shown. Minimum size cables for sub circuits shall be:

Lighting

1.5 mm2

Socket Outlets

2.5 mm2

SWITCH/SOCKET OUTLETS EL 07

The single phase switch/socket outlets shall be flush mounting ivory polycarbonate Excel Range units.

DATA CABLES AND TELEPHONE EL 08

Wire up data cables as directed with Category 5 UTP cable.

Run Telephone cables to connect as directed. Terminate in outlet boxes, and check them working.

PAINTING

PT 01 GENERAL

Paint all surfaces both interior and exterior, which it is usual to paint.

PT 02 MATERIALS

All material shall be of first quality approved manufacturer and shall conform with NZS Specifications wherever these are application. All paints, including primers, enamels, varnishes and similar materials shall be ready mixed and shall be brought on to the job in the manufacturer's sealed containers. No "trade lines" allowed.





PT 03 PAINT SYSTEMS

Paint systems shall be consistent with and according to the manufacturer's recommendations unless clearly specified otherwise. Printing, undercoating and finishing costs shall be of the same brand. Conditions of preparation, application and thinning shall be as recommended by the manufacturer.

PT 04 WORKMANSHIP

All work shall be done by skilled tradesmen in accordance with best trade practice and with NZS 7703:1985, "The Painting of Buildings", and with the further requirements of this specification. Any work or lesser standards shall be made good.

The top and bottom edges of doors, facings etc, both exterior and interior, shall be fully painted. Paint all surfaces behind loose fittings, steel shelving or similar.

Ensure that all surfaces are thoroughly clean and dry before paint is applied.

PT 05 PRECAUTIONS

No painting is to be done in wet, cold, or otherwise unsuitable weather. Make good any damage that is caused by weather conditions. Take adequate precautions to prevent damage to other paintwork and the work and finishes of other trades during painting operations.

PT 06 SUB SURFACE

Prior to painting ensure that all surfaces are so made, smoothed, cleaned and filled that there will be no detriment to the permanency or finish of the paintwork. Sand, stop and fill wherever necessary apply sealers or neutralizers to surfaces to ensure compatibility with paint films.

PT 07 PRIMING

Priming for exterior painted woodwork shall be approved GENERAL PURPOSE, lead free primer. Priming for interior painted woodwork shall be lead free interior primer-undercoat of the same brand as the finishing coats and as recommended by the manufacturer of the finishing paints in use with these paints.

Priming for metalwork shall be lead free single pack blended vinyl etc holding primer, Resene or equal approved. Thoroughly degrease surfaces before priming. Prime exterior bare steel and welds with Zincgalv or equal zinc paint applied at the rate of 300 grams per sq. metre. Prime interior steelwork with a red oxide zinc chromate, anti-corrosive primmer.

PT 08 UNDERCOATS

Undercoats shall be recommended by the manufacturers of the finishing coats and shall be tinted to differ from the colour of the finishing coats. For high gloss enamel paints, the undercoat shall be formulated to suit the high gloss finish and shall be of the same brand as that of the finishing coat. Thinning shall be strictly confined to the manufacturer's recommendations.

PT 09 PAINT APPLICATION

Generally all paint shall be applied by brush. Roller application is permitted for interior paintwork provided that the correct roller appropriate to finish is used and a high standard of work is achieved.





PT 10 HARDWARE

Arrange the trades concerned for all hardware, electrical fittings and similar items to be removed and re fixed to allow for painting adjacent surfaces.

PT 12 COMPLETION

Clean up at completion, leave all paintwork complete and remove all debris and equipment. Arrange with carpenter to ease all tight joinery; make good paintwork. Remove all paint spots, stains and blemishes. Clean all glass.

PT 13 COLOURS

The colour scheme will be given by owner.

CM CONCRETE MASONRY

CM 1 GENERAL

Follow the Approved Documents of the **NZ Building Code**, with regard to the criteria and/or methods that must be used in this section to establish compliance with the Code.

- B1/AS1 Structure general 3.0 Masonry
- B1/AS4 Structure foundations 1.0 for small buildings
- E2/AS1 External moisture 2.0 Walls
- DOCUMENTS referred to in this section are:
- AS/NZS 4455 Concrete masonry units
- NZS 4210 Masonry construction materials and workmanship.
- NZS 4229 Conc mas buildings not requiring specific design
- AS/NZS 4671 Steel reinforcing materials
- Documents listed above and cited in the clauses which follow are deemed to form part
 of this specification. However, this specification takes precedence in the event of it
 being a higher standard than the cited documents.
- BLOCKLAYER QUALIFICATIONS: All work in this section to be carried out by competent experienced tradesmen and under the supervision of a registered mason.
- INSPECTION: Allow for inspection of the work at critical stages such as set out, reinforcing, and prior to and during grouting, to recognised good trade practice as set out in NZS 4210.
- QUALITY RECORDS: Keep accurate records relating to strength and quality of materials
 used in the construction, and make available to the Engineer or Territorial Authority
 inspector when requested.

CM 2 MATERIALS

- GROUT: To conform to NZS 4210. Design strength of 20 Mpa at 28 days.
- BLOCKS: To conform with AS/NZS 4455.
- REINFORCEMENT: To conform with AS/NZS 4671 and details as per plan.



MORTAR: Conform to the requirements of NZS 4210 to provide a compressive strength
of not less than 12.5 Mpa for structural walls and work below ground, or 8.5 Mpa for all
other masonry.

CM 3 WORKMANSHIP

- GENERALLY: Comply with NZS 4210 and NZS 4229.
- STORE BLOCKS: Clear of the ground, under cover and well ventilated until placed in the work.
- CHECK BASE: Check that the base concrete on which block work is to be built is true to line and level. If more than 20 mm thickness of mortar bed will be needed to correct inaccuracies obtain direction from the Engineer. Ensure that all laitance, loose aggregate, or anything that would prevent bond is removed prior to block laying.
- STARTER POSITIONS: Before commencing block laying check location of starter reinforcement by measure or by a dry trial lay up of the first course. Do not attempt to correct misplacement by cranking bars. Where misplacement exceeds the location tolerance obtain direction from the Engineer.
- TOLERANCES: Construct within the tolerances set out in NZS 4210 Clauses 2.6.5 and 2.7.1.4. Lay blocks with jointing of consistent thickness throughout.
- MOISTURE CONTENT: Ensure that blocks are air-dry prior to laying.
- PROTECTION: Protect fair faced block walls to keep them clear of all mortar droppings, grout splashes, or stains of any kind as the work proceeds.
- LAYING: Use good trade practice to ensure consistent fully filled and tooled joints. Where walls are reinforced prevent mortar droppings from entering cells to be grouted, or clean out by adequate means prior to grouting. Unless Low Lift grouting is used, provide clean out holes at base of wall. Ensure reinforcement is accurately placed and tied. Lay in regular running bond with all necessary special units and sill blocks. Cut blocks if necessary true and square without chipping. Fully grout all cells.
- CONTROL JOINTS: Locate at major changes of wall height or thickness, at openings, and at not more than 8 metre centres, or as shown on the drawings. Where reinforcement passes through a control joint, provide for breaking bond using methods detailed on Fig. 2.10.1 of NZS 4210, unless specifically detailed otherwise on the drawings.
- BRACING: Provide adequate temporary lateral bracing where necessary to ensure stability until final supporting construction is in place.

CM GROUTING

- INSPECTION: Inspect walls prior to grouting. Ensure that cells are clean and reinforcement is correctly placed. Where high lift grouting is used, seal the clean out holes and brace to prevent blow outs.
- GROUTING PROCEDURE: Grout fill the whole of the block walls using procedures set out in NZS 4210.
- CONSTRUCTION JOINTS: Form and treat construction joints between grout pours and between block walls and hardened concrete work so that bonding occurs. Comply with NZS 4210 Section 2.16 to ensure this happens.

CM ANCILLARY WORK

BUILD IN COMPONENTS: Mortar in place as the work proceeds, components such as sills, copings, lintels, steps, fixings such as plugs, bolts, ties, metal flashings, dowels, fastenings and fixings required by this and other work sections. Co-operate with others to meet this requirement.





CM COMPLETION

CLEANING: Clean off mortar splashes and grout spills if and as they occur making good any damage at the same time. At completion, clean down all block work and remove waste material from adjoining surfaces and floors.

CM CONTROL JOINTS

Install vertical control joints:

- At 6000 mm centres.
- · At 600 mm of return angles for T and U shaped floor plans
- At 600 mm of L shape corner OR restrict next control joint to 3200mm.
- · At changes of wall height exceeding 600 mm
- · At changes of wall thickness
 - Reinforcement shall be continuous through control joints for bond beams and lintels, all other horizontal reinforcement shall be stopped at joint (see detail).
 - Block cavity to each side of joint will be vertically reinforced and filled.
 - Control joints will be weatherproof.

All work to comply with NZS 4229 section 13

SPECIFICATION FOR EARTHWORKS

EW 01 SCOPE

Earthworks include the clearance of the site, stockpiling and respreading of topsoil, removal of unsuitable material.

EW 02 SETTING OUT

The contractor shall set out the contract in accordance with the contract drawings, specifications, pegs or instructions supplied by the Engineer from time to time. All work will be finished to levels and gradients shown on the plans.

EW 03 CLEARANCE

The site shall be cleared of all vegetarious matter including trees and shrubs, excluding those being retained, all structures, fences and the like. Roots of trees, bush, shrubs etc shall be removed.All above material, unless otherwise directed, shall be removed from site.



EW 04 TOPSOIL AND TURF

All topsoil and turf located within the cut and fill areas, shall be excavated and stockpiled within contract area. The contractor will site stockpile to facilitate his working, any double handling is at his expense.

EW 05 UNSUITABLE

Unsuitable material is defined as material which by virtue of its inherent properties of grain size, water content, or organic content, is not suitable for inclusion in earthfills.

All unsuitable material beneath areas to be filled, shall be removed prior to commencement of any filling. The material shall be removed from site.

The contractor shall ensure that unsuitable material is not buried or deposited on any part of the site other than directed by the Engineer.

Material unsuitable due to moisture content, shall be spread and dried for later inclusion in the filling.

EW 06 CONSTRUCTION PROTECTION

The contractor shall place and maintain surface profile drains to control and direct stormwater runoff to approved catchments. This shall be done by the construction and maintenance of cut off drains above batter faces, and contour drains. Interceptor drains shall be formed at the base of batters, and uphill of adjacent properties.

EW 07 SILT TRAPS

The contractor shall supply silt traps on all temporary and permanent open channels. The type and size may vary according to location, but generally consist of a stilling pond and brush fence. Allow to maintain these traps.

If measures taken fail to control silt, then contractor shall at his expense clean and rectify all damage. Erect warning signs as required.

EW 08 SUBSOIL DRAINS

Subsoil drains will be constructed where shown or directed. If the contractor encounters damp areas, springs or the like, then it shall be brought to the attention of the engineer.

Subsoil drains will consist of novaflo pipe with drainage metal surround.

EW 09 FILLING

Before filling commences, the engineer shall inspect the area and give written order to commence.

Batters shall be formed at maximum of 1 metre vertical for 1.5 metres horizontal. Fill shall be benched into the existing ground, as fill is brought up. The fill layers shall not exceed 150mm within





450mm of surface, and 200mm elsewhere. The material size shall not exceed 75mm, crushing is accepted. Moisture content will generally be kept within 2% of optimum. Watering or drying of the materials may be required.

Compaction shall be to each layer, and shall be 100% percentage of the maximum dry density obtainable for the material by standard compaction at optimum moisture content. This equates to a minimum 2 blows of the penetrometer over 50mm.

Compaction shall be carried out using suitable equipment for the type of material, and size of the job. The contractor shall prove compliance with the compaction required.

The contractor shall supply any help required for test pits, or any other, when the engineer is taking tests.

Note the contractor shall indemnify the Principal and Engineer against all claims or injunctions that may arise from nuisance caused by dust.

TRW SPECIFICATION FOR TIMBER RETAINING WALL

TRW 00 GENERAL

All workmanship shall be to best trade practice, and materials shall be of first quality. Set out work accurately from the plans supplied.

TRW 01 MATERIALS

Timber shall be rough sawn, unless otherwise stated, H5 treated, structural grade. All hardware shall be hot dipped galvanised or stainless steel.

Concrete shall be 25 Mpa special grade.

TRW 02 CONSTRUCTION

The wall shall be constructed at a slope of 10 vertical to 1 horizontal, leaning back against fill.

Posts/ poles shall be sizes shown on plans or calculations, placed at centres given, and embedded to the distance shown from the front of the hole, and concreted in. Hole sizes are generally 400 mm diameter.

Walings shall be ex 200mm by 50mm thickness, placed and nailed to posts. Joints for rough sawn shall be staggered over posts, and shall be mitre cut. If using tongue and groove timber, the joints may be placed between posts, but shall be staggered such that the next joint above is not between the same posts.

All cut timber surfaces shall be treated with METALEX. Walings are on the inside of posts.





Backfill the wall with drainage metal shall be laid for the first vertical metre, and site material used thereafter. Spread and compact fill to 95% dry density.

DRAINLAYER

DR 01 EXTENT OF WORK

The work of this section comprises of the supply and installation of all pipework customarily done by the drainlaying trade.

DR 02 MATERIALS

All materials and fittings shall be the best of their respective kind in accordance with the above standards. Supply UPVC 'Terrain' 110mm diameter sewer and 90m diameter stormwater systems including gully traps, lubricant, etc.

DR 03 LAYING DRAINS

<u>Check invert levels of existing drains</u> before commencing work on site. The minimum cover for drains shall be 300mm.

Lay drains in even gradient in 75mm minimum depth bedding of clean gravel, with pipes fully supported and with gravel haunched to side for half of pipe diameter. All junctions other than manholes shall be made with 'Y' shaped inspection junctions and bends. Fit cleaning eyes, brought to the surface, at all junctions and bends where shown or directed. Complete installation as per Manufacturer's instructions as to jointing etc.

DR 04 GULLY TRAPS

Exterior gully traps shall be standard uPVC gully traps with precast concrete surround finishing 75mm above adjacent surfaces.

DR 05 TESTING

At completion clear all drains of debris, operating freely and entirely without leaks. Test all drains and arrange for inspection by Local Authority. Self certify as appropriate.

STRUCTURAL STEEL

Fabricate steel members as calculated and shown on the drawings. Cut, drill and assemble by means of welding, bolting or other suitable methods in accordance with sound trade practice.

All welding shall conform to the requirements of NZS 1554: Structural Steel Welding Set, unless noted otherwise. All welds will be full penetration fillet welds unless noted otherwise on the drawings. Preparatory work, procedure and sequence of welding shall be such as to preclude distortion and minimise shrinkage stresses. All welds shall be ground to a clean, smooth even surface in the shop, and all welded connections in tubular members shall be fully sealed. Holes for screws or bolts shall be no larger than required.

Dress cut edges to a neat finish free from distortions and remove burrs. All cleats,



straps and holes shall be square and true in line and position. All steelwork exposed to view shall be neatly finished and shall present no rough or sharp edges.

All steelwork, unless galvanised, shall be factory cleaned down with power wire brushing to remove all rust and given a coat of non organic silicate primer before delivery to the site. Any areas damaged in construction shall be patch primed with the above primer.

All external steelwork shall be hot dip galvanised after fabrication. Allow to correct any deformations due to the galvanising process.

ENSURE compatibility of the paint with polystyrene or other products in contact.



INSTRUCTIONS ON THE USE OF THIS MANUAL

This Manual consist of two Sections:

Section 1: Firth RibRaft Floor System Design Information

and

Section 2: Firth RibRaft Floor System Installation Information

Section 1 contains information principally useful for the specifier or building designer while Section 2 is primarily aimed at the person on site installing the Firth RibRaft Floor system.

This document contains non-specific design and installation information. A variation to any of the information given requires specific design and is hence beyond the scope of this document. Firth Industries can provide specific design information should this be necessary.

Firth RibRaft Floor System can be constructed for all slab-on-ground concrete floors for domestic or residential buildings that fall within the scope of NZS 3604:1999 "Timber Framed Buildings" and Clause 3 "Scope" of Section 1 of this Manual. The design and installation details in this Manual shall be used to design and construct such a floor.

The Firth Ribraft Floor System is covered by the BIA Codemark®. This is conditional on the system being used as described in Opus Appraisal Certificate 1999/22 dated May 2000 which in turn requires design in accordance with Section 1 and installation with the Section 2 of this Manual.

This Manual shall cover only the non-specific design details, but an engineer may wish to use this Manual to assist with a specific design of a RibRaft floor.

SECTION 1



FIRTH RIBRAFT FLOOR SYSTEM DESIGN INFORMATION

May 2000

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1 GENERAL

This Section of this Manual contains non-specific design information required for the Firth RibRaft Floor System (the system). Full information on the non-specific installation procedures is described in Section 2 of this Manual (Installation Information).

2 TECHNICAL DESCRIPTION

2.1 Overview

The Firth RibRaft floor system is a reinforced concrete waffle raft floor slab-on-ground. It consists of an 85mm thick top slab supported by a grid of ribs normally 100mm wide at 1200mm x 1200mm centres. The overall depth is 305mm. Edge beams and ribs under loadbearing walls are 300mm wide to provide for the extra load carried by these members.

2.2 Pods

Polystyrene pods 1100mm square and 220mm thick are placed directly on levelled ground and are arranged in such a way as to form a reinforced concrete floor slab with a grid of reinforced concrete ribs and edge beams when concrete is placed onto them. Pods may be cut to suit specific architecture layout and also to accommodate services.

(300mm thick pods are available if needed for deeper edge beams and internal ribs for construction following specific engineering design. Such uses are outside the scope of this document.)

2.3 Steel

Reinforcing steel consists of steel 665 mesh in the top slab with reinforcing bars in the ribs and edge beams. The reinforcing bars shall comply with the requirements of NZS 3402:1989 "Steel Bars of the Reinforcement of Concrete". All welded mesh fabric reinforcing shall conform to NZS 3422:1975 "Welded Fabric of Drawn Steel Wire for Concrete Reinforcement". Specifically designed spacers are used to position the polystyrene pods and the rib and edge beam reinforcing steel bars in a secure manner until the concrete is placed. The reinforcing mesh is held in place by mesh chairs. Conventional timber or steel formwork is used to form the edge of the slab.

2.4 Concrete

One of the following Firth concrete products shall be used in the system:

- Raftmix a 20 MPa 80mm slump structural mix available in either a 13mm or more usually a 19mm nominal aggregate size. This mix is normally placed in the floor straight from the concrete truck shute and if necessary by wheelbarrow over planks set up over the pods.
- 2) Raftmix Pump a 20 MPa 100mm slump pump mix available in either a 13mm or more commonly a 19mm nominal aggregate size. The selection of aggregate size may be determined either by the capability of the available concrete pump or by the concrete placer's preference.

3 SCOPE

This Clause sets out the limitations that apply to the use of the non-specific details for the system. The concrete floor slab for buildings or ground conditions that do not meet this scope must be subjected to specific engineering design to comply with the requirements of the New Zealand Building Code.

3.1 Structure Limitations

The non-specific details of the system shall only be used where the structure supported by the system complies with the following criteria:

- The system is laid level, and is not stepped.
- The structure supported by the system has no basement, part basement or foundation walls.
- The structure supported by the system has a roof pitch limited to 30 degrees maximum from the horizontal.
- Roof and ceiling loads of the structure supported by the system are taken to the external walls by roof trusses.
- . The maximum height of each storey of the structure supported by the system is 3m.
- Only ground floor walls of the structure supported by the system are permitted to be "heavy external walls" (as defined in Clause 3.3 below)
- Three storey buildings supported by the system shall be limited to those with live loadings on the upper floors of 1.5 kPa.

3.2 Live Loading

The live loading cases of structures covered by these designs are:

- 1.5kPa and 3.0kPa as per NZS 3604:1999 "Timber Framed Buildings".
- 9.0kN concentrated load in garage area (vehicle limited to 2500kg tare).

3.3 Dead Loading

The dead loading cases of structures covered by these designs are:

- Light external walls with total mass not exceeding 60kg/m²
 - e.g. timber framing with weather boards and interior wall linings
- Heavy external walls with total mass greater than 60kg/m² but not exceeding 290kg/m²

 e.g., timber framing with masonry veneer or partially filled 20 series masonry blocks
- Internal walls with total mass not exceeding 35kg/m²
 - e.g. timber framing and linings
- Light roofs with total mass not exceeding 45kg/m²
 - e.g. ceiling linings and metal roof, including framing
- Heavy roofs with total mass greater than 45kg/m² but not exceeding 85kg/m²
 - e.g. ceiling lining and concrete tiles or slates, including framing
- Mid-floors with total mass not exceeding 60kg/m²
 - e.g. timber framing and flooring, including ceiling linings

3.4 Building Types

The designs given in this Manual are limited to where the system supports Building Types A to E as described in Table 1. The classification of wall weights is as detailed in Clause 3.3 of this Section. Single, two and three storey shall be as defined in NZS 3604:1999.

Building Type	Description	Ground Floor External walls	Second Storey External Walls	Third Storey External Walls
Α	Single storey	Light		
В	Single storey	Heavy		
C	Two Storey	Light	Light	
D	Two Storey	Heavy	Light	
E	Three Storey	Heavy	Light	Light

Table 1: Building Identifier

3.5 Foundation soils

The system shall be used when the supporting ground meets the definitions of "good ground" given in Section 3 of NZS 3604:1999, except that the ultimate bearing capacity shall be as given in Table 2 below. However, the systems shall not be used for damp sites i.e. where it can be reasonably expected that the ground water level could come within 600mm of the underside of the system. The acceptability of the ground shall be verified in accordance with Clause 3.1.3 of NZS 3604:1999.

Politica Tona	Ultimate Bearing Capacity (kPa) for:			
Building Type	1.5 kPa Live Load	3.0 kPa Live Load		
A	150	150		
В	150	180		
С	150	180		
D	210	240		
E	270	300		

Table 2: Minimum Ultimate Bearing Capacity

The ultimate bearing capacity required of the supporting ground shall be verified with by Scala Penetrometer testing in accordance with Clause 3.3 of NZS 3604:1999. Where the required bearing capacity differs from 300kPa, the bearing capacity shall be verified when the number of blows per 300mm depth of penetration below the underside of the system at each test site, exceeds the values given in Table 3 below

Min. blows per 300mm depth	Bearing Capacity (kPa)
6	150
7	180
8	210
9	240
10	270

Table 3: Scala Penetrometer Blows Required For Determining Ultimate Bearing Capacity

3.6 Flow Diagrams

The flow diagrams on the following pages (adapted from NZS 3604:1999) will help in determining whether the non-specific details for the system can be used for the purposes of the concrete floor slab construction. There are two checks in the process. The first is to determine whether the proposed building complies with the requirements set out in this Manual (Building Check), and the second is to determine whether the site complies with the requirements set out in this Manual (Site Check).

(Note: NZS 3604:1999 provides for parts of buildings to be considered as individual buildings. These flow diagrams apply to those parts of the building where slab on ground is being considered and where the part of the building can be considered as an individual building under NZS 3604:1999).

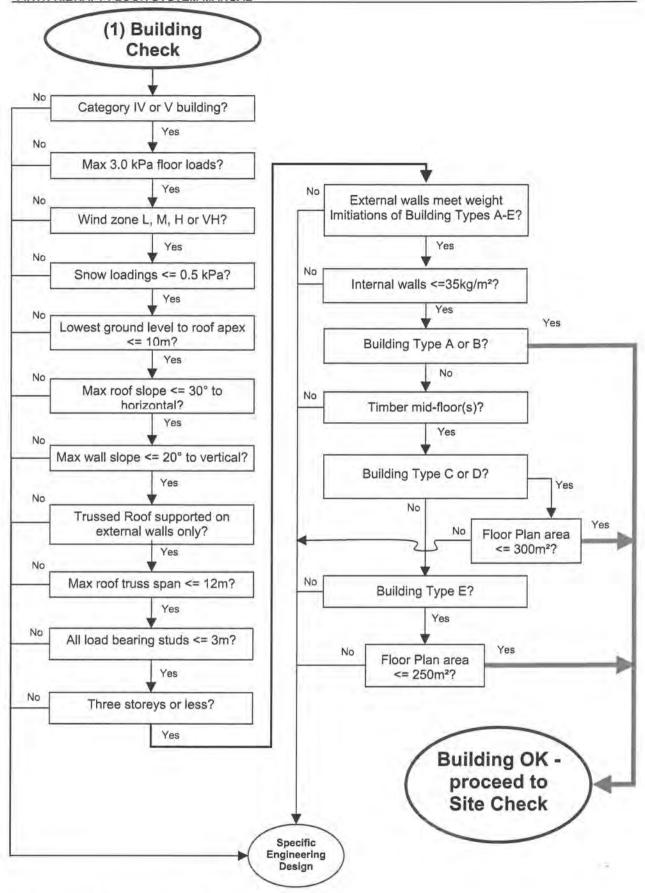


Figure 1: Building Check Flow Diagram

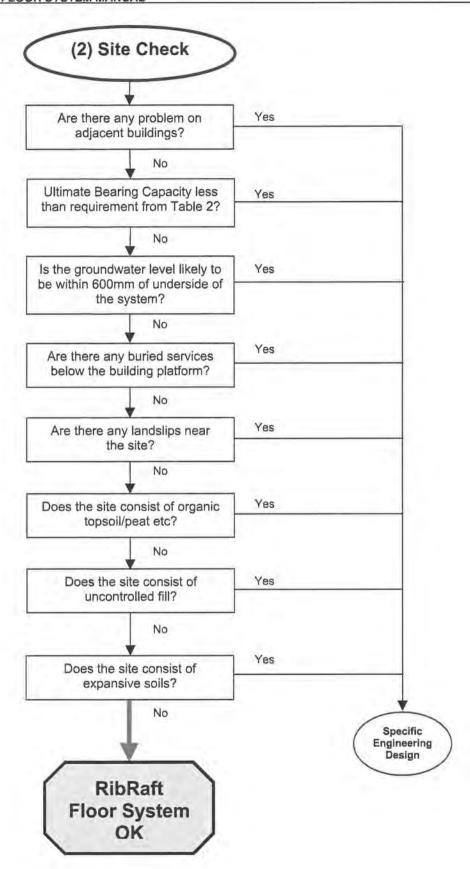


Figure 2: Site Check Flow Diagram

4 CONSTRUCTION DETAILS

Standard construction details for the system are provided here for buildings that fall within the above scope.

4.1 Pod Layout

Firth polystyrene pods (1100x1100x220mm thick) shall be placed on levelled ground and arranged in a waffle pattern. The pods are used as void formers while the concrete is curing. Once the concrete cures, the pods do not add to the structural performance.

Pods shall be placed so as to provide the necessary spacing between the edge beams and ribs as described below. The first rib out from the edge beam shall have a maximum clear separation of 1100mm however in all other cases the centre to centre distance between the ribs, whether they are 100mm or 300mm wide, shall be 1200mm. In the case of 100mm ribs this centre to centre spacing is achieved by the 1100mm square pods however between 100mm and 300mm ribs, or between two 300mm ribs, the pods shall be cut down to suit. Pods may be cut down to size but never added to, where this is necessary to suit the building layout or orientation of beams and ribs.

Figure 3 below shows a typical layout of the pods and ribs. Note the part pods around the edge, where the building shape dictates, and adjacent to the 300mm rib.

Firth suggests that when drawing the building plan, the location of any loadbearing walls be identified first. This establishes the location of the 300mm wide ribs. A generic RibRaft grid (100mm wide ribs at 1200mm centres) can then be laid out on the plan and the location of the pods can then be confirmed. A common approach is to use a corner of the building as a starting point. Ribs can be used at less than 1200mm centres, however it is more cost effective to use the 1200mm centres wherever practicable.

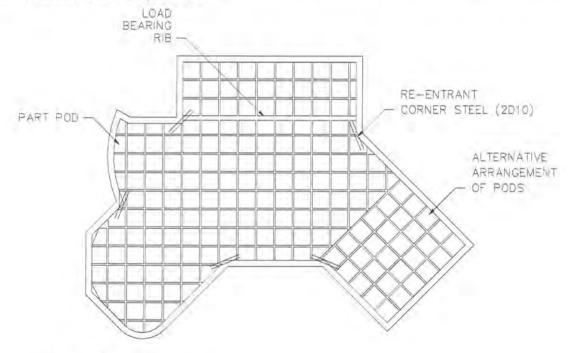


Figure 3: Typical RibRaft Plan

4.2 Edge Beam Width and Reinforcement

Edge beams around the perimeter of the floor slab shall be 300mm to provide bearing capacity for external load bearing walls, and contain 2-HD12 bars (Grade 430) as bottom steel and 1-HD12 bar (Grade 430) in the top. Refer Figure 4, below for construction details. The edge beam shall be rebated for brick veneers where necessary as shown in Figure 4(C).

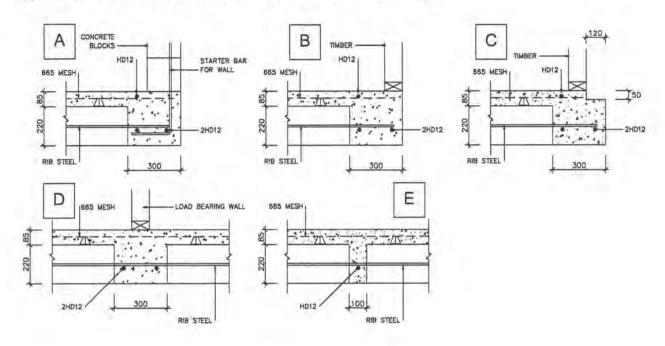


Figure 4: Standard RibRaft Construction Details

4.3 Internal Ribs Width and Reinforcement

Each standard internal rib shall be 100mm wide and shall contain 1-HD12 steel bar (Grade 430) held in place by a Firth spacer. For all loadbearing walls, the pods shall be cut to create a 300mm wide rib directly under the loadbearing wall, with 2-HD12 (Grade 430) steel bars as bottom steel. Figures 4(D) & (E) show construction details for standard ribs and ribs under loadbearing walls. Where the ribs meet at other than right angles, the reinforcement from each rib shall be bent into the adjacent rib and tied together. The reinforcement shall lap for at least 480mm.

4.4 Mesh reinforcement

The entire floor slab shall be reinforced with 665 steel mesh supported on 40mm mesh chairs sitting on the polystyrene pods.

4.5 Re-entrant Corners

In order to limit cracking at the re-entrant, or internal corners, extra steel shall be placed on top of the mesh. These shall be 2-D10 bars (Grade 300), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover from the internal corner - refer Figure 3 above.

5 LATERAL RESISTANCE

Unlike conventional foundation systems, the Firth RibRaft system is not embedded into the ground. Sliding resistance to horizontal seismic and wind loads is provided primarily by frictional contact with the soil. Depending on the seismic or wind zone and the weight of the building elements this frictional resistance may not be sufficient on its own, and specific shear keys may be required.

To determine if shear keys are required the system's lateral resistance shall be checked firstly for seismic loads in accordance with Clause 5.1 and secondly for wind loads in accordance with Clause 5.2.

For the purposes of this Manual, the ground shall be classified as clay or sand according to the following descriptions:

Clay: retains shape when moulded under hand pressure; may stick to boots and hands; cracks and becomes hard, but retains shape, when dried in direct sunlight; and when dug with a spade the cut vertical surface stands.

Sand: Individual particles visible to the unaided eye; when dry will run through the fingers and forms a conical mound if poured; when moist quickly dries out under direct sunlight, and when dug with a spade the vertical surface does not stand for long.

5.1 Seismic Resistance

To determine the required number of shear keys, follow the two steps below:

Step 1: From Figure 5 below (from NZS 3604:1999) determine the seismic zone for the building,

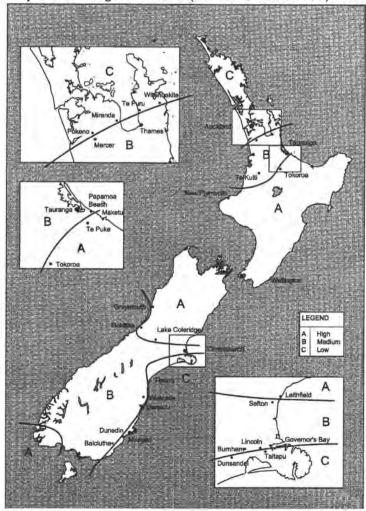


Figure 5: Seismic zones

Step 2: From the Tables below determine the number of shear key piles required based on the soil type supporting the system.

	Seismic Zone A				Seismic	Zone B	Seismic	Zone C
Building Type	Roof Type	Sand	Clay	Sand	Clay	Sand	Clay	
Α	Light	6	8	3	4	4	-	
Α	Heavy	7	8	4	4	- T/4-01 -1		
В	Light	10	12	5	6		1	
В	Heavy	11	13	6	7	- 1 -	- 1	
С	Light	9	11	5	6	F 160 H	1	
С	Heavy	10	11	5	6		1	
D	Light	13	15	7	8	1	1	
D	Heavy	13	16	7	8	_ 1	_ 1	
E	Light	15	18	8	9	1	1	
E	Heavy	16	19	8	10	1	1	

Table 4: Number of Shear Key Piles per 100 m² of ground floor area for 1.5kPa live load

		Seismic Zone A	Seismic Zone B		Seismic Zone C		
Building Type	Roof Type	Sand	Clay	Sand	Clay	Sand	Clay
Α	Light	7	8	4	4		-
Α	Heavy	8	9	4	5		-
В	Light	11	13	6	7	1	1
В	Heavy	11	13	6	7	1	1
С	Light	10	12	4	6		1
С	Heavy	11	13	5	7	11	1
D	Light	14	16	6	9	1	1
D	Heavy	14	17	7	9	1	1
E	Light	16	19	9	10	1	1
E	Heavy	17	20	9	11	-1	1

Table 5: Number of Shear Key Piles per 100 m² of ground floor area for 3.0 kPa Live Load

5.2 Wind Resistance

The building's bracing demand from wind loading shall be assessed from Section 5 of NZS 3604:1999 for both directions (i.e. along and across the building). The bracing capacity of the system must exceed the greater of the bracing demands determined.

The bracing capacity of the system shall be determined as the sum of the bracing capacity provided by frictional resistance (i.e. friction between the system and the ground) and the bracing capacity provided by the shear keys (if any) necessary to meet the requirements of Clause 5.1.

The bracing capacity provided by frictional resistance shall be determined from Table 6 depending on the Building Type, roof weight, and floor live loading.

The bracing capacity provided by the shear keys shall be sum of the bracing capacity of the individual shear keys determined as follows. If the shear key is in clay, each shear key shall be considered to contribute 170 BU's. If the shear key is in sand, each shear key shall be considered to contribute 200 BU's

If the bracing capacity of the system, determined from the frictional resistance and the shear keys as described above, is less than the bracing demand further shear keys shall be added until the bracing demand is met.

Dullding Tons	Doof Toma	BU's provided per 100m² for live loading of		
Building Type	Roof Type	1.5kPa	3.0kPa	
Α	Light	1150	1267	
Α	Heavy	1267	1383	
В	Light	1800	1917	
В	Heavy	1917	2033	
C	Light	1617	1833	
С	Heavy	1717	1950	
D	Light	2267	2483	
D	Heavy	2367	2600	
E	Light	2717	2933	
E	Heavy	2833	3050	

Table 6: Bracing Capacity provided by Frictional Resistance per 100 m² of ground floor area

5.3 Shear Keys

Shear key piles required by Clauses 5.1 and 5.2 must be uniformly distributed around the perimeter of the building, and be located at the edge beam/internal rib junction. Where a shear key is required, the minimum number of shear keys shall be two per floor plan.

Construction details of the shear keys shall be as shown on Figure 6 below. Shear keys shall be a minimum of 900mm long. The holes shall be over-drilled at least 100mm and a polystyrene RibRaft Shear Key Support placed into the bottom of each hole. This will support only the plastic (wet) concrete and then allow movement of the shear key if settlement of the supporting ground occurs. The effective end bearing of the shear keys is therefore eliminated.

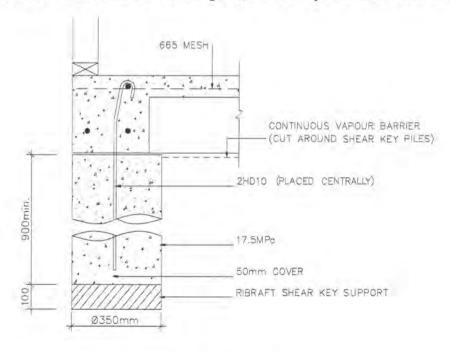


Figure 6: Shear Key Pile Construction Details

6 OTHER DESIGN DETAILS

6.1 Shrinkage Control

Shrinkage control joints shall be installed in exactly the same manner and locations as would be required for a conventional slab on ground. The joints shall be installed as per Section 7 of NZS 3604:1999.

Supplementary reinforcing using 2-D10 bars (Grade 300) shall be used at all re-entrant corners as shown on Figure 3. These bars shall be 1200mm long, 200mm apart, tied to the top of the mesh, with 50mm cover and shall not be placed across any shrinkage control joints.

6.2 Services Detailing

Ideally, services ducts shall be conveyed underground to their plan location then brought up through the polystyrene pod and 85mm thick concrete floor slab, but this may not always be possible. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. The maximum diameter of the services (excluding the sleeve - see below) shall be as follows:

Through the slab:
Through edge beam:
Through 300mm internal ribs:
Through 100mm internal ribs:

110mm vertically but **nil** horizontally and vertically 50mm both horizontally and vertically 50mm horizontally but **nil** vertically

Any services crossing ribs or the edge beam (either horizontally or vertically) shall be placed only within the middle third of the member. At no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the ribs. The pods shall be cut to allow for this and if necessary, the spacing of the ribs shall be decreased locally. There shall be 600mm minimum spacing in each direction between penetrations through the system.

At all locations where services pass through the system, they shall be placed centrally within a sleeve 50mm greater in diameter than the service duct/pipe. This is to allow seismic tolerances to prevent shearing of the services during a seismic event. Where the services pass through the top of the system, the sleeves shall be sealed with Denso tape and a type of easily compressible foam, or similar, to prevent materials entering the subfloor cavities.

END OF SECTION 1

SECTION 2



FIRTH RIBRAFT FLOOR SYSTEM INSTALLATION INFORMATION

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	GENERAL TEMPORARY EXCAVATIONS SURFACE WATER NSTALLATION PROCEDURE SITE PREPARATION EARTHWORKS SHEAR KEYS PLUMBING AND SERVICES SAND BLINDING DAMP PROOF MEMBRANE EDGE FORMWORK LAYING THE PODS AND SPACERS REINFORCING STEEL 9.1 Edge Beam Steel 9.2 Rib Steel 9.3 Mesh Reinforcing 9.4 Re-Entrant Corner Steel CONCRETE INSTALLATION 10.1 Placing 10.2 Finishing 10.3 Curing SHRINKAGE CONTROL JOINTS REMOVAL OF FORMWORK BRICK VENEER LANDSCAPING/PAVING

1 GENERAL

This Section details the non-specific installation information required for the Firth RibRaft Floor System (the system). Full information on the non-specific details and design procedures, and requirements for the site assessment are described in Section 1 of this Manual (Design Information).

2 SITE REQUIREMENTS

2.1 General

The site requirements of this Manual are concerned solely with the soil conditions under or immediately adjacent to the system. If a site does not comply with this Manual, the system shall be subject to specific design.

This Section shall only apply for building sites such that:

- the ground is as specified in the Section 1 of this Manual;
- any system erected at the top of a slope (whether fill or natural ground) shall be located as shown in Figure 1 so that the finished ground is always outside the dashed line shown. (The vertical distance, V, shall be measured to 50mm below the underside of the slab).

Where the finished ground does not comply with Figure 1, the slope shall be retained by a specifically designed retaining wall.

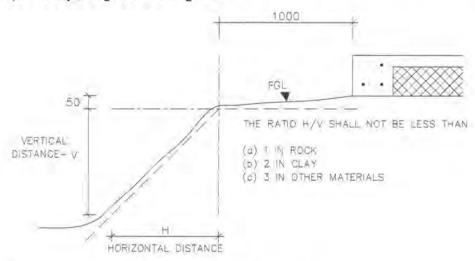


Figure 1: Relationship of RibRaft to Sloping Ground Surface

2.2 Temporary Excavations

No excavation shall take place at a location or in a manner where the stability of the foundation material is likely to be compromised. The backfilled material shall match the compaction and strength of, and have similar properties to, the surrounding material. The sides of the excavation shall be propped as necessary.

Temporary excavations shall be open for no longer than 48 hours and shall take place only above the critical depth line as shown on Figure 2. Should temporary excavations be required below this line, specific engineering design is required.

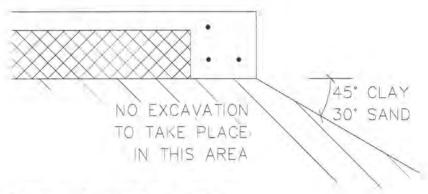


Figure 2: Temporary Excavation Limits

2.3 Surface water

Surface water from the site shall not flow across the slab platform. For example, on cut and fill sites the ground uphill from the system shall be graded to direct any surface run-off away from the system as shown in Figure 3.

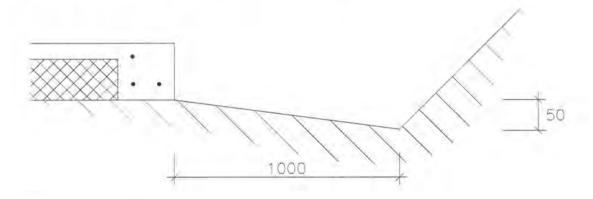


Figure 3: Site Grading

3 INSTALLATION PROCEDURE

3.1 Site Preparation

All vegetation, topsoil and other organic or deleterious material shall be removed from the area to be covered by the building (formation area) prior to commencing construction of the system.

3.2 Earthworks

The formation area shall be cut or filled to a level approximately 330mm below finished floor level. Where fill is required to achieve this level, the fill shall be certified by a geotechnical engineer (outside the scope of this Manual) or shall be in accordance with Clause 7.5.3 of NZS 3604:1999 "Timber Framed Buildings".

The formation area shall also extend a minimum of 1000mm beyond the slab perimeter as shown in Figure 4 below. The installer shall confirm the acceptability of the ground over the entire building platform before proceeding with the construction. Refer to Clause 3.5 of Section 1 (Design Information) for requirements.

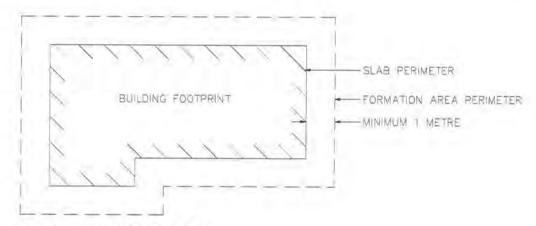


Figure 4: Plan of Formation Area

3.3 Shear Keys

Where shear keys are required, the holes shall be drilled following the site clearing and earthworks, in accordance with Clause 4 below, and prior to the construction of the system commencing.

3.4 Plumbing and Services

Any plumbing and services required beneath the system shall be conveyed underground to their plan location then brought up through the system. The trenching, placing, and bedding of the pipes/ducts and the backfilling of the trenches shall conform to the requirements of the consent documentation. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. The maximum diameters of the services/ducts shall be as dictated in Section 1.

Where required, the services shall be installed by removing unnecessary polystyrene and placing pipes within the pod depth. All pipes shall be held firmly in place and have temporary end covers. Any services crossing ribs or the edge beam (either horizontally or vertically) shall be placed only within the middle third of the member. At no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the ribs. The pods shall be cut to allow for this and if necessary, the spacing of the ribs shall be decreased locally. There shall be 600mm minimum spacing in each direction between penetrations through the system.

At all locations where services pass through the system, they shall be placed centrally within a sleeve 50mm greater in diameter than the service duct/pipe. This is to allow seismic tolerances to prevent shearing of the services during a seismic event. Where the services pass through the top of the system, the ducts shall be sealed with Denso tape and a type of easily compressible foam, or similar, to prevent materials entering the subfloor cavities.

3.5 Sand Blinding

A layer of sand shall be placed, screeded and compacted over the building platform, extending to at least 500mm beyond the system perimeter - refer Figure 5. The maximum thickness of this blinding layer shall be 50mm. The surface shall be level and a minimum of 305mm below finished floor level. A small plate compactor, vibrating roller or similar, should be used to compact the sand blinding layer. The sand is required to be level to ensure that pods remain stable throughout the installation of the slab.

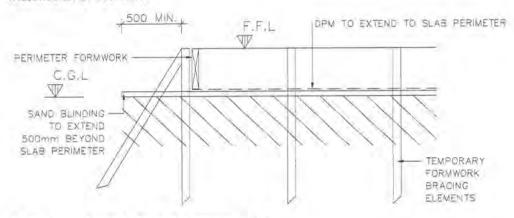


Figure 5: Sand Blinding/DPM/Formwork Details

3.6 Damp Proof Membrane

The damp proof membrane (DPM) material shall be in accordance with NZS 3604:1999. The DPM shall be laid over the entire building platform on top of the sand blinding layer, extending to the outside of the edge beam - refer Figure 5 above. The joints shall be lapped not less than 150mm and sealed with pressure sensitive tape. All penetrations of the DPM by plumbing and services shall also be sealed with pressure sensitive tape.

The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork. The installer shall ensure a square and tidy finish at the underside and at all corners of the edge beam.

3.7 Edge Formwork

The edge formwork shall be constructed ensuring that the requirements of NZS 3109:1997 "Concrete Construction" are adhered to. The formwork shall be adequately supported and braced to prevent any buckling or warping. If the wall is to be constructed in brick veneer, formwork for a brick veneer rebate should be adequately fixed to the perimeter formwork.

Thorough cleaning of re-useable formwork and the use of release agents enhances the life and performance of formwork and maintains a quality surface finish.

3.8 Laying the Pods and Spacers

The Firth polystyrene pods shall be laid out over the DPM in a regular waffle pattern. The Firth 300mm spacers for the edge beam shall be placed at a maximum of 1200mm centres along the perimeter of the slab and one per pod or part pod. Except where there is a loadbearing wall, each

pod or part pod shall be separated by 100mm from the adjacent pod or part pod, using a minimum of one Firth 100mm spacer in each direction. Ribs supporting a loadbearing wall shall be formed using the Firth 300mm spacer.

The ribs in both directions shall form a waffle pattern throughout the slab. Except where a 300mm wide rib is required, the pods shall always be separated by 100mm. Figure 6 below shows a detailed layout of the pods and spacers.

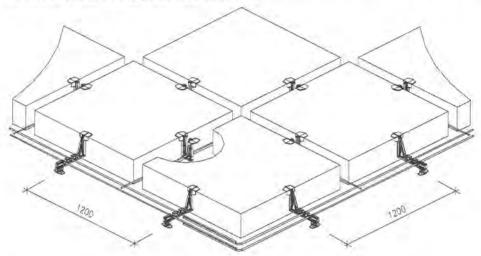


Figure 6: Detailed Layout of Pods and Spacers (mesh and top steel omitted for clarity)

Where the shape of the house plan dictates, it may be more practical to consider the floor to be made up of different segments. The pods in each segment shall be in a regular waffle pattern - refer right hand side of Figure 7 below. Where these segments meet, the pods shall be cut to suit and the ribs made to join. The non right-angle rib junctions created by this approach are acceptable.

Alternatively, it is also acceptable to keep the orientation of the pods constant throughout the plan and have non right-angle junctions between the ribs and edge beam - refer left hand side of Figure 7 below.

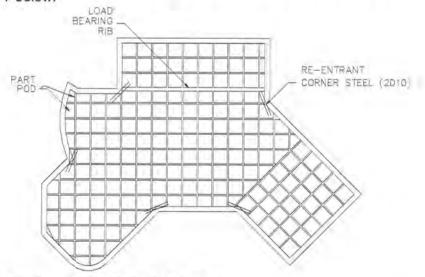


Figure 7: Typical Pod and Rib Layout

As can be seen from Figure 7, it is not necessary for the pods to line up perfectly with the edge beam. It is acceptable to cut the pods (i.e. use part pods) where the building layout dictates.

3.9 Reinforcing Steel

All reinforcing steel shall conform to NZS 3402:1989 "Steel Bars for the Reinforcement of Concrete". All steel shall be of deformed type. All bends shall be made cold without fracture. Welded lap joints are not permitted. All welded mesh fabric reinforcing shall conform to NZS 3422:1975 "Welded Fabric of Drawn Steel Wire for Concrete Reinforcement". Figure 10 shows the detailed layout of the spacers and the steel in the edge beam and the standard ribs.

3.9.1 Edge Beam Steel

Two edge beam reinforcing bars shall be placed in the bottom of the edge beam and supported in the correct position by the Firth spacers, as shown in Figure 10. One edge beam bar shall be tied above the mesh at the perimeter of the area covered by the polystyrene pods as shown in Figure 10. All steel shall be lapped a minimum of 40 bar diameters (480mm for 12mm steel). Tying of the edge beam steel is only required at corners. Figure 8 shows the two acceptable types of layouts for the corner steel.

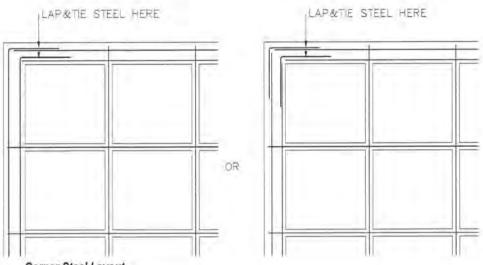


Figure 8: Corner Steel Layout

3.9.2 Rib Steel

Rib reinforcing steel shall be placed in the bottom of the internal ribs and supported in the correct position by the Firth spacers. Figure 9 shows the detail of the Firth spacers, and Figure 10 shows a detailed section identifying how the steel is located in the spacers. The 300mm spacer shall be used for the 300mm wide internal ribs.

All steel shall be lapped a minimum of 480mm. At the junction with the edge beam, each rib steel bar shall sit on top of the edge beam bars, and extend to the outermost bar. The 75mm cover to the edge of the beam shall still be allowed for. One HD12 bar shall be placed in each 100mm wide rib and two HD12 bars shall be placed in each 300mm wide rib.

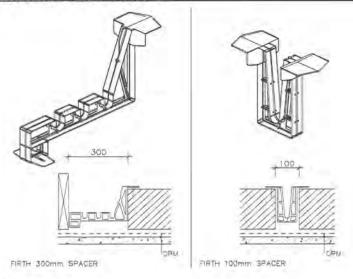


Figure 9: Spacer Details

3.9.3 Mesh Reinforcing

665 mesh reinforcing shall be placed over the pods and supported on 40mm mesh chairs spaced at a minimum of 1200mm centres, with at least two mesh chairs placed per pod and at least one per part pod. The mesh shall be lapped 225mm minimum and tied at all laps.

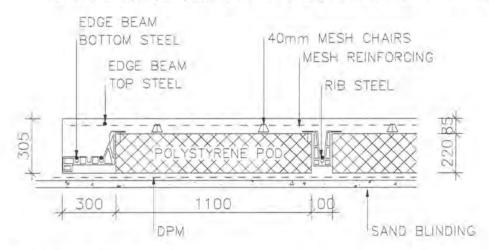


Figure 10: Detailed Section

3.9.4 Re-Entrant Corner Steel

Two D10 bars, 1200mm long shall be placed across the corner, tied to the top of the mesh at re-entrant corners at 200mm centres, with 50mm cover from the internal corner as detailed in Figure 7 (this steel is to control cracking at this potential weak point).

3.10 Concrete Installation

Concrete placing, finishing and curing shall be in accordance with NZS 3109:1997, Clause 7.

3.10.1 Placing

Only Firth Raftmix or Raftmix Pump concrete shall be used in the floor. These two different concrete mixes shall be used in the following instances:

- Raftmix For placement in the floor directly from the concrete truck chute.
- Raftmix Pump For placement in the floor by concrete pump.

The concrete shall be poured in such a way to ensure that the pods remain in position during placing (Firth recommends that small amounts of concrete be placed on top of the pods prior to the ribs being filled). The concrete shall be compacted with the use of an immersion vibrator around all steel and into all corners of the formwork.

3.10.2 Finishing

Screeding with the aid of a level shall commence immediately after compaction. Unless specifically installed as a screeding datum, the top of the formwork shall not be assumed as level and thus shall not be used for screeding purposes. Final finishing with a trowel shall take place after all the bleed water has evaporated. Edge of slab and rebates shall be tooled to prevent chipping of top of slab. The surface shall be a blemish free surface to class U3 finish (refer NZS 3114:1987 "Specification for Concrete Finishes").

3.10.3 Curing

Proper curing of the concrete must take place immediately after finishing the concrete. One of the following methods of curing is recommended:

- Ponding or continuous sprinkling of water.
- Placing a wet covering or plastic membrane over the slab
- The use of liquid membrane curing compounds.

3.11 Shrinkage Control Joints

Shrinkage control joints shall be installed in exactly the same manner and locations as would be required for a conventional slab on ground. The joints shall be cut to a depth of 25mm and shall be cut no later than 24 hours in summer, or 48 hours in winter, after the concrete is placed. Shrinkage control joints shall be installed in accordance with Clause 7.5.8.6.4 of NZS 3604:1999.

3.12 Removal of Formwork

The formwork shall not be removed prior to 12 hours after the slab has been finished. No installation loads are to be placed on the slab before adequate curing has taken place.

3.13 Brick Veneer

Where the building is to be clad with brick veneer, the rebate in the edge beam shall be waterproofed with a bituminous sealer due to the possibility of ponding of water. Firth recommends a Flintcote® or equivalent coating on both the vertical and horizontal faces of the rebate.

3.14 Landscaping/Paving

Landscaping and/or paving adjacent to the slab shall be kept the minimum required distance below FFL, as per the requirements of NZS 3604:1999. The landscaping shall allow for large trees to be kept sufficiently away from the edge of the slab. This is to prevent the tree roots from disturbing the soil moisture conditions under the slab. As a guide, trees should be as far away from the edge of the slab as they are tall.

3.15 Ongoing Maintenance

The building owner shall ensure that the ground surrounding the system be maintained so that the integrity of the system is not jeopardised. In other words, at no time shall the ground immediately adjacent to system be allowed to settle away to expose the underside of the slab.

This can also be ensured by maintaining the landscaping or providing a paved surface or similar around the edge of the building.

4 SHEAR KEYS

Shear keys shall be provided to conform to the requirements of Section 1 of this Manual.

Holes for the shear keys shall be drilled at least 1000mm deep. Into the bottom of each hole a RibRaft Shear Key Support shall be placed. Every precaution shall be taken to ensure that the shear key support is laid level and at the base of the hole. The minimum depth of concrete placed on the support shall be 900mm.

The connection steel (2HD10) shall be secured in place and held during pouring to ensure the bars are correctly located. The concrete for the shear keys shall be placed separately to the rest of the floor and shall be finished level to the top of the sand blinding layer.

The top surface of the shear key shall be finished rough to ensure a good join to the Raftmix concrete in the system and the DPM shall be neatly cut around the shear keys.

END OF SECTION 2





Firth Industries' RibRaft Floor System is accredited by the Building Industry Authority as complying with certain provisions of the New Zealand Building Code. The Authority's accreditation is hindfloor on territorial authorities and huilding portion.



BRANZ Appraised

Appraisal No.633 [2009]

BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL No. 633 (2009)

GRAPHEX CAVITY SYSTEM

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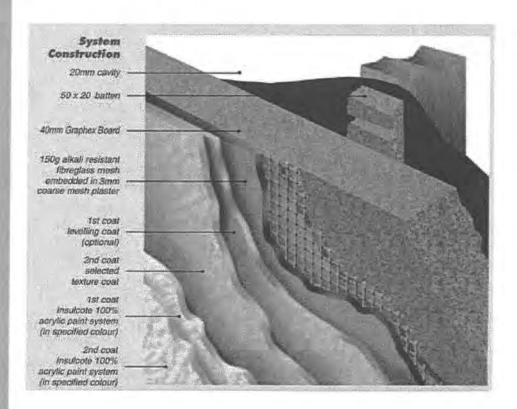


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Product

- 1.1 The Graphex Cavity System is a cavity-based Exterior Insulation and Finishing System (EIFS) wall cladding. It is an external wall cladding system for residential and light commercial type buildings where domestic construction techniques are used.
- 1.2 The system consists of Neopor®, a graphite composite board fixed over polystyrene battens to form the cavity. The plaster coating system consists of a 3-4 mm thickness of fibreglass mesh reinforced, polymer-modified, cement-based plaster, which is finished with a cement-based finishing plaster that is then painted with a 100% acrylic-based paint system. The chosen finishing plaster is applied to give a range of different appearances, such as a sponge, patterned, adobe or spray textured finish.
- 1.3 The system incorporates a primary and secondary means of weather resistance (first and second line of defence) against water penetration by separating the cladding from the external wall framing with a nominal 20 mm drained cavity.



Scope

- 2.1 The Graphex Cavity System has been appraised as an external wall cladding system for buildings within the following scope:
- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- · constructed with timber framing complying with the NZBC; and,
- with a risk score of 0-20, calculated in accordance with NZBC Acceptable Solution E2/ AS1, Table 2; and,
- · situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.
- 2.2 The Graphex Cavity System has also been appraised for weathertightness and structural wind loading when used for timber and steel framed buildings subject to specific design up to a design differential ultimate limit state (ULS) wind pressure of 2.5 kPa.
- 2.3 The Graphex Cavity System must only be installed on vertical surfaces (except for tops of parapets, sills and balustrades, which must have a minimum 15° slope and be waterproofed in accordance with the Technical Literature).
- 2.4 The system is appraised for use with aluminium window and door joinery that is installed with vertical jambs and horizontal heads and sills. (The Appraisal of the Graphex Cavity System relies on the joinery meeting the requirements of NZS 4211 for the relevant Building Wind Zone or wind pressure.)
- 2.5 Installation of components and accessories supplied by PSL and approved installers must be carried out only by PSL approved installers.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the Graphex Cavity System if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet or contribute to meeting the following provisions of the NZBC:

Clause B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. The Graphex Cavity System meets the requirements for loads arising from self-weight, wind, impact and creep [i.e. B1.3.3 (a), (h), (j) and (q)]. See Paragraphs 10.1 - 10.4.

Clause B2 DURABILITY: Performance B2.3.1 (b), 15 years, B2.3.1 (c), 5 years and B2.3.2. The Graphex Cavity System meets these requirements, See Paragraphs 11.1 and 11.2.

Clause C3 SPREAD OF FIRE: Performance C3.3.5. The Graphex Cavity System meets this requirement. See Paragraphs 14.1 - 14.3.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. The Graphex Cavity System meets this requirement. See Paragraphs 16.1 - 16.5.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Graphex Cavity System meets this requirement and will not present a health hazard to people.

3.2 This is an Appraisal of an Alternative Solution in terms of New Zealand Building Code compliance.

Technical Specification

4.1 System components and accessories supplied by PSL are as follows:

Cavity Battens

 Graphex peel 'n' stick battens are manufactured from high density (Class H) expanded polystyrene (EPS) with an approximate density of 24 kg/m³. The battens are 21 mm thick by 45 mm wide and have a slotted face to allow air movement. The battens are coated on the back face with an acrylic adhesive, which is protected prior to installation by a removable film.

Neopor®

 Neopor® boards are 40 or 60 mm thick with an approximate density of 24 kg/m³. The boards are supplied in lengths ranging from 2.4 to 3.6 m x 1.2 m wide and are manufactured to meet the requirements of AS 1366 Part 3.

Plasters

- Coarse Mesh Render is a polymer-modified, Portland cement-based plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is applied as the base coat in a minimum 2 mm layer followed by the embedment of fibreglass mesh reinforcement in the outer surface. Coarse Mesh Render can also be used to achieve a spray textured finish.
- Ezytex is a polymer-modified, Portland cement-based finishing plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is available in three grades to provide a textured, patterned or sponge finish.

Paint System Specification

At least two coats of a 100% acrylic-based exterior paint
must be used over the finishing plasters to make the system
weathertight and give the desired finish colour to exterior
walls. Insulcote is a 100% acrylic-based exterior paint
formulated for use over cement-based plasters and can be
used over Coarse Mesh Render and Ezytex finishing plasters.
Insulcote is supplied in 4 litre, 10 litre and 20 litre pails.

 PSL allows the use of other latex exterior paint systems over Coarse Mesh Render and Ezytex finishing plasters. A latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730 must be used over the finishing plasters to make the system weathertight and give the desired finish colour to exterior walls. Paint colours must have a light reflectance value of 40% minimum regardless of gloss value. Proprietary paint systems not supplied by PSL have not been assessed and are therefore outside the scope of this Appraisal.

Accessories

- Reinforcing mesh alkali-resistant fibreglass mesh with a nominal mesh size of approximately 4 mm square and a weight of 150 g/m² for use in domestic and light commercial situations. Where a greater level of impact resistance is required, 360 g/m² alkali-resistant fibreglass mesh with a nominal mesh size of approximately 3 mm square is available.
- uPVC components sill flashing, jamb flashing and head flashing, base caps, corner beads, cavity vent strip, Z-flashing and horizontal and vertical control joint flashings.
- Neopor® board fixings (timber frame) 90 x 3.6 mm (for 40 mm thick) and 110 x 4.0 mm (for 60 mm thick) hotdipped galvanised flat head nails with 22 or 40 mm diameter washers.
- Neopor® board fixings (steel frame) 8-gauge x 75 mm (for 40 mm thick) and 8-gauge x 95 mm (for 60 mm thick) self-drilling AS 3566 Corrosion Class 3 or 4 screws in NZS 3604 defined Corrosion Zones, 1, 2, 3 and 4 and Grade 304 stainless steel screws in the sea spray zone with 40 mm diameter washers.
- · Washers 22 or 40 mm diameter polypropylene washers.
- 4.2 Accessories used with the system which are supplied by the approved applicator are:
- Waterproof membrane tapes tapes covered by a valid BRANZ Appraisal for use as waterproofing membranes over tops of plastered parapets, balustrades, fixing blocks and the like.
- Flexible sealant sealant complying with NZBC Acceptable Solution E2/AS1, or sealant covered by a valid BRANZ Appraisal for use as a weather sealing sealant for exterior use.
- Adhesive EPS compatible adhesive for gluing uPVC components to the Neopor® boards as and where required.
- 4.3 Accessories used with the system which are supplied by the building contractor are:
- Building wrap paper or wrap complying with NZBC Acceptable Solution E2/AS1 Table 23, or breather-type membranes covered by a valid BRANZ Appraisal for use as wall wraps.
- Building wrap support polypropylene strap for securing the building wrap in place and preventing bulging of the bulk insulation into the drainage cavity where cavity battens are installed at greater than 450 mm centres. (Note: additional vertical battens may also be installed to provide support.)
- Flexible sill and jamb flashing tapes flexible flashing tapes complying with NZBC Acceptable Solution E2/AS1 Paragraph 4.3.11, or flexible flashing tapes covered by a valid BRANZ Appraisal for use around window and door joinery openings.
- Window and door trim cavity airseal air seals complying with NZBC Acceptable Solution E2/AS1 Paragraph 9.1.6, or self-expanding, moisture cure polyurethane foam air seals covered by a valid BRANZ Appraisal for use around window, door and other wall penetration openings.

Handling and Storage

- 5.1 Handling and storage of all materials supplied by PSL or the approved installer, whether on or off site, are under the control of PSL approved installers. Dry storage must be provided on site for the fibreglass mesh and bags of plaster. Neopor® boards, battens, uPVC flashings and profiles must be protected from direct sunlight and physical damage, and should be stored flat and under cover. Liquid components must be stored in frost-free conditions.
- 5.2 Handling and storage of all materials supplied by the building contractor, whether on or off site, are under the control of the building contractor. Materials must be handled and stored in accordance with the relevant manufacturer's instructions.

Technical Literature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Graphex Cavity System. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed. The Graphex Cavity System listing on the BRANZ website excludes specific details. These details are outside the scope of this Appraisal.

Design Information

Framing

Timber Treatment

7.1 Timber wall framing behind the Graphex Cavity System must be treated as required by NZS 3602.

Timber Framing

- 7.2 Timber framing must comply with NZS 3604 for buildings or parts of buildings within the scope limitations of NZS 3604. Buildings or parts of buildings outside the scope of NZS 3604 must be to a specific design in accordance with NZS 3603 and AS/NZS 1170. Where specific design is required, the framing must be of at least equivalent stiffness to the framing provisions of NZS 3604. In all cases studs must be at maximum 600 mm centres for buildings designed to NZS 3604 and at maximum 400 mm centres for specifically designed buildings situated in Building Wind Zones above NZS 3604 defined 'Very High'. Dwangs must be fitted flush between the studs at maximum 800 mm centres.
- 7.3 Timber framing must have a maximum moisture content of 24% at the time of the cladding application. (If Neopor® boards are fixed to framing with a moisture content of greater than 24% problems may occur at a later date due to excessive timber shrinkage.)

Steel Framing

- 7.4 Steel framing must be to a specific design meeting the requirements of the NZBC.
- 7.5 The minimum framing specification is 'C' section studs and nogs of overall section size of 75 mm web and 32 mm flange. Steel thickness must be minimum 0.55 mm.
- 7.6 For steel framed buildings situated within NZS 3604 defined Building Wind Zones up to, and including, 'Very High', studs must be at maximum 600 mm centres. For all other buildings studs must be at maximum 400 mm centres. Dwangs must be fitted flush between the studs at maximum 800 mm centres.

Neopor® Board Setout

7.7 All vertical Neopor® board edges must be supported and fixed through the cavity battens to the framing. Horizontal board edges must be supported at fixing locations with cavity spacers in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.2(f). At the base of the wall, the Neopor® boards must hang 50 mm below the supporting framing.

7.8 Additional framing will be required at soffits, internal and external corners and window and door openings for the support and fixing of sheet edges.

General

- 8.1 When the Graphex Cavity System is used for specifically designed buildings up to 2.5 kPa design differential ULS wind pressure, only the weathertightness aspects of the cladding and maximum framing centres and sheet fixing centres are within the scope of this Appraisal. All other aspects of the building need to be specifically designed and are outside the scope of this Appraisal.
- 8.2 Openings in the cavity vent strip provide a minimum ventilation opening area of 1000 mm² per lineal metre of wall in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.3(b).
- 8.3 The ground clearance to finished floor levels as set out in NZS 3604 must be adhered to at all times. At ground level, paved surfaces, such as footpaths, must be kept clear of the bottom edge of the cladding system by a minimum of 100 mm, and unpaved surfaces by 175 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Table 18.
- 8.4 At balcony, deck or roof/wall junctions, the bottom edge of the Graphex Cavity System must be kept clear of any adjacent surface, or above the top surface of any adjacent roof flashing by a minimum of 35 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.3.6.
- 8.5 All buildings must have barriers to airflow in the form of interior linings with all joints stopped, or alternatively, unlined gables and walls must incorporate a rigid sheathing or an air barrier which meets the requirements of NZBC Acceptable Solution E2/AS1, Table 23. Where rigid sheathings are used, the fixing length must be increased by a minimum of the thickness of the sheathing.
- 8.6 Where penetrations through the Graphex Cavity System are wider than the cavity batten spacing, allowance must be made for airflow between adjacent cavities. A minimum 10 mm gap must be left between the bottom of the vertical cavity batten and the flashing to the opening.
- 8.7 Where the system abuts other cladding systems, designers must detail the junction to meet their own requirements and the performance requirements of the NZBC. The Technical Literature provides some guidance. Details not included within the Technical Literature have not been assessed and are outside the scope of this Appraisal.

Electrical Cables

8.8 PVC sheathed electrical cables must be prevented from direct contact with the Neopor®. When cables must penetrate the Neopor® for exterior electrical connections, the cable must be directly supported by passing through an electrical conduit.

Control Joints

- 9.1 Control joints must be constructed in accordance with the Technical Literature, and be provided as follows:
- Horizontal control joints at maximum 6 m centres.

 Vertical control joints - at maximum 20 m centres; aligned with any control joint in the structural framing; where the system abuts different cladding types, or where the system covers different structural materials.

(Note: Horizontal and Vertical Control joints must be located over structural supports. The design of vertical control joints where the system abuts different cladding types is outside the scope of this Appraisal and is the responsibility of the designer - see Paragraph 8.7.)

Inter-storey Junctions

9.2 Inter-storey drained joints must be provided for walls over 2 storeys in height in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.9.4(b). Inter-storey junctions must be constructed in accordance with the Technical Literature.

(Note: Refer to Paragraph 14.2 for the requirements for barriers to vertical fire spread at inter-storey junctions for buildings of three or more floors.)

Structure

Mass

10.1 The mass of the Graphex Cavity System is approximately 7 kg/m², therefore it is considered a light wall cladding in terms of NZS 3604.

Impact Resistance

10.2 The system has adequate resistance to hard body impacts likely to be encountered in normal residential use. Where a greater level of impact protection is required a heavier grade of reinforcing mesh may be used. The heavy-grade fibreglass reinforcing mesh (360 g/m²) embedded in 5 mm thick plaster provides approximately 4 times the hard body impact strength of the standard grade mesh in 3 mm thick plaster. The likelihood of impact damage to the system when used in light commercial situations should be considered at the design stage, and appropriate protection such as the installation of bollards and barriers should be considered for vulnerable areas.

Wind Zones

10.3 The Graphex Cavity System is suitable for use in all Building Wind Zones of NZS 3604, up to, and including Very High where buildings are designed to meet the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 1.1, or up to 2.5 kPa design differential ULS wind pressure where buildings are specifically designed.

Neopor® Board Fixing

10.4 Neopor® boards must be fixed through the cavity battens and cavity spacers to the wall framing at maximum centres specified in Table 1.

Table 1: EPS Sheet Fixing Centres for Edges and Intermediate Studs

NZS 3604 Building Wind Zone with studs at maximum 600 mm centres	Maximum fixing centres (mm) beyond 1.5 m from an external corner	Maximum fixing centres (mm) within 1.5 m of an external corner
Low	300	300
Medium	300	200
High	300	150
Very High	300	150

Note: One fixing is also required into each dwang at mid-dwang length.

Note: In Low, Medium or High Building Wind Zones, 22 or 40 mm diameter washers may be used. In Very High Building Wind Zones, 40 mm diameter washers must be used.

	igned buildings up to 2.5 wind pressure with studs s.	
Maximum vertical fixing centres (mm) along studs	Maximum horizontal fixing centres (mm) along top and bottom plates	Maximum horizontal fixing centres (mm) along dwangs
150	200	150

Note: 40 mm diameter washers must be used in all situations.

Durability

11.1 The Graphex Cavity System meets code compliance with NZBC Clause B2.3.1 (b), 15 years for the cavity system and plaster finish, and code compliance with NZBC Clause B2.3.1 (c), 5 years for the exterior paint system.

Serviceable Life

11.2 The Graphex Cavity System is expected to have a serviceable life of at least 30 years provided the system is maintained in accordance with this Appraisal, and the Neopor® boards, fixings and plaster are continuously protected by a weathertight coating and remain dry in service.

Maintenance

- 12.1 Regular maintenance is essential to ensure the performance requirements of the NZBC are continually met and to ensure the maximum serviceability of the system.
- 12.2 Regular cleaning (at least annually) of the paint coating is required to remove grime, dirt and organic growth and to maximise the life and appearance of the coating. Grime may be removed by brushing with a soft brush, warm water and detergent. Paint systems must be recoated at approximately 5-10 yearly intervals in accordance with the paint manufacturer's instructions.
- 12.3 Annual inspections must be made to ensure that all aspects of the cladding system, including the coating system, plaster, flashings and any sealed joints remain in a weatherproof condition. Any cracks, damaged areas or areas showing signs of deterioration which would allow water ingress, must be repaired immediately. Sealant, coatings and the like must be repaired in accordance with the instructions of PSL.
- 12.4 Minimum ground clearances as set out in this Appraisal and the Technical Literature must be maintained at all times during the life of the system. (Failing to adhere to the minimum ground clearances given in this Appraisal and the Technical Literature will adversely affect the long term durability of the Graphex Cavity System.)

Control of Internal Fire and Smoke Spread

13.1 The Neopor® board used with the system meets the flame propagation criteria of AS 1366. The Neopor® board must also be protected from ignition in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 6, Paragraphs 6.20.11 and 6.20.12. Where required by NZBC Acceptable Solution C/AS1 Part 6, Table 6.3, flame barriers meeting the requirements of C/AS1 Part 6, Paragraph 6.20.13 and Appendix C, Paragraph C10.1 must be provided.

Control of External Fire Spread

14.1 The Graphex Cavity System has a performance level A in accordance with NZBC C/AS1 Table 7.5. The system is suitable for use as an external wall cladding system on buildings in all Purpose Groups, at any distance to the boundary.

14.2 For buildings of three or more floors where the cladding system extends to cover the walls of at least three floors, the requirements for barriers to vertical fire spread in the cladding as set out in NZBC Acceptable Solution C/AS1 Part 7, Paragraphs 7.9.18 and 7.9.19 must be met. These joints are not covered by the Technical Literature, and are outside the scope of this Appraisal. Design of the barrier joint must be specifically detailed by the designer to meet the NZBC, including blocking of the cladding cavity and wall framing cavity, and installation of flashing and sealing systems to collect and direct any moisture to the outside of the cladding system at this point.

Outbreak of Fire

15.1 The Graphex Cavity System must be separated from chimneys and flues in accordance with the requirements of NZBC Acceptable Solution C/AS1, Part 9 for the protection of combustible materials.

External Moisture

16.1 The Graphex Cavity System, when installed in accordance with this Appraisal and the Technical Literature, prevents the penetration of moisture that could cause undue dampness or damage to building elements.

16.2 The cavity must be sealed off from the roof and subfloor space to meet code compliance with Clause E2.3.5.

16.3 The Graphex Cavity System allows excess moisture present at the completion of construction to be dissipated without permanent damage to building elements to meet code compliance with Clause E2.3.6.

16.4 The details given in the Technical Literature for weather sealing are based on the design principle of having a first and second line of defence against moisture entry for all joints, penetrations and junctions. The ingress of moisture must be excluded by detailing joinery and wall interfaces as shown in the Technical Literature. Weathertightness details that are developed by the designer are outside the scope of this Appraisal and are the responsibility of the designer for compliance with the NZBC.

16.5 The use of the Graphex Cavity System where there is a designed cavity drainage path for moisture that penetrates the cladding, does not reduce the requirement for junctions, penetrations, etc to remain weather resistant.

Internal Moisture

17.1 The Graphex Cavity System alone does not meet NZBC Acceptable Solution E3/AS1, Paragraph 1,1.1(a). Buildings must be constructed with an adequate combination of thermal resistance and ventilation, and space temperature must be provided to all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated or may accumulate.

Water Vapour

17.2 The Graphex Cavity System is not a barrier to the passage of water vapour, and when correctly installed will not create or increase the risk of moisture damage resulting from condensation.

17.3 When the Graphex Cavity System is installed over a steel frame, the EPS battens and insulated drainage cavity will act as a thermal break to the steel frame in accordance with NZBC Acceptable Solution E3/AS1.

Energy Efficiency

Building Thermal Envelope

18.1 NZBC Acceptable Solution H1/AS1 or NZBC Verification Method H1/VM1 can be used for housing, communal residential, communal non-residential and commercial buildings.

Determining Thermal Resistance

18.2 The thermal resistance (R-values) of building elements may be verified by using NZS 4214. The BRANZ 'House Insulation Guide' Third Edition provides thermal resistances of common building elements and is based on calculations from NZS 4214. Calculations in accordance with NZS 4214 require that the ventilated air gap and the thermal resistance of each layer between the ventilated air gap and outside air be de-rated by a factor of 0.45. Therefore, in the Graphex Cavity System, unless better information is available for a specific case, the R-value of the Neopor® layer must be taken as R0.69 (40 mm thick) and R1.03 (60 mm thick) based on a thermal conductivity (k value) of 0.032 W/m °C.

Installation Information

Installation Skill Level Requirements

19.1 Installation and finishing of components and accessories supplied by PSL and the approved installers must be completed by P.P.C.S. qualified tradepersons, approved by PSL.

19.2 Installation of the accessories supplied by the building contractor must be completed by tradespersons with an understanding of cavity construction, in accordance with instructions given within the Graphex Cavity System Technical Literature and this Appraisal.

System Installation

Building Wrap and Flexible Sill and Jamb Flashing Tape

20.1 The selected building wrap and flexible sill and jamb tape system must be installed by the building contractor in accordance with the wrap and tape manufacturer's instructions prior to the installation of the cavity battens and the rest of the Graphex Cavity System. Building wrap must be installed horizontally and be continuous around corners. The wrap must be lapped 75 mm minimum at horizontal joints and 150 mm minimum over studs at vertical joints. Particular attention must be paid to the installation of the building wrap and sill and jamb tapes around window and door openings to ensure a continuous seal is achieved and all exposed wall framing in the opening is protected.

Aluminium Joinery Installation

20.2 Aluminium joinery and associated head flashings must be installed by the building contractor in accordance with the Technical Literature. A 7.5-10 mm nominal gap must be left between the joinery reveal and the wall framing so a PEF rod and air seal can be installed after the joinery has been secured in place.

Graphex Cavity System

20.3 The system must be installed in accordance with the Technical Literature by PSL approved installers.

20.4 The Graphex plaster system must only be applied when the air and substrate temperature is within the range of $+5^{\circ}$ C to $+30^{\circ}$ C.

Inspections

20.5 The Technical Literature must be referred to during the inspection of Graphex Cavity System installations.

Finishing

20,6 Insulcote or other paint manufacturers' instructions must be followed at all times for application of the paint finish. The plaster must be cured for a minimum of 2-3 days and must be dry before commencing painting.

Health and Safety

21.1 Safe use and handling procedures for the components that make up the Graphex Cavity System are provided in the relevant manufacturer's Technical Literature.

Basis of Appraisal

The following is a summary of the technical investigations carried out:

Tests

22.1 The following testing has been completed by BRANZ:

- BRANZ expert opinion on NZBC E2 code compliance for the Graphex Cavity System was based on testing and evaluation of the Insulciad Cavity System incorporating all of the details within the scope and as stated within this Appraisal. The Insulciad Cavity System was tested to E2/VM1. The testing assessed the performance of the foundation detail, window head, jamb and sill details, meter box head, jamb and sill details, vertical and horizontal control joints, internal and external corners and balustrade to wall junction with a plastered cap. In addition to the weathertightness test, the details contained within the Technical Literature have been reviewed, and an opinion has been given by BRANZ technical experts that the system will meet the performance levels of Acceptable Solution E2/AS1 for drained cavity claddings.
- Wind face load and fastener pull through testing for EIFS cladding systems. BRANZ determined design wind suction pressures, and by comparing these pressures with NZS 4203 pressure coefficients, the fixing requirements were determined for timber and steel framed walls.
- Cone Calorimeter testing of the Graphex plaster system over 40 mm EPS. The testing was carried out in accordance with AS/NZS 3837.

Other Investigations

- 23.1 The performance of Insulclad External Insulation and Finishing Systems in New Zealand since 1985 has been considered.
- 23.2 Structural and durability opinions have been given by BRANZ technical experts.
- 23.3 Site visits have been carried out by BRANZ to assess the practicability of installation, and to examine completed installations.
- 23.4 The manufacturer's Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

24.1 The manufacture of the plasters has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

24.2 The quality management system of PSL is covered by the Nuplex Industries Ltd quality management system which has been assessed and registered as meeting the requirements of AS/NZS ISO 9001:2000 by Telarc Limited, Registration Number 158.

24.3 Quality on site is the responsibility of the PSL approved installers.

24.4 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing systems and joinery, building wraps, flashing tapes, air seals and joinery head flashings in accordance with the instructions of PSL.

24.5 Building owners are responsible for the maintenance of the Graphex Cavity System in accordance with the instructions of PSL.

Sources of Information

- AS 1366.3 1992 Rigid cellular plastic sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS-M)
- AS 3566 2002 Self-drilling screws for the building and construction industries.
- AS/NZS 1170: 2002 Structural design action General principles.
- AS/NZS 3837: 1998 Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- NZS 3603: 1993 Timber Structures Standard.
- · NZS 3604: 1999 Timber framed buildings.
- NZS 4211: 2008 Specification for performance of windows.
- NZS 4214: 2006 Methods of determining the total thermal resistance of parts of buildings.
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992, up to, and including August 2008 Amendment



In the opinion of BRANZ, the Graphex Cavity System is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to Nuplex Industries Ltd, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

- 1. This Appraisal:
- a) relates only to the product as described herein:
- b) must be read, considered and used in full together with the technical literature;
- c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
- d) is copyright of BRANZ.
- 2. Nuplex Industries Ltd:
- a) continues to have the product reviewed by BRANZ;
- shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
- abides by the BRANZ Appraisals Services Terms and Conditions.
- Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
- BRANZ makes no representation or warranty as to:
- a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
- b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- any guarantee or warranty offered by Nuplex Industries Ltd.
- Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
- BRANZ provides no certification, guarantee, indemnity or warranty, to Nuplex Industries Ltd or any third party.

For BRANZ

P Burghout Chief Executive

Date of issue: 30 October 2009



BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL CERTIFICATE No. 437 (2003)

UNIPIPE PIPING SYSTEM

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Product

- This Certificate relates to the Unipipe Piping System, which consists of multi-layer composite pipe, fittings and manifolds.
- The system has been appraised for use as the piping components for both potable hot and cold water supply and underfloor heating.
- The system must be designed, installed, used and maintained in accordance with the technical literature supplied by Uponor Rohrsysteme GmbH 'Unipipe Sanitary 3.0' and 'Unipipe MF-System 5.0', both dated November 1998. Unless otherwise stated, reference throughout this Certificate to 'Technical Literature' shall be taken as these documents.



1. New Zealand Building Code (NZBC)

In the opinion of BRANZ, the Unipipe Piping System, if used, designed, installed and maintained in accordance with the statements and conditions of this Certificate, will meet or contribute to meeting the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1(a) not less than 50 years; B2.3.1(b) 15 years; and B2.3.1(c) 5 years. See Section 6.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The system will not present a health hazard to people.

Clause G10 PIPED SERVICES: Performance G10.3.1 and G10.3.3. See Section 5. Clause G12 WATER SUPPLIES: Performance G12.3.1 and G12.3.5 (a) and (b). See Sections 9 and 11.

2. Description

- 2.1 The multi-layer composite pipe manufactured by Uponor is a longitudinally overlapped welded aluminium pipe with inner and outer layers of ethylene-octene copolymer PE-RT (Polyethylene Raised Temperature), tightly bonded to the aluminium with adhesive.
- 2.2 The multi-layer composite pipe is 100% oxygen tight, which prevents any oxygen diffusion through the pipe wall into the system.
- 2.3 The pipe sizes include 16, 20, 25 and 32 mm nominal external diameter.
- 2.4 The pipes are supplied in coils of 200 and 500 m lengths for 16 mm pipes, 100 m lengths for 20 mm pipes and 50 m lengths for 25 and 32 mm pipes.
- 2.5 The pipe bears a continuous mark showing the manufacturer's trademark, production code, the pipe size, pipe length and the maximum working pressure and temperature.
- 2.6 There are two ranges of fittings available for use with the multi-layer composite pipe. They are categorised as Standard Fittings and M-Fittings. Both the Standard Fitting and M-Fitting ranges include press connectors, screw connectors, elbows, T-joints, couplers and reducing couplers. The Standard Fittings are manufactured in tin-plated brass and Dezincification Resistant (DR) brass, while the M-Fittings are available in tin-plated brass only.
- 2.7 The fittings provide corrosion resistance and are suitable for use with potable water. The pressing case, which provides mechanical connection to the pipe, is pre-mounted on the fitting body and is made of stainless steel for the Standard Fittings and aluminium for the M-Fittings.
- 2.8 Each fitting is marked with the production code and fitting size.

Underfloor heating component

- 2.9 The Uponor manifolds control the flow of heated water through the underfloor pipe circuit. These are manufactured from bright-polished nickel-plated brass pipe and are mounted on plastic brackets. The manifold is available in a range of sizes from 2 to 12 outlets. Screw connectors are used to join the pipe to the manifold.
- 2.10 The tools specified by Uponor for installation, such as manual, battery operated and electric hand tools are outside the scope of this Certificate.

Handling and Storage

Unipipe Piping System components should be handled and stored with care to prevent damage. The pipe must be stored where it will not be exposed to sunlight. Riser sections of pipe in underfloor heating systems must be covered from direct sunlight during installation and operation, or until the building is closed in.

4. General

- 4.1 The Unipipe Piping System is used for potable hot and cold water supply and for underfloor heating. The system must be designed in accordance with the Technical Literature.
- 4.2 The low elastic modulus of the multi-layer composite pipe enables it to absorb water hammer more effectively than metallic pipes.

Limitations on Use

- 4.3 The Unipipe Piping System must not be used in the following applications:
- As part of a water meter assembly.
- · Within one metre of the inlet or outlet of a water heater.
- · Where subject to direct sunlight.
- 4.4 Pipes exposed to conditions where freezing may occur must be insulated or drained.

Working Pressures and Temperatures

- 5.1 The working pressure and temperature for the Unipipe Piping System, whether it is used as an underfloor heating component or a hot water supply component, is 1 MPa at 70°C. The multi-layer composite pipe has a maximum working temperature of 95°C.
- 5.2 Multi-layer composite pipe must never be connected to auxillary heaters such as solar collection panels or wet-backs without the installation of temperature protection devices in the system. Without protection, temperatures may exceed the operating limits.

6. Durability

- 6.1 The ethylene-octene copolymer used to manufacture the multi-layer composite pipe is suitable for use with potable water, and any chemical additive specified by Uponor for use in the Unipipe underfloor heating system.
- 6.2 Pipe used for underfloor heating systems and hot and cold water delivery, if used with a maximum working pressure and temperature of 1 MPa at 70°C throughout its serviceable life, should provide a durable life of up to 50 years.
- 6.3 Pipe used with a maximum working pressure and temperature of 1 MPa at 90°C should provide a durable life of 15 years.
- 6.4 The durable life of pipes embedded in concrete in underfloor heating applications will be reduced if they are exposed to extremes in elevated temperatures and pressures for prolonged periods.
- 6.5 Tin-plated brass Standard Fittings, tin-plated brass M-Fittings and DR brass fittings used with multi-layer composite pipe for potable hot and cold water supply should provide a durable life of 15 years. The durable life of fittings embedded in concrete in underfloor heating applications has not been assessed (see Section 10.6).

Maintenance

The Unipipe Piping System as assessed, being potable hot and cold water supply components and underfloor heating components, do not require any special maintenance. Items such as valves and control equipment are outside the scope of this Certificate but may require routine maintenance, as specified by the installation instructions of the valve or control equipment manufacturer.

8. Spread of Fire

- 8.1 In all applications where multi-layer composite pipe passes through a fire rated element of a structure or cavity barrier, the opening must be fire-stopped in a way that will permit thermal movement. If mineral fibres are used, they must have a melting point of greater than 1000°C.
- 8.2 When the pipe is used as a component in an underfloor heating system intended for use with fire-resistance rated (FRR) suspended floor construction, a Fire Engineer must check that

9. Water Supplies

The Unipipe Piping System for hot and cold water supply is hygienic, non-toxic and suitable for use with potable water.

10. General

- 10.1 Multi-layer composite pipe must be installed in accordance with this Certificate and the Technical Literature.
- 10.2 When installing multi-layer composite pipe in framed walls, the holes must be accurately sized to allow pipework to expand and contract. In metal framework grommets must be used to protect the pipe from sharp edges. The grommets used for this application are outside the scope of this Certificate.
- 10.3 Multi-layer composite pipe has a permitted unaided cold bending radius of 5x the external diameter of the pipe.
- 10.4 Fittings installed below ground must be wrapped with an impermeable protection tape. Fittings used in this application are outside the scope of the Certificate.

Underfloor Heating Component

- 10.5 Underfloor heating circuits must be arranged in such a way that the pipe length does not exceed 120 m.
- 10.6 Uponor Rohrsysteme GmbH does not recommend the jointing of pipes in locations where they will be concealed within concrete slabs or screeds. If a joint beneath the floor is unavoidable, such as with local damage repair, then a fitting designed and supplied by Uponor Rohrsysteme GmbH must be used for this purpose. The fitting used for this application is outside the scope of this Certificate.

11. Charging and Pressure Testing

- 11.1 Prior to system closure, whether it is for plumbing in wall or floor cavities, or underfloor heating systems, a visual check of every fitting is required to ensure all pressing cases are securely crimped.
- 11.2 All circuits within the system must be flushed with fresh, clean water so that they are free from trapped air and any foreign matter that may have entered the system.
- 11.3 When all air has been bled from the system, it must be pressure tested.
- 11.4 Piped services used for potable hot and cold water supply must not show any leakage when subjected to a pressure of 1500 kPa at 20°C for a period of not less than 30 minutes, in accordance with AS/NZS 3500.
- 11.5 Underfloor heating systems must be tested to 600 kPa at ambient temperatures. The pressure must remain stable at between 400 to 600 kPa for a minimum of 24 hours before the system has settled and is functioning satisfactorily. Special precautions are necessary if the pressure testing of the underfloor heating pipes is to take place in sub-zero temperatures.

Commissioning Underfloor Heating Systems

11.6 Heat must not be applied to the underfloor heating system until the concrete has cured for a minimum of 28 days. However BRANZ Bulletin No. 344 recommends 6 weeks, especially in winter. When cured, water at 20°C must be introduced into the system and maintained for 24 hours, increasing by 5°C every 24 hours thereafter, until maximum operational temperature is reached. The system must then be allowed to cool until the working temperature is acquired.

The following is a summary of the technical investigations carried out:

12. Tests

- 12.1 Tests have been carried out on the Unipipe Piping System by SKZ (Suddeutsches Kunststoff-Zentrum) Testing Laboratory in accordance with DVGW (German Gas and Water Professional Association) worksheet W542 and W534. The test results have been reviewed by BRANZ experts and found to be satisfactory.
- 12.2 Tests have been carried out on the tin-plated brass Standard Fittings and M-Fittings by SKZ Testing Laboratory in accordance with DVGW worksheet W534. The test results have been reviewed by BRANZ experts and found to be satisfactory.
- 12.3 Tests have been carried out on the DR brass fittings by the Australian Water Quality Centre in accordance with AS/NZS 4020. The test results have been reviewed by BRANZ experts and found to be satisfactory.

13. Other Investigations

- 13.1 An assessment was made of the durability of the Unipipe Piping System by BRANZ technical experts.
- 13.2 Site inspections were carried out by BRANZ to examine completed installations and installation methods.
- 13.3 The Technical Literature entitled 'Unipipe Sanitary 3.0' and 'Unipipe MF-System 5.0', both dated November 1998, has been reviewed by BRANZ and found to be satisfactory.

14. Quality

- 14.1 The Unipipe Piping System is manufactured by Uponor Rohrsysteme GmbH, under an ISO 9001 Quality Management System (SKZ Certificate No. 602.QU/99.1).
- 14.2 The piping and DR brass fittings are quality assured to MP52 Spec 429 manufacturing standard and QAS Standardsmark Licence No. 1P077 issued to Uponor Rohrsysteme GmbH.
- 14.3 The M-Fittings are certified to DVGW W534 and are the subject of a DVGW test mark, Registration No. DW-8501BN0017.
- 14.4 The tin-plated brass Standard Fittings are certified to DVGW W534 and are the subject of a DVGW test mark, Registration No. DW-8501AT2302.
- 14.5 Uponor Rohrsysteme GmbH is responsible for the quality of the product supplied.
- 14.6 Quality of installation on site is the responsibility of the installer.

15. References

- AS/NZS 3500.1.2:1998 Water supply.
- · AS/NZS 3500.4.2:1997 Hot water supply systems.
- AS/NZS 4020:1999 Products for use in contact with drinking water.
- DVGW W534 September 1995 Connecting pipe elements and pipe connections.
- DVGW W542 April 1997 Compound pipes in drinking water installations; requirements and testing.
- MP52 Spec 429: 2 PE composite pipes and fittings for hot and cold water pressure applications.
- BRANZ Bulletin No. 344 (1996) Embedded Floor Heating.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- · The Building Regulations 1992, up to, and including January 2002 Amendment.



In the opinion of BRANZ, the Unipipe Piping System is fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided it is used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Uponor Rohrsysteme GmbH, and is valid until further notice, subject to the Conditions of Certification.

Conditions of Certification

- 1. This Certificate:
- a) relates only to the product as described herein;
- b) must be read, considered and used in full together with the technical literature;
- c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
- d) is copyright of BRANZ.
- 2. The Certificate Holder:
- a) continues to have the product reviewed by BRANZ:
- shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
- abides by the BRANZ Appraisals Services Terms and Conditions.
- The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
- 4. BRANZ makes no representation as to:
- the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
- the presence or absence of any patent or similar rights subsisting in the product or any other product;
- any guarantee or warranty offered by the Certificate Holder.
- Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

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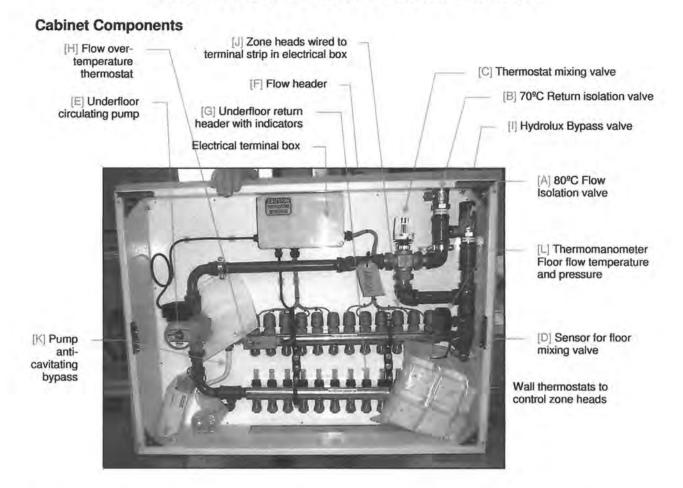
For BRAI

J R Wander

M E Ree

Date of issue: 28 February 2003

UNDERFLOOR HEATING CABINET PRINCIPLE



Operating Principle

Boiler water is supplied to the cabinet to Point A and returned through point B. Pump E circulates water through the under floor pipes via header F & returning via header G. The temperature in the floor pipes is controlled by the mixing valve C and its sensor D to between 20°C-50°C. If the temperature goes over the set point of the overtemp clamp on stat H, the stat will shut the pump off until the temperature drops down and automatically resets and restarts the pump.

Zone actuators J control individual loops by room stats. Bypass K is to protect pump E from cavitating if all zone heads shut down.

Hydrolux valve I is to bypass water back to the boiler if the 3 way valve is totally passing all underfloor water back through the loops. It will protect the main boiler pump from cavitating if no other system relief is available. The hydrolux valve can be replaced by a 15mm lockshield valve to give an alternative permanent regulated relief.

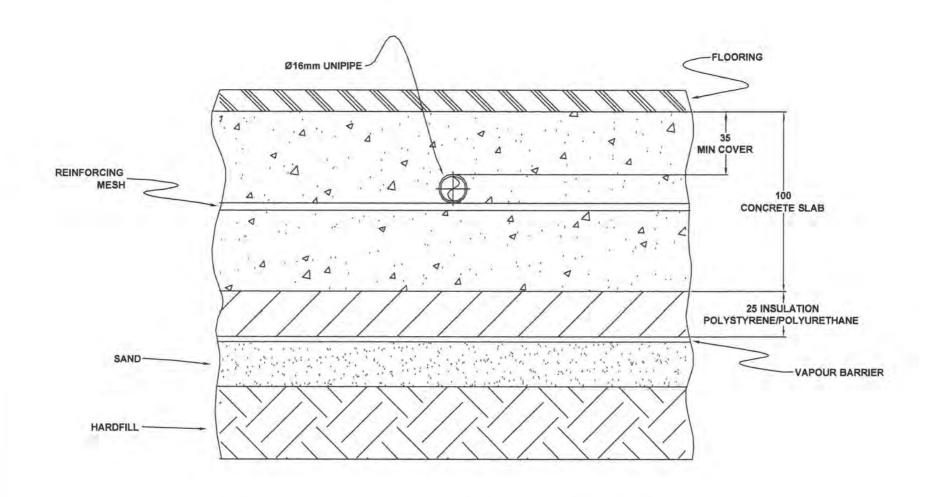
Gauge L tells the temperature & pressure of the loop water.

The return header has individual sight glass gauges that tell the flow & double as isolating valves for that particular loop.

When the boiler flow and return pipes enter from the bottom of the cabinet, auto air vents will be fitted.

Cabinet sizes are ordered to accommodate the individual pipework required for each job application.

BASIC	UNIPIPE UN	IDERFI	OOR	DESIG	N SHE	ET						
	Contractor: Advan	ced Plumb	ing									
	Project: Ward Hous	se 35B Ko	tare st Wa	aikanae								
	Input Detail		1	Cabinet De	etail			Pump Sizing				
	Flow Temp	50	°C	Total Floor	Space*	117.6	m²	Pump Pressure	4.12	m Head		
				Total Unipip	be Length	700	m	Pump Flow	0.38	l/s		
	Room Temp	20	°C					Total kW	13.33	kW		
				Number of	Zones	4		Actual kW	16.00	kW		
	Maximum Run Length	120	m	Number of	Loops	7		Safety Factor	1.20			
Heat Load Density (W/m²)	Room Reference	Effective Floor Area* (m²)	m to Control Cabinet	No Loops per Zone	Heat Load (Watts)	Actual Length (m)	L for heating (m)	Loop Length (m)	Unipipe Spacing (mm)	Flow/loop (I/s)	Return Water Temp (°C)	Pressure Drop (kPa)
96	Bed 1	21.25	1	1.	2,040	108.25	106.25	108.3	200	0.05	40	33.9
96	Bed 2	14.7	5	1	1,411	83.50	73.50	83.5	200	0.03	40	13.8
96	Bed 3	10.8	1	1	1,037	56.00	54.00	56.0	200	0.025	40	5.4
124.8	Dining / Living	70.85	12	4	8,842	450.25	354.25	112.6	200	0.053	40	40.5





TITLE:

UNIPIPE TYPICAL SLAB INSTALLATION

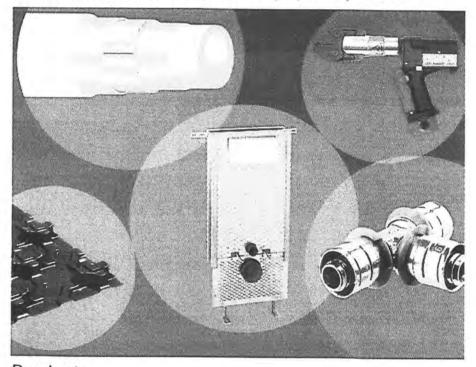
PARK LIGHT		
MODEL:	CAI	hmm
111	V.	OHIII

Ī	CLIENT: XX			DATE:	SHEET No:	
	A	DRAWN BY:	A.D.M	1/04/04	1/1	
	SCALE: N.T.S	CHECKED BY:			REVISION	
		ISSUE:		1/04/04	0	
	STATUS: MANUAL			CAD FILE:	UNIPIPE TYP	





UNIPIPE – the innovative multi-layer composite pipe system



Products







UNIPIPE for smart installation

continuous improvement of new multi-ayer composite pipe systems, this pioneering company. Inanufactured by one and the same company. developed to become market lauder in its field.

UPONOR and UNIPIPE continuously offer convincing solutions for a wide range of installations. All UNIPIPE new developments - for example, the easy to install products and space parts are available over the fittings generation with reliable test safety. Get to know the complete UNIPIPE multi-layer composite - thandliness are key objectives in the development pipe system as well as UPONOR propess. MEROBLOCK and UPONOR MITEC for on wall installations. Convince yourself of the diverse range. Our courage to invent, our expertise and co-operation system has to offer.

solution for all types of installations in the area of

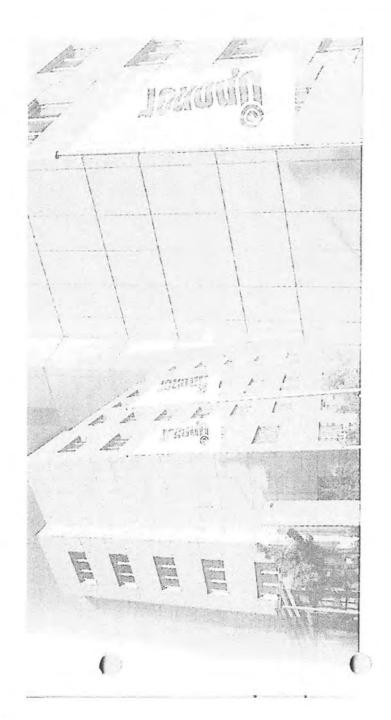
With an annual production of over 55 million metres of pipe and many millions of metal and composite fittings, UPONOR markets the comprehensive UNIPIPE system in more than 60 countries worldwide - underlining UPONOR's pioneering role worldwide today. The key to success is responding

The name UPONOR is synonymous with extensive injuriedy and flexibly to market requirements as well as plastics and metal processing expertise. With the offering a spectrum of products that are unbeaten in terms of quality and range - designed, developed and

> Our customers profit from convenient and reliable long-term. Quality, service and environmental

all applications this innovative and comprehensive in partnership with our oustomers, have laid the foundation for the success of numerous projects through-air the world with the convincing The UNIPPE brand plays a key role: The successful advantages of the UNIPPE system making a multi-layer composite pipe system is the perfect invalidate contribution. Based on our extensive expertise and progressive attitude, our customers plumbing, heating/cooling and radiant temperature. Combit assured of being provided with the products, control as well as thermally active building structures. Systems and solutions they need in order to be successful in the long-term.





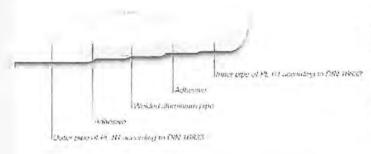
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Thermally active building structures with UNIPIPE
UNIPIPE service



With UNIPIPE, you no longer have to decide between metal and plastic, because the UNIPIPE multi-layer composite pipe generation combines all the benefits of plastic and metal pipes. This ensures state of the art products and quality, high degree of flexibility and endurance, coupled with high pressure and temperature stability. For plumbing, heating/cooling or radiant temperature control – there's nothing like UNIPIPE for smart installation.

One pipe does it all



The basis for professional installation: UNIPIPE multi-layer composite pipe

With our five ayer composite pipe, we have rieveloped an advanced product that unites the advantages of ametal and plantic pipe and climinates the disadvantages of both materials at the same time. This offers product advantages that are second to none. The aluminum core is absolutely diffusion tight; it reliably prevents the ingress of daygon. It compensates and reduces snap-back forces and heat expansion with changes of temperature. The system is designed for easy, safe and last pipe installation, simply bend, cut to length, bovel, join and press – that's all!

A unique bond

UNIP PF multi-ayer composite ope consists of an overlapped, longitudinally welded aluminium pipe with an inner and outer layer of high temperature-resistant polyethylene. All layers are permanently beneed together by intermediate, adhesive layers. A special welding technique ensures high reliability. The aluminium thickness for UNIPIPE has been specially selected to meet compressive and flexural strength requirements.

	ens	

External mm 110 x 10.0

90 x 8,5

/5 x 7.5

63 x 6

Internal mm

73

60

51

All advantages at a glance:

Absolutely diffusion tight

The aluminum core is continuously overlapped willded and prevents oxygen/gases from permeating into the pipe. Subsequently, the corrusion of metallic installation components is avoided.

High form stability

Because of the metal/plastic composition, UNIPIPE remains in position after bending for ease of installation.

High bending flexibility

UNIPIPF can easily be bent by hand without tools, thus making the use of numerous fittings unnecessary.

Low heat expansion

The permanent bond of plastic layers to the aluminium considerably reduces heat expansion.

Easy iointing

No welding, thread cutting, soldering or gluing! The UNIPIPE range of fittings and accessories is perfectly co-ordinated; simply cut pipe to length, bevel it, join pipe and fitting and press – that's a'l!

Corrosion resistance

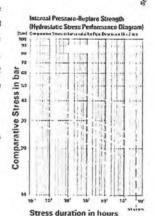
The smooth plastic inner and outer layers keep water at pay – preventing deposit accumulation and corresion.

Excellent long-time rupture strength

The combination of plastic and metal makes UNIP PE a permanently reliable system for its use in all common het and cold water installations.
'Internal Pressure-rupture Strongth' Isee graphic), tests have proven, that UNIPIPF exceeds the generally required DVGVV standards 70° C/10 bar/50 years, by far. Therefore, up to 95° C water temperature in heating systems are no problem at all, also in the long term. It can further be confirmed that up to 80 bar burst pressure rating for example for the most common size 16 x 2 mm is quite usual.

Wide range of sizes

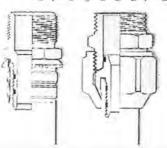
UNIPIPE is available from 14 to 110 mm for all types of instal ations



50 x 4,5	40 x 4	32 x 3	25 x 2,5	20 x 2,25	18 × 2	16 x 2	14 x 2
O 41	32	26	20	15.5	14	12	10

system components leaves nothing to be desired: Pressing or screwing - both methods can be used The UNIPIPE range of fittings, consisting of couplings, clbows, tees and a large number of other to ensure a permanently tight connection. With the new press fitting generation, UNIPIPE is the first so that pressure testing reveales non-pressed connections which would discharge water – a smart system designed for your safety. An additional bonus is the clever range of tools for fast and supplier offering a multi-layer composite pipe system with reliable test safety. The fitting is designed convenient installation.

Fittings concept



Quick, easy, permanent, safe: The smart connection system

Our plastics and motal procussing expertise is not only reflected in the manufacture of unknown composite pixes. With UNIPPE, all products are from one source; the strongth of UNIPPE also ies in the fitting, which is designed to particular the pre-This consues that all futurgs have an optimised meet part geometry. The O-most connection between the insent part and inner other wall, the quality of the complete system is DVGW confised.

A further notal after option using modern system technology is officient by the new composite titing. This fitting is made of special PPSU plastic, high temperature-resistance, high strength and suitability for its use with particularly aggressive water or lead are the key advantages of the composite fitting.

Connection by screwing

UNIPIPE screw trings are available for cianneters from 14 to 25 mm and trial UNIPIPE nipples, e-bows, nees, transmors and mandolas. For example, a teacan be formed into a reducing leet by combrang various different sized pipe screw fittings with identical threads. The system reduces werehousing casts and facilitates ordering procedures.





Advantages of the new metal fittings:

- Reliable test safety
 - Easy installation
- Full surface pressing ■ Pressure sleeve with
- pressing jaw guide grooves ■ Use of existing UNIPIPE tools
- Connection adjustable up to final tightening

Connection by pressing

Complete system

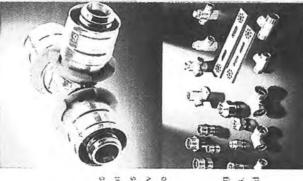
all practical available for all sizes from 14 to 75 mm. The system also includes composite fittings of PPSU in the sizes applications. Press fittings of tin plated triass are 16 to 32 mm. Available for diameters 90 and 110 are available for specially developed damp fittings. Press fittings are

Pressure sleeve

The pressure sleeve of high-quality aluminum is permanently connected with the fitting body, so that the O sings are protected against mechanical effects enables a check to be made during installation to see during transport and handling. The integrated window whother the pipe is correctly inserted.

Compact design

The insulation material can be laid over the fitting without interuption. When using tees and olbows, the same insulation material can be processed without changing to larger sizes.





use in conjunction with UNIPIPE power and UNIPIPE pressing jaws are designed specially for battery-operated pressing tools.

n case pressing tools of other make will be used the respective manufacturer should be contacted in order to approve the qualification, warranty and operational Salery.



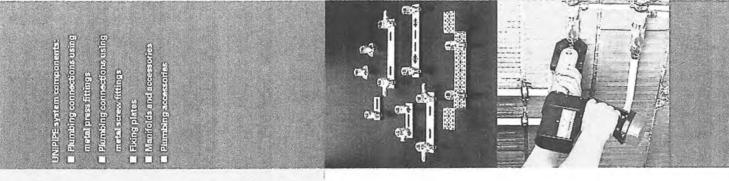
Comprehensive range of products

The comprehensive range of products enables complete installation from the rise to the fixture with only one system, installation with UNIPPE is extremely economical and easy; all components are designed to fit perfectly. The dimensional stability of this pipe and low heat expansion make only a few fixing points necessary—a practical advantage for fact installation. A range of clever tools rounds off the UNIPIPE system from pipe cutters to bewelfing bools through to prossing tools.

In practice

0

The UNIPIPE system has been designed to fast and teliah is invasibilities -swing valuable installation time. The system is extremely durable and safe, as exhibited by the German DVGW and SKZ and verified in numerous international tests and approvals.



For large projects, sophisticated detached houses and multiple dwellings, the on-wall elements UPONOR MEROBLOCK and UPONOR M-TEC offer a complete system for installation in stud walls and solid walls. And, with the added benefits of sound and fire protection, UPONOR MEROBLOCK also offers a high degree of safety in your installation. UPONOR MEROBLOCK is also the ideal solution for barrier-free construction. Where creativity in the design of plumbing installations is important, the new UPONOR M-TEC modular system for on-wall and in-wall installation offers plenty of scope.

UPONOR MEROBLOCK and UPONOR M-TEC

Sound protection - a key feature of UPONOR MEROBLOCK, given by its sound-isolated installation. The installation units fully comply with the requirements of the relevant German standard IDIN 4109, amended version), allowing a maximum permissible noise level of 30 dB (A).

Fire protection - a vital aspect for safety in buildings UPONOR MEROBLOCK is available in two versions with the fire resistance class F 30, F 90 L for installation in stud walls and F 90 M for installation in problematic.

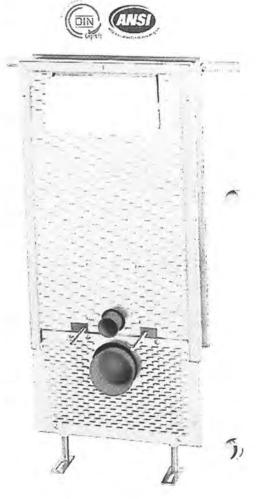
Barrier-free construction key to future fiving comfort, UPONOR MERORLOCK is available as a barrier-free variant conforming to OIN 18024 and 18025 and with special pre-installed lixing components.

Further variants

UPONOR MEROBLOCK is available in a range of different variants for WC, urinel, washbasin/sink bidet, shower and bath. Special variants are also available for complex situations.

Installation variants

The rugged construction of UPONOR MEROBLOCK and UPONOR M-TEC allows quick and easy on-wall or in-wall installation.







UPONOR M-TEC - the alternative

System components

A few of UPONOR M-TEC system components provide a wide range of products, when used in conjunction with the practical selection of branded items for flushing systems and electronic control systems.

Prefabricated elements

Industrial prefabricated UPONOR M-TEC elements are highly flexible and designed for use with both on-wall and in-wall installations. UPONOR M-TEC elements are highly suitable for individual and, when used in conjunction with a universal UPONOR M-TEC system rail, also for rail installation. A small number of system components can be used to cover any applications

Quick connector

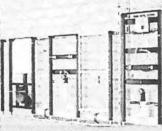
UPONOR M-TEC quiex connector and UPONOR M-TEC on-wall elements allow UPONOR M-TEC to provide extremely test, reliable, simple and therefore cost-efficient installations.

The variable system

The continuously adjustable fitting dimensions of UPONORM-TEC elements make them highly suitable for use on pitched roofs, in shafts and when installed around corners.

Sound protection

UPONOR M-TEC furies all the sound protection requirements established by DIN 4109, and offers the ideal conditions for barrier-free construction.



TRANSPORTATION VIII) URDNOTE CORRECTED SISTEMATION

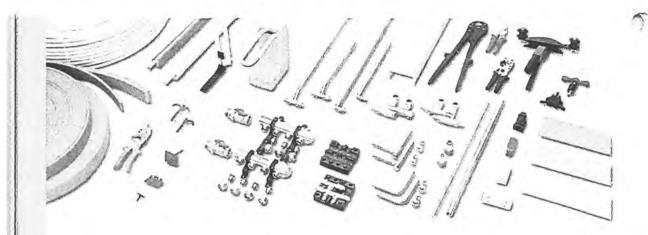


UNTIFE THE PLANT CONTRACTOR

UniPiPE

The UNIPIPE radiator connection system allows the installation of complete heating systems – from the boiler to the furthest radiator – quickly and economically. The range can easily be combined with all commercially available boilers and radiators. Convince yourself of the diversity of the UNIPIPE system with components for heat distribution, control and measurement in houses and multiple dwellings.

Radiator connection



UNIPIPE - diverse connections

The UNIPIPE radiator connection system is a complete system with numerous components, attering diverse connection options. The UNIPIPE radiator connection system is suitable for single and two cipe connection and can be used on all commercially available radiators. The flexibility of the system allows the use of all pipe installation methods.



5)

The range:

- Radiator connection
- Heat distribution
- II Insulation
- Fasteners
- Manifolds
- Accessories
- m Risers
- Special tools

UNIPIPE presents several radiator connection options:

Radiator connection with UNIFIX radiator connection set:

The UNIFIX set not only facilitates installation, it protects the pipe from damage in the screed and also ensures a clean spacing arrangement.

Press connection tee:

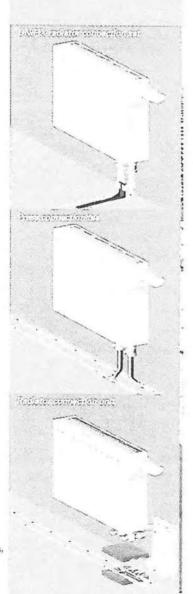
With the press connection tee, radiator connection can take place with plated copper pipes. This ensures sturdiness in everyday use. This variant is used where wall connection is not possible.

Radiator connection unit:

The system can be pressure tested prior to radiator installation. Pre-bent UNIP PF in the insulation box is simply placed in the wall and connected to the radiator or manifold. Radiators can also easily be installed at a later time. Installation of the connection takes place in the wall. This offers the advantage of clean connection and simple radiator installation.

Tested quality

The UNIPIPE system consists of tested and certified quality mediates, making it possible to comply with all relevant building regulations, including the protection, sound protection and heat insulation requirements. The system has been built to last and is reliable, as confirmed by numerous tests and approvals.





Whether underfloor or panel heating: A complete range of UNIPIPE products is available for all connections. Four installation options are available for radiant heating: lightweight construction, pipe positioning panel, staple and clamp track. UNIPIPE also offers special solutions e. g. for heating industrial buildings and outdoor areas. All components are designed to fit perfectly for fast and economical installation. The UNIPIPE range of products is rounded off by an efficient control system.

Radiant heating



UK PIPE clamp tracks and staple system are suitable for UNIPIPE pipes from 14 to 20 mm external diameter. All installation shapes can be used stilliar or meander-shaped). The dimensionally stable UNIPIPE pipe only requires few fixing points – even for narrow bends. Simply choose an installation shape to suit your requirements.

Clamp track

UNIPIPE Clamp track 16 is especially suitable for laying on multi-fail, as its printed-on grid pattern simplifies positioning. The integrated self-adhesive strips ensures imple and reliable foung of the Clamp track 16. Marked snap-off points on the Clamp track 16 also allow short sections (10 cm) to be configured. UNI Clamp track 14 - 20 can be extended to any length.

UNIPIPE staple

The new UNIPIPE stable - for which European patent has been applied for - has been designed to ensure a reliable connection between the pipe and insulation roll with texture foil below. The advantage is that the pipe is prevented from floating - any structural damage such as screed cracks and impact sound bridges is prevented.



All advantages at a glance:

- Structural separation by local insulation
- One pipe open for diverse fixing options
- Quick and easy one-man installation
- One system for all applications – from bathrooms to industrial floorings

Pipe-positioning panel

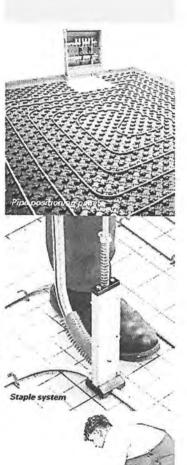
UNIPIPE pipe positioning panel (without insulation) pormits the simple and flexible adaptation of insulating layers to the requirements of DIN EN 1264.4 and the various calculation factors lenergyrequirement specifications) of the German energysaving directive (EnEv). Stable construction permits laying of heat and sound insulation provided by the customer. The laying operation is especially fast and simple. The incividual panels are simply posted on top of each other to adapt to any surface. There is no waste, and the panels are designed to prevent any penetration of Louid screed. The special design of the pane's permits the installation of 14 and 16 mm UNIPIPE. In addition to the pipe positioning panel edging strip, a diagonal fixing clip and a PE toil are available to complete the system.

Lightweight construction

The UNIPIPE lightweight construction is the ideal addition to the UNIPIPE rabiant heating system with wall screed. It is suitable for both the modernisation of eld buildings as well as for new buildings. It can also be used for special applications such as underfloor heating in sports halls. The UNIPIPE lightweight radiant heating system can be combined with commercially available screed elements as well as with conventional cement or self-levelling screed. The UNIPIPE lightweight construction is also suitable for wall panels.

Control system

Special control systems are required to maintain a pleasant temperature in rooms. UNIPIPE offers the right system to suit diverse requirements. The new radio control, for example, is ideal for returbishment; no channelling in walls is necessary. The radio control can be used to conveniently control heating and coding, UNIPIPE also offers controls with 230 V supply or the tried and tested MF-trenie-2 bus control system.





Constantly growing demands on indoor climates and increased energy conservation awareness call for tailor-made air-conditioning concepts. UPONOR offers with UNIPIPE tabs the ideal solution for tomorrow's technology of thermally activated building structures.

UNIPIPE \$255 Thermally active building structures



Example of structural requirements

Total energy efficiency of glass: 0,40
Heat transfer coefficient
Facades: 0,90 W/m'x K
Heat transfer coefficient
Walls/Roof: 0,25 W/m'x K
Illumination: 11 W/m'
Free component surface
Hygiene ventilation
External sun protection

Convenient climate-control for buildings

UNIPIPE tabs permits the efficient heating and cooling of a building via its concrete elements. Concrete floors and ceilings are, from a physical point of view, the best means of storing heat and cold. Embedded UNIPIPE tabs module, turn threat elements into thermally active surfaces. In the warm season, the energy is temporarily stored in the component during the day and released at hight. This system thus provides for convenient, draught free cooling of a quality that cannot be provided by conventional air conditioning systems. In the cold action, the concents mass heats the room.

The UNIPIPE tabs system produces a pleasant room climate all the year mond. But that's not all? The used technology also stands for its cost, and energy-efficiency. Whether in industrial buildings, exhibition halls or warchouses—or even in single-tamily homes and apartment blocks—UNIPIPE tabs conform to all televant construction requirements in practically any type of building.



1

All advantages at a glance:

- Complete system and installation technology with perfectly fitting components
- Intensive support in the planning phase
- Calculation and planning software
- Pre-fabricated UNIPIPE tabs-modules
- Comprehensive service from logistics through to installation instruction

Planning/Production

to each project. We place great value on flexibility at modules are pressure-tested before despatch, with the planning stage – all sections of the system are — the results recorded in a report, and delivered to the individually matched to the building's ground plan and - construction site under pressure. Each section is thus adapted to the geometry of each room. Static aspects of the project can also be incorporated into the concept. The advanced tabscal software is available to ensure reliable planning. Using the lipe detected and dealt with immediately. software developed by EMPA Debendorf and IRANSSOLAR, the selected concept can be Tustrated and displayed in detail.

Installation

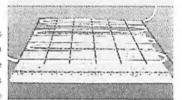
Installation is carried out in a simple and rational way, at the same time as the structural reinforcement and concreting work: Once the bottom layer of reinforcement is in place, the prefablicated system elements are laid on spacers and the top layer of steel. reinforcement is laid. The solid construction of all these modules means that people can walk on top without damaging them, and the UNIPIPE multilayer composite pipes are completely protected at all

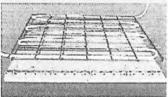
The modules are supplied prefabilicated and related. Safety is a general too priority for us: ATUNIPIPE tabs. fitted with a pressure gauge, which displays the internal pressure of the conduit throughout the Type EFA installation phase - allowing any possible defects to



The medules are laid on the pottom layer of steel reinforcement - simply and efficiently.

Constructions of the **UNIPIPE tabs-modules**

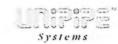




Type SAWI



Type DIRO



We will be happy to assist and advise you on all aspects of UNIPIPE, whether you require information on how to install the UNIPIPE system, need advice on solving difficult problems or would like help with sophisticated projects. We are there for you – by phone or on site. Our experienced service team are available to assist you on a technical level. Take advantage of our UNIPIPE product training and advanced training seminars. For your convenience, we offer professional support with the UNIPIPE planning aid CAD-line.

You can also contact our website for the latest information and practical tips: www.unipipe.de

Service



The service for planners

Centimuous information and co-ordination between the industry, developer and installer are essential precenditions for the smooth building progress. We at UNIPIPE provide a comprehensive and individual service. Personal advisors are available to order you sound advise on materials, processing, logistics and applications of the multilayer composite pipe. They can provide you with software updates and instruction in the use of our calculation and tender software.



Basic package

The technical documents of UNIPPE Our efficient service team consisting of planned building projects.

Coaching

To keep you up to date, we regularly organise

Export software seminars and advance training courses on - A CAD compatible calculation program that products, software and special fields. is now in preparation is designed to fulfill Contact us if you would like information on export specific requirements. our current training programme.

Software

With UNIPIPE CAD-line, you can take advantage of all the benefits of professional planning with CAD, component libraries and optimal export ections. The required data is simply drawn into the architect's plan, automatically calculated and experted as a quotation. And to save time, the assistant will guide you through the complete calculation.

Comprehensive field service

provide a detailed insight into the complete 40 and 100 employees offers you precisely system. They contain materials and the level of service you would expect from processing information and tools as well as - a forward-looking company. Whether you valuable information on use locally. The require information or how to install the ideal medium for further processing or. UNIPPE system or need advice on solving difficult problems - we are there for you on site in many countries.



UPONOR – a reliable connection in professional installation



As a perfect solution for many types of installations, the innovative multi-layer composite pipe system has become the popular choice of planners and installers in the international market. A success that is attributed to harnessed expertise within the UPONOR Group. Many years of experience in plastics and metal processing and the unique combination of engineering and pipe production under one tool.

unitifē



UNIPIPE

- 1. One system for all applications
- 2. Absolutely diffusion tight
- 3. Adjustable up to final tightening
- 4 Low heat expansion
- 5. Easy handling
- 6. One system from 14 - 110 mm

The UNIPIPE brand is not only symbol of unique composite pipes, but also the associated fittings concept, itools and accessories as well as UPONOR MEROBLOCK and UPONOR MITEC on-wall units. These are the best preconditions for a perfectly co-ordinated range of high-quality products and efficient quality management.

As a system supplier, UNIPIPE is a competent partner in all aspects of installation in the area of plumbing, heating/cooling and radiant temperature as well as on-wall installations.





BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL CERTIFICATE No. 356 (2005)

This Certificate replaces BRANZ Appraisal Certificate No. 356 (1998) issued June 1998.

THERMAKRAFT COVER-UP™ BREATHER-TYPE **BUILDING WRAP**

Thermakraft Industries (NZ) Ltd

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BRANZ Limited Private Bag 50 908 Porirua City New Zealand

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BRANZ Pty Ltd



FREIDTUS

Thermakraft Cover-Up™ is a synthetic breather-type building wrap for use as 1.1 a wall wrap and air barrier under direct and non-direct fixed wall cladding on timber framed buildings. The product is manufactured from tapes of high density polyethylene woven into sheet form, and is coated on both sides with pigmented low density polyethylene. Micro-perforations are made through the coated membrane to permit the passage of water vapour.



- Thermakraft Cover-Up™ has been appraised for use as a wall wrap on timber 2.1 framed buildings within the following scope:
- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- with absorbent wall claddings directly fixed to framing; and,
- with absorbent and non-absorbent wall claddings installed over an 18 mm minimum drained cavity; and,
- with masonry veneer in accordance with NZS 3604:1999; and,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.
- Thermakraft Cover-Up™ has also been appraised for use on buildings subject to specific weathertightness design. Building designers are responsible for the building design and for the incorporation of Thermakraft Cover-UpTM into their design in accordance with the declared properties and the instructions of Thermakraft Industries

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Thermakraft Cover-Up™ Breather-Type Building Wrap, if used, designed, installed and maintained in accordance with the statements and conditions of this Certificate, will meet, or contribute to meeting the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1(a), 50 years and B2.3.1(b), 15 years. Thermakraft Cover-Up[™] meets these requirements. See Paragraphs 8.1 and 8.2.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. When used as part of the cladding system, Thermakraft Cover-Up[™] will contribute to meeting this requirement. See Paragraphs 11.1 - 11.3.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. Thermakraft Cover-UpTM meets this requirement and will not present a health hazard to people.

3.2 This Certificate appraises an Acceptable Solution in terms of the New Zealand Building Code compliance. Thermakraft Cover-UpTM meets the requirements for wall wraps and air barriers specified in accordance with NZBC Acceptable Solution E2/AS1, Table 23.

Technical Specification

- 4.1 Thermakraft Cover-UpTM is a 95 g/m² white sheet membrane material approximately 0.25 mm thick.
- 4.2 The product is supplied in rolls 2.54 and 2.74 m wide by 18.5, 27.5 and 36.5 m long and 1.37 m wide by 18.5, 27.5 and 73.0 m long. The product is printed with a two colour Thermakraft Cover-Up™ logo repeated along the length of the roll and is labelled with the marketing or construction company's name. The rolls are wrapped in clear polythene film.

Accessories

- 4.3 Accessories used with Thermakraft Cover-Up™ which are supplied by the installer are:
- Fixings staples, clouts or proprietary wrap fixings, or other temporary fixings to attach the wall wrap to the framing.
- Building wrap support polypropylene strap, 75 mm galvanised mesh or galvanised wire, or vertical cavity battens where required to support the wall wrap in accordance with NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.5.

Handling and Storage

5.1 Handling and storage of the product, whether on or off site, is under the control of the installer. The rolls must be protected from damage and weather. They must be stored on end, under cover, in clean, dry conditions and must not be crushed.

Technical Literature

6.1 Refer to the Appraisals listings on the BRANZ website for details of the current Technical Literature for Thermakraft Cover-UpTM. The Technical Literature must be read in conjunction with this Certificate. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Certificate must be followed.

Design Information

Timber Framing

7.1 Studs must be provided at maximum 600 mm centres.Dwangs must be fitted flush between the studs at maximum 1200 mm centres.

General

- 7.2 Thermakraft Cover-UpTM is intended for use as an alternative to conventional building papers which are fixed over timber framed walls in order to limit the entry of wind into building cavities, and to act as a secondary barrier to wind-driven rain.
- 7.3 The material also provides a degree of temporary weather protection during early construction. However, the product will not make the building weathertight and some wetting of the underlying structure is always possible before the building is closed in. Hence, the building must be closed-in and made weatherproof before moisture sensitive materials such as wall or ceiling linings and insulation materials are installed.
- 7.4 Thermakraft Cover-Up™ is suitable for use under wall claddings as a wall wrap and air barrier as called up in NZBC Acceptable Solution E2/AS1, Table 23, except that it must not be used with non-absorbent wall claddings such as vinyl or metal based sidings or weatherboards in direct fixed installations. Refer to Table 1.

Table 1: NZBC E2/AS1 Table 23 Requirements

NZBC E2/AS1 Table 23 Wall Wrap Properties	Property Performance Requirement	Actual Property Performance
Absorbency	≥ 100 g/m ²	Does not comply
Vapour Resistance	≤ 7 MN s/g	2.7 MN s/g
Water Resistance	≥ 20 mm	Pass
pH of Extract	≥ 6 and ≤ 9	6.8
Shrinkage	≤ 0.5%	-0.015%
Mechanical	Edge tear and tensile strength	Edge tear: Machine direction = 380 N Cross direction = 299 N Tensile strength: Machine direction = 7.82 kN/m Cross direction = 5.90 kN/m
Air Barrier	Edge tear strength: 90 N Air resistance: ≥ 0.1 MN s/m³	Pass 0.205 MN s/m ³

7.5 In cavity installations where the cavity battens are installed at greater than 450 mm centres, the building wrap must be supported between the battens to prevent the wrap bulging into the cavity space when bulk insulation is installed in the wall frame cavity in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.5.

7.6 Thermakraft Cover-UpTM is suitable for use as a non-rigid backing material for stucco plaster in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.3.5.1. The wrap must be supported with 75 mm galvanised mesh or plastic tape or wire at 150 mm centres run across the cavity battens to limit deflection to a maximum of 5 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.3.5.2.

7.7 Thermakraft Cover-UpTM may also be used as a slip layer over rigid backings for stucco plaster in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.3.3(b).

Structure

7.8 Thermakraft Cover-Up™ is suitable for use in all Building Wind Zones of NZS 3604 up to, and including, 'Very High'.

Durability

8.1 Thermakraft Cover-Up™ meets code compliance with NZBC Clause B2.3.1 (a), 50 years for building wraps used where the cladding durability requirement or expected serviceable life is not less than 50 years, and code compliance with NZBC Clause B2.3.1 (b), 15 years for building wraps used where the cladding durability requirement is 15 years.

Serviceable Life

8.2 Provided it is not exposed to the weather or ultra-violet light for a total of more than 60 days, Thermakraft Cover-UpTM is expected to have a serviceable life of at least 50 years.

Control of Internal Fire and Smoke Spread

9.1 Thermakraft Cover-Up™ has an AS 1530 Part 2 Flammability Index of 1 and meets the requirements of NZBC Acceptable Solution C/AS1 Part 6, Table 6.2 for surface finish requirements for suspended flexible fabrics, and therefore it may be used with no restrictions in all buildings.

Outbreak of Fire

10.1 Thermakraft Cover-Up[™] must be separated from fireplaces, heating appliances, flues and chimneys in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9 for the protection of combustible materials.

External Moisture

11.1 Thermakraft Cover-Up™ must be used behind claddings that meet the requirements of the NZBC, e.g. such as those covered by NZBC Acceptable Solution E2/AS1, or claddings covered by a valid BRANZ Appraisal Certificate.

11.2 Thermakraft Cover-Up™, when installed in accordance with the Technical Literature and this Certificate, will assist in the total cladding systems compliance with NZBC Clause E2.

11.3 When used as an air barrier, particular care must be taken to ensure an air tight barrier is achieved, and weather sealing at all openings and penetrations through the cladding meets the requirements of the NZBC.

Installation information

Installation Skill Level Requirements

12.1 Installation must always be carried out in accordance with the Technical Literature and this Certificate, by competent tradespersons with an understanding of wall wrap installation.

Wrap Installation

13.1 Thermakraft Cover-UpTM must be fixed to all framing members at maximum 300 mm centres with hot-dip galvanised, large-head clouts 20 mm long, zinc plated 6-8 mm staples, or proprietary wrap fixings. The membrane must be pulled taut over the framing before fixing.

13.2 Thermakraft Cover-Up™ must be run horizontally and must extend from the upper-side of the top plate to the under-side of the bearers or wall plates supporting ground floor joists, or below bottom plates on concrete slabs. Horizontal laps must be no less than 75 mm wide, with the direction of the lap ensuring that water is shed to the outer face of the membrane. End laps must be made over framing and be no less than 150 mm wide.

13.3 The wall wrap should be run over openings and these left covered until windows and doors are ready to be installed. Openings are formed in the membrane by cutting on a 45 degree diagonal from each corner of the penetration. The flaps of the cut membrane must be folded inside the opening and stapled to the penetration framing. Excess wrap may be cut off flush with the internal face of the wall frame.

13.4 Thermakraft Cover-Up[™] can be added as a second layer over head flashings in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.7(e).

13.5 When fixing the product in windy conditions, care must be taken due to the large sail area created by the wide roll width.

13.6 Any damaged areas of Thermakraft Cover-UpTM, such as tears, holes or gaps around service penetrations, must be repaired. Damaged areas can be repaired by covering with new material lapping the damaged area by at least 150 mm and taping, or by taping small tears.

Basis of Appraisal

The following is a summary of the technical investigations carried out:

Tests

14.1 The following tests have been carried out on Thermakraft Cover-UpTM by Ensis Papro: Cold extract pH in accordance with AS/NZS 1301.421s; edge tear resistance and tensile strength in accordance with AS/NZS 4200.1; shrinkage in accordance with AS/NZS 4201.3, water resistance in accordance with AS/NZS 4201.4, and air resistance in accordance with BS 6538-3.

14.2 The following tests have been carried out on Thermakraft Cover-Up™ (marketed in Canada as Airgard®) by an independent laboratory for the Canadian Construction Materials Centre (CCMC), in accordance with the requirements of CAN/CGSB-51.32-M77: pliability; tensile strength; water vapour permeance, and water ponding.

14.3 The following tests have been carried out on Thermakraft Cover-UpTM by BRANZ: flammability in accordance with AS 1530.2, and tensile tear strength before and after two months of natural UV aging.

Other Investigations

15.1 A durability opinion was given by BRANZ technical experts.

15,2 Site inspections were carried out by BRANZ to assess methods used for the installation of Thermakraft Cover-UpTM, and to examine completed installations.

15.3 The marketer's Technical Literature, including installation instructions, has been examined by BRANZ and found to be satisfactory.

Quality

16.1 The manufacture of Thermakraft Cover-UpTM has not been examined by BRANZ, but details of the methods adopted for quality control and the quality of the materials used, have been obtained.

16.2 The quality management system of the wrap manufacturer, Fabrene Corporation, has been assessed and registered as meeting the requirements of ISO 9001: 2000 by TUV ESSEN, Registration Number 02-1308.

16.3 The quality of supply to the market is the responsibility of Thermakraft Industries (NZ) Ltd.

16.4 Building designers are responsible for the design of the building, and for the incorporation of the wall wrap into their design in accordance with the instructions Thermakraft Industries (NZ) Ltd.

16.5 Quality of installation is the responsibility of the installer in accordance with the instructions of Thermakraft Industries (NZ) Ltd.

Sources of Information

- AS 1530.2 1993 Test for flammability of materials.
- AS/NZS 1301.421s: 1988 Determination of the pH value of aqueous extracts of paper, board and pulp - cold extraction method.
- AS/NZS 4200.1: 1994 Pliable building membranes and underlays materials.
- AS/NZS 4201.3: 1994 Pliable building membranes and underlays Methods of test
 Shrinkage.
- BS 6538-3: 1987 Method for determination of air permeance using the Garley apparatus.
- CAN/CGSB-51.32-M77 Technical Guide for Sheathing, Membrane, Breather-Type.
- NZS 3604: 1999 Timber Framed Buildings.
- Compliance Document for the New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to, and including October 2004 Amendment.



In the opinion of BRANZ, Thermakraft Cover-Up' Breather-Type Building Wrap is fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided its used, designed, installed and maintained as set out in this Certificate. The Appraisal Certificate is issued only to the Certificate Holder, Thermakraft Industries (NZ) Ltd, and is valid until further notice, subject to the Conditions of Certification.

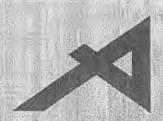
Conditions of Certification

- 1. This Certificate:
- a) relates only to the product as described herein;
- b) must be read, considered and used in full together with the technical literature;
- c) does not address any Legislation, Regulations, Codes or Standards, not specifically named better.
- d) is copyright of BRANZ
- 2. The Certificate Holder:
- eontimes to have the product reviewed by BRANZ;
- shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
- ahides by the BRANZ Appraisals Services Terms and Conditions.
- The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
- 4. BRANZ makes no representation as to:
- a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
- the presence or absence of any patent or similar rights subsisting in the product or any other product;
- c) any guarantee or warranty offered by the Certificate Holder.
- Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

For BRANZ

P Robertson Chief Executive

Date of issue: 13 December 2005



BRANZ Appraised
Appraisal No.710 [2010]

BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL No. 710 (2010)

Amended 20 October 2010.

THERMAKRAFT COVERTEK 403 ABSORBENT BREATHABLE ROOF UNDERLAY

Thermakraft Industries (NZ) Ltd

P.O. Box 58-112 Botany Manukau 2163 AUCKLAND

Tel: 0800 806 595 Fax: 09 273 3726 Web: www.thermakraft.co.nz



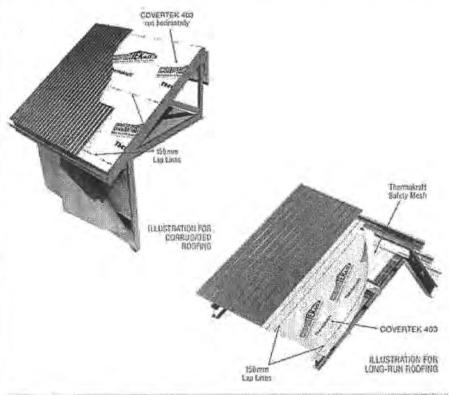
BRANZ

BRANZ Limited
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Fax: +64 4 237 1171
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Engratura

1.1 Thermakraft Covertek 403 Roof Underlay is a synthetic building underlay for use under roof claddings. The product consists of a micro-porous water resistant film laminated to two layers of non woven spun-bonded polyolefin.



Scope

- 2.1 Thermakraft Covertek 403 Roof Underlay has been appraised for use as a roof underlay on buildings within the following scope:
- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1 with regards to building height and floor plan area; and,
- · with masonry tile roof cladding; and,
- · with metal tile and profiled metal roof cladding; and,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.

Buriding Regulation.

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Thermakraft Covertek 403 Roof Underlay, if used, designed, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet, or contribute to meeting the following provisions of the NZBC: Clause B2 DURABILITY: Performance B2.3.1(a), not less than 50 years, B2.3.1(b), 15 years and B2.3.2. Thermakraft Covertek 403 Roof Underlay meets these requirements. See Paragraphs 9.1 and 9.2.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. When used as part of the roof cladding system, Thermakraft Covertek 403 Roof Underlay will contribute to meeting this requirement. See Paragraphs 12.1 and 12.2.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. Thermakraft Covertek 403 Roof Underlay meets this requirement and will not present a health hazard to people.

3.2 This is an Appraisal of an Alternative Solution in terms of the New Zealand Building Code compliance.

Technical Specification

4.1 Thermakraft Covertek 403 Roof Underlay is a synthetic building underlay for use under roof claddings. The product consists of a micro-porous water resistant film laminated to two layers of non woven spun-bonded polyolefin. Thermakraft Covertek 403 Roof Underlay is coloured white on the top and bottom faces.

4.2 The product is supplied in rolls 1.350 m wide x 18.6 m, 37.0 m and 55.6 m long. The product is printed with the Thermakraft Covertek 403 logo repeated along the length of the roll. The rolls are wrapped in clear polythene film.

Accessories

4.3 Accessories used with Thermakraft Covertek 403 Roof Underlay which are supplied by the installer are:

 Fixings - stainless steel staples, clouts, screws or proprietary underlay fixings, or other temporary fixings to attach the roof underlay to the framing.

 Roof underlay support - polypropylene strap, or minimum 0,9 mm diameter galvanised steel wire mesh where required to support the roof underlay in accordance with NZBC Acceptable Solution E2/AS1, Paragraph 8.1.5.1. (Note: The mesh must be galvanised in accordance with AS/NZS 4534.)

Handling and Storage

5.1 Handling and storage of the product, whether on or off site, is under the control of the installer. The rolls must be protected from damage and weather. They must be stored on end, under cover, in clean, dry conditions and must not be crushed.

Technical siterature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for Thermakraft Covertek 403 Roof Underlay. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

Design Information

Timber and Steel Framing

7.1 Timber and steel roof framing must be provided in accordance with the requirements of the NZBC and the roof cladding manufacturer.

General

7.2 Thermakraft Covertek 403 Roof Underlay is intended for use as an alternative to conventional kraft paper roof underlays, which are fixed over timber or steel framed roofs in order to limit the entry of wind into the roof cavity, and to assist in the moisture management of the roof cladding system.

7.3 The material also provides a degree of temporary weather protection during early construction. However, the product will not make the roof weathertight and some wetting of the underlying structure is always possible before the roof cladding is installed. Hence, the entire building must be closed-in and made weatherproof before moisture sensitive materials such as ceiling linings and insulation materials are installed.

7.4 Thermakraft Covertek 403 Roof Underlay must not be exposed to the weather or ultra violet light for a total of more than 7 days before being covered by the roof cladding.

7.5 Thermakraft Covertek 403 Roof Underlay is suitable for use under roof claddings on buildings as a roof underlay as called up in NZBC Acceptable Solution E2/AS1, Table 23. Refer to Table 1 for the material properties of Thermakraft Covertek 403 Roof Underlay.

Table 1: NZBC E2/AS1 Table 23 Requirements

NZBC E2/AS1 Table 23 Roof Underlay Properties	Property Performance Requirement	Results
Absorbency	≥ 100 g/m ²	Pass > 150 g/m ²
Vapour Resistance	≤ 7 MN s/g	Pass
Water Resistance	≥ 100 mm	Pass
pH of Extract	≥ 6 and ≤ 9	Pass
Shrinkage	≤ 0.5%	Pass
Mechanical	Edge tear and tensile strength	Edge tear (Average); Machine direction = 144 N Cross direction = 107 N Tensile strength (Average); Machine direction = 2.86 kN/m Cross direction = 2.20 kN/m

7.6 Thermakraft Covertek 403 Roof Underlay is suitable for use at roof pitches 8° and above. At pitches 8° and above, Thermakraft Covertek 403 Roof Underlay if supported by a corrosion resistant material can be installed vertically or horizontally and must span no greater than 300 mm in one direction. (Note: For roof pitches less than 8°, Thermakraft recommends the use of Covertek 407 Roof Underlay, refer to BRANZ Appraisal No. 651 (2009).)

Structure

8.1 Thermakraft Covertek 403 Roof Underlay is suitable for use in all Building Wind Zones of NZS 3604 up to, and including, 'Very High'.

Durability

9.1 Thermakraft Covertek 403 Roof Underlay meets code compliance with NZBC Clause B2.3.1 (a), not less than 50 years for roof underlays used where the roof cladding durability requirement or expected serviceable life is not less than 50 years, e.g. behind masonry roof tile cladding, and code compliance with NZBC Clause B2.3.1 (b), 15 years for roof underlays used where the roof cladding durability requirement is 15 years.

Serviceable Life

9.2 Provided it is not exposed to the weather or ultraviolet light for a total of more than 7 days, and provided the roof cladding is maintained in accordance with the cladding manufacturer's instructions and the roof cladding remains weather resistant, Thermakraft Covertek 403 Roof Underlay is expected to have a serviceable life equal to that of the roof cladding.

Control of Internal Fire and Smoke Spread

10.1 Thermakraft Covertek 403 Roof Underlay does not meet the requirements of NZBC Acceptable Solution C/AS1 Part 6, Table 6.2 for surface finish requirements for suspended flexible fabrics. Therefore, Thermakraft Covertek 403 Roof Underlay must not be exposed to view in occupied spaces in purpose groups SC, SD, SA, WL, WM, WH, WF, CO, CM, CS, CL and IE.

Outbreak of Fire

11.1 Thermakraft Covertek 403 Roof Underlay must be separated from fireplaces, heating appliances, flues and chimneys in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 9 for the protection of combustible materials.

External Moisture

12.1 Thermakraft Covertek 403 Roof Underlay must only be used under roof claddings that meet the requirements of the NZBC, such as those covered by NZBC Acceptable Solution E2/AS1, or roof claddings covered by a valid BRANZ Appraisal. 12.2 Thermakraft Covertek 403 Roof Underlay, when installed in accordance with the Technical Literature and this Appraisal, will assist in the total cladding system's compliance with NZBC Clause E2.

Installation information

Installation Skill Level Requirements

13.1 Installation must always be carried out in accordance with the Thermakraft Covertek 403 Roof Underlay Technical Literature and this Appraisal, by competent tradespersons with an understanding of roof underlay installation.

Underlay Installation

14.1 Thermakraft Covertek 403 Roof Underlay must be fixed at maximum 300 mm centres to all framing members with large-head clouts 20 mm long, 6-8 mm stainless steel staples, self drilling screws or proprietary underlay fixings. The membrane must be pulled taut over the framing before fixing.

14.2 Thermakraft Covertek 403 Roof Underlay may be run vertically or horizontally at roof pitches greater than 8° and must be laid horizontally at roof pitches less than 8°. It must extend from the ridge and overhang the fascia board by 20-25 mm. Vertical laps must be no less than 150 mm wide. Horizontal laps must also be no less than 150 mm, with the direction of the lap ensuring that water is shed to the outer face of the underlay. End laps must be made over framing and be no less than 150 mm wide. To assist with achieving the correct lap dimension, Thermakraft Covertek 403 Roof Underlay has a 150 mm lap line printed continuously along the top face.

14.3 When fixing the product in windy conditions, care must be taken due to the large sail area created.

14.4 Any damaged areas of Thermakraft Covertek 403 Roof Underlay, such as tears, holes or gaps around service penetrations, must be repaired. Damaged areas can be repaired by covering with new material lapping the damaged area by at least 150 mm and taping, or by taping small tears.

Inspections

14.5 The Technical Literature must be referred to during the inspection of Thermakraft Covertek 403 Roof Underlay installations.

Basis of Appraisal

The following is a summary of the technical investigations carried out:

Tests

15.1 The following tests have been carried out on Thermakraft Covertek 403 Roof Underlay in accordance with NZBC Acceptable Solution E2/AS1, Table 23: tensile strength, edgetear resistance and resistance to water vapour transmission in accordance with AS/NZS 4200.1, shrinkage in accordance with AS/NZS 4201.3, resistance to water penetration in accordance with AS/NZS 4201.4, surface water absorbency in accordance with AS/NZS 4201.6 and pH of extract in accordance with AS/NZS 1301.421s. A range of these tests were completed before and after Thermakraft Covertek 403 Roof Underlay was exposed to ultra-violet light.

Other Investigations

16.1 A durability opinion has been given by BRANZ technical experts.

16.2 An evaluation of the expected performance of Thermakraft Covertek 403 Roof Underlay in direct contact with metal roof cladding has been completed by BRANZ.

16.3 The practicability of installation of Thermakraft Covertek 403 Roof Underlay has been assessed by BRANZ and found to be satisfactory.

16.4 The Technical Literature, including installation instructions, has been examined by BRANZ and found to be satisfactory.

Quality

17.1 The manufacture of Thermakraft Covertek 403 Roof Underlay has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

17.2 The quality of supply to the market is the responsibility of Thermakraft Industries (NZ) Ltd.

17.3 Building designers are responsible for the design of the building, and for the incorporation of the roof underlay into their design in accordance with the instructions of Thermakraft Industries (NZ) Ltd.

17.4 Quality of installation is the responsibility of the installer in accordance with the instructions of Thermakraft Industries (NZ) Ltd.

Sources of Information

AS 1530.2: 1993 Test for Flammability of Materials.

AS/NZS 1301.421s: 1988 Determination of the pH value of aqueous extracts of paper, board and pulp - cold extraction method.

AS/NZS 4200.1: 1994 Pliable building membranes and underlays - materials.

AS/NZS 4201.3: 1994 Pliable building membranes and underlays - Methods of test - Shrinkage.

AS/NZS 4201.4: 1994 Pliable building membranes and underlays - Methods of test -Resistance to water penetration.

AS/NZS 4201.6: 1994 Pliable building membranes and underlays - Methods of test -Surface water absorbency.

AS/NZS 4534:2006 Zinc and zinc/aluminium-alloy coatings on steel wire.

NZS 3604: 1999 Timber Framed Buildings.

Compliance Document for the New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.

New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.

The Building Regulations 1992 up to, and including, August 2008 amendment.



the BRANZ. opinion of Covertek 403 Thermakraft Absorbent Roof Breathable Underlay is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to Thermakraft Industries (NZ) Ltd, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

This Appraisal:

a) relates only to the product as described

b) must be read, considered and used in full together with the technical literature;

c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein; d) is copyright of BRANZ.

Thermakraft Industries (NZ) Ltd:

continues to have the product reviewed by

shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed:

o) abides by the BRANZ Appraisals Services Terms and Conditions.

d) Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal

of the product. BRANZ makes no representation or warranty as to:

a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;

the presence or absence of any patent or similar rights subsisting in the product or any other product;

any guarantee or warranty offered by Thermakraft Industries (NZ) Ltd.

4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.

BRANZ provides no certification, guarantee, indemnity or warranty, to Thermakraft Industries (NZ) Ltd or any third party.

For BRANZ

P Burghout Chief Executive

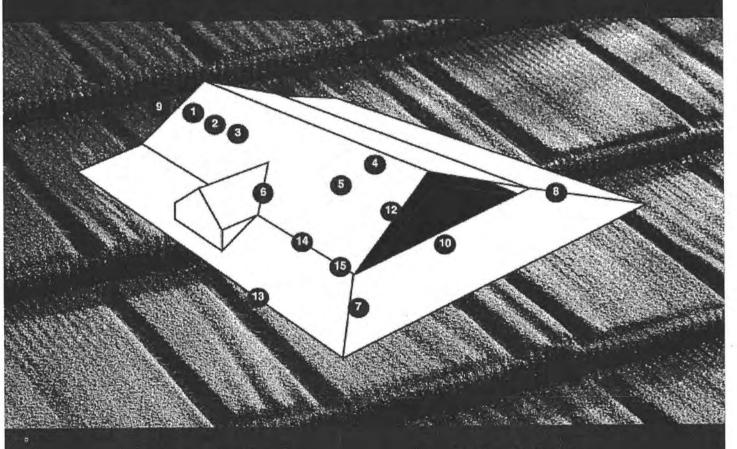
Date of issue: 1 October 2010

Amendment No. 1, dated 20 October 2010.

This Appraisal has been amended to remove the use of Thermakraft Covertek 403 Roof Underlay when the roof pitch is less than 8°.

TECHNICAL SPECIFICATIONS

FOR THE INSTALLATION OF GERARD ROOFS



- 1 Important technical notes
- 2 Batten Spacing
- 3 Determining Rafter Length
- 4 Truss Option
- 5 Barrel Trims
- 6 Valleys
- 7 Hip Boards
- 8 Ridge and Hip Boards
- 9 Barge Boards
- 10 Junctions with Vertical Faces

- 11 Pop Top Side Flashing
- 12 Dutch Gables
- 13 Fascia
- 14 Mansard Roof
- 15 Pitch Change
- 16 Nailing positions
- 17 Tile Dimensions
- 18 Trim Dimensions
- 19 Tile Coverage Table







IMPORTANT TECHNICAL NOTES:

GENERAL

- When off-loading water onto lower roof, avoid laps and flashings to ensure adequate drainage.
- Zincalume** steel waterflow must not run off onto Galvanised Steel.
- Lead waterflow must not run off onto Zincalume[®] steel.
- Copper waterflow must not run off onto Zincalume* steel.
- Where the use of lead with Zincalume[®] steel roofs is unavoidable, eg, re-roof, or
 existing flashings, you must prime and top coat both sides of the lead flashing to
 avoid corrosion.
- Gerard Corona Shake, Gerard Senator Shingles and Gerard Oberon Shingles must be random laid.

NAILING

Gerard Colortile® must have 4 nails per tile. Gerard Tuffcoat® Tile must have 4 nails per tile. Gerard Corona® Shake must have 4 nails per tile. Gerard Senator® Shingle must have 4 mails per tile. Gerard Oberon® Shingle must have 5 nails per tile.

VALLEYS

Custom valleys with increased depth and width may be required in the following circumstances:

- 1. Twin pitch roofs.
- 2. Change of direction in valley.
- 3. Large volumes of water directed to valley.

Due to a number of contributing factors, eg, pitch of roof, angle of direction change, volumes of water meeting twin pitch, we recommend consulting your local Gerard Certified Roofer or our technical sales staff for advice.

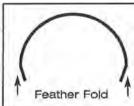
POP TOP SIDE FLASHING

Due to numerous wall claddings available in the market, plaster in particular, it has been a historical issue as to how to direct waterflow away from the wall at the end of a wall flashing to avoid seepage. Please contact your local Gerard Certified Roofer or our technical sales staff for advice. There are too many variants to detail all the wall cladding types here. Note Section 11.

BARREL TRIM

The bottom edge of barrel trims require a feather fold to achieve a tight fit and to avoid gaps between upturn on tile and barrel. See Diagram right.

NOTE: This cannot be done during the manufacturing process due to packing problems, and variation in requirements.



RESPONSIBILITY

It is the responsibility of architects, builders and roof installers to ensure that local standards, by-laws and requirements are satisfied. Special care should be taken to ensure:

- 1. All live electrical cables will be well clear of any nailing positions;
- 2. Nailing is done in the positions and manner specified by the Installation Manual;
- 3. Nalls of the correct length are used.

*Zincalume® is a registered trademark held within BHP Steel.



PITCH

The efficient, interlocking tile design will allow any pitch from 12° minimum with an underlay to a vertical face.

GERARD ROOFS MINIMUM PITCH TABLE

PRODUCT	MIN.PITCH	
Gerard Colortile®	12°	
Gerard Tuffcoat® Tile	12°	
Gerard Corona® Shake	15°	
Gerard Senator® Shingle	15°	
Gerard Oberon® Shingle	20°	

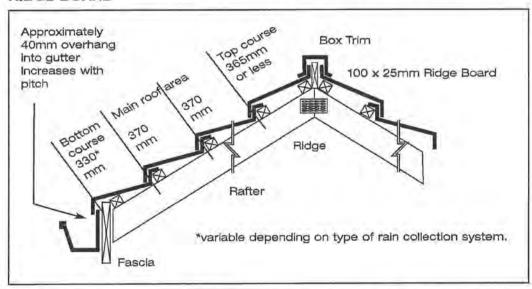
RAFTERS

Worthwhile cost savings can be achieved if rafter lengths are designed to accommodate an exact number of tile courses. Where this is not practical, cutting of the top course of tiles will be necessary. Rafters or roof trusses can be set at various centres depending on the type of construction.

NORMAL BATTEN SIZES

Rafter or Truss Centres	Batten Size (normal)	
Recommended Up to 900mm	50mm x 40mm	
Optional		
1200mm	50mm x 50mm	
1500mm	50mm x 65mm (on edge)	
1800mm	50mm x 75mm (on edge)	

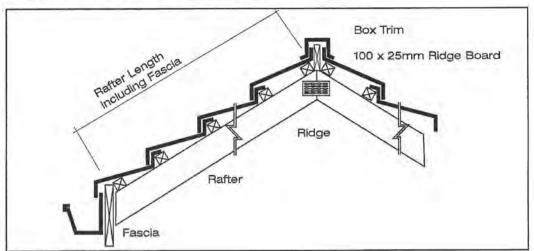
BATTEN SPACING - BOX TRIM WITH CONVENTIONAL RAFTER AND RIDGE BOARD



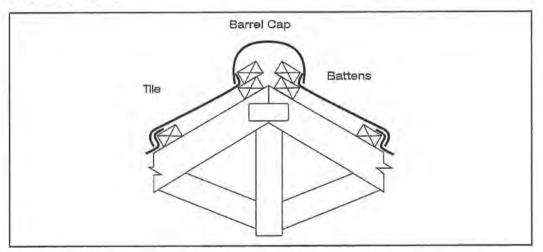
NOTE: This batten spacing applies to Gerard Colortile, Gerard Tuffcoat Tile and Gerard Corona Shake. For Gerard Senator Shingle the main roof area batten spacing is 185mm and for Gerard Oberon Shingle It is 160mm.



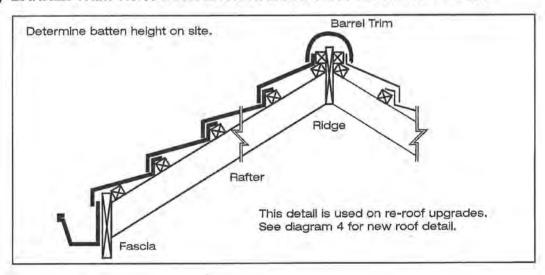
DETERMINING THE RAFTER LENGTH



A TRUSS OPTION

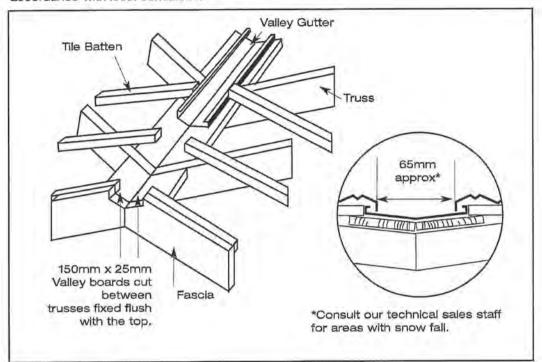


BARREL TRIM WITH CONVENTIONAL RAFTER AND RIDGE BOARD

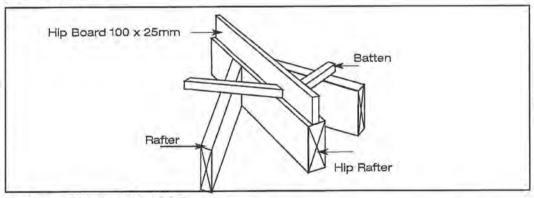


6 VALLEYS

The accompanying details suggest some of the ways valley gutters may be fitted. Local accepted practice, building regulations and site conditions will dictate the final method. The valley gutter is formed from Zincalume® steel sheet, the size being determined in accordance with local conditions.

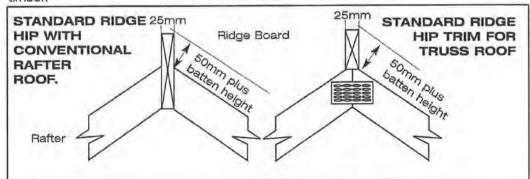


HIP BOARDS



RIDGE AND HIP BOARDS

Should project 50mm plus batten height above rafters, and be formed from 25mm thick timber.

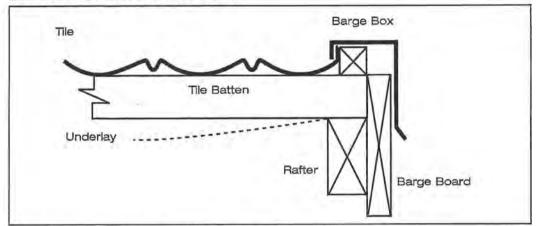


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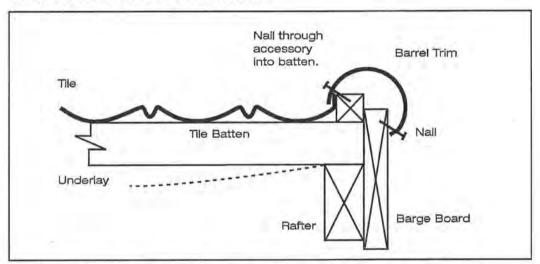
BARGE BOARDS

Barge Boards must project batten height above rafters, Note: Tile ends must be turned up.

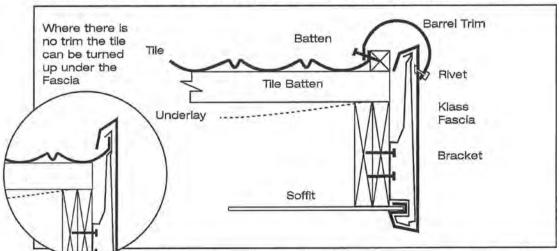
BARGE FINISH FOR BOX BARGE



BARGE FINISH FOR BARREL TRIM.



INSTALLATION OF BATTEN OVER KLASS FASCIA AT GABLE END.

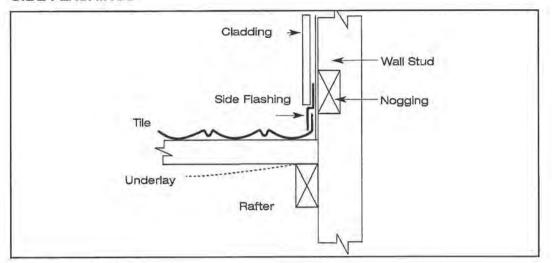


This has become a popular gable option when using fascia systems.

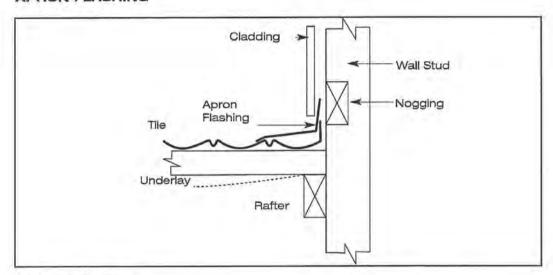
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JUNCTIONS WITH VERTICAL FACES

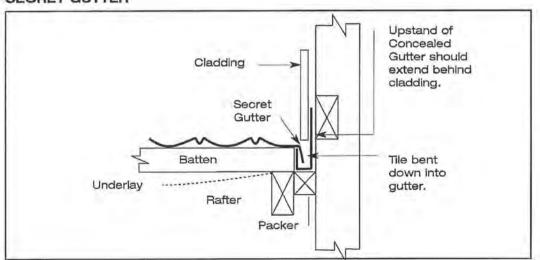
SIDE FLASHINGS



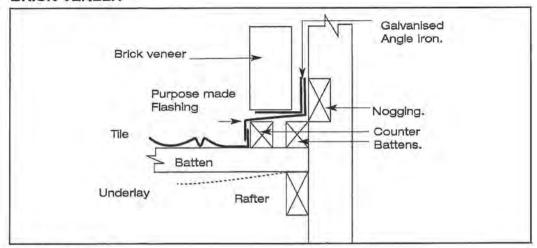
APRON FLASHING



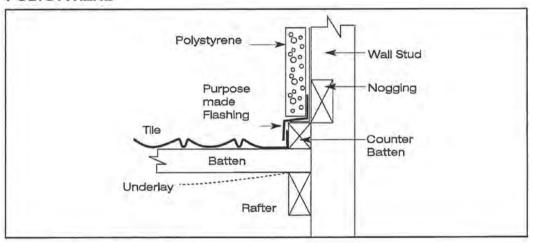
SECRET GUTTER



BRICK VENEER

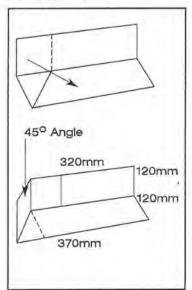


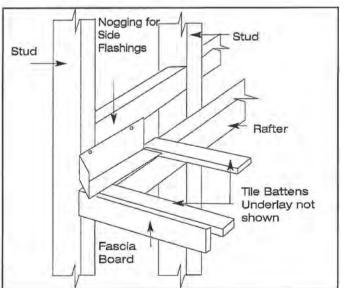
POLYSTYRENE



POP TOP SIDE FLASHING

Tray Flashing is fitted before Side Flashings are fitted. It sits over top of the first Batten at same pitch as tile.





B

DUTCH GABLES

When vertical junctions occur, the tiles are bent up and flattened to provide a turn-up under the dutch gable lining (Figure A). Where the rafter length takes full courses of tiles exactly, use the Apron Flashing. Bend up under lining and press aluminium edge into contours of the tile (Figure B).

FIGURE A

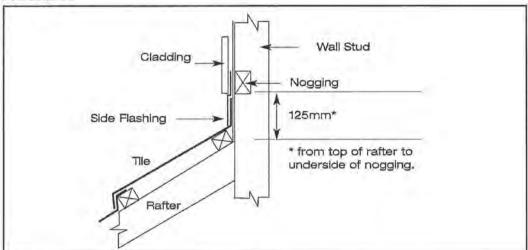
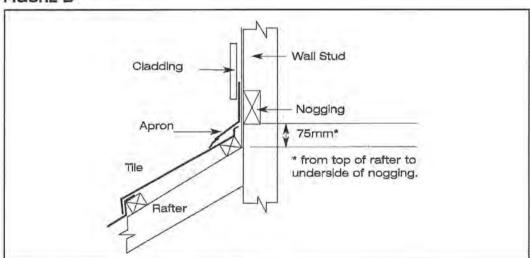


FIGURE B

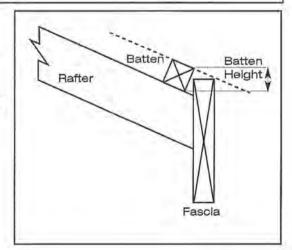


B

FASCIA

The fascia must not project above the rafter more than the height of the batten being used.

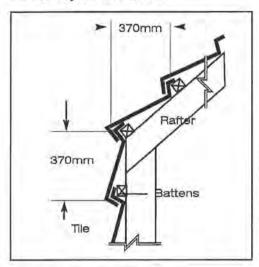
When a rainwater collection system is not required, the tiles will overhang the fascia by 25mm.

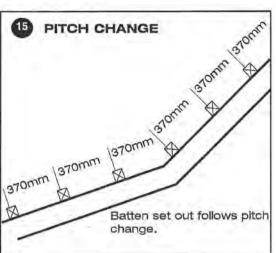




MANSARD ROOF INCLUDING A CHANGE OF ROOF PITCH

In this situation, a batten is placed at the point where the roof line changes pitch as illustrated. If an exact number of full tile courses is not practical at this change of pitch, a full tile may be bent to suit.

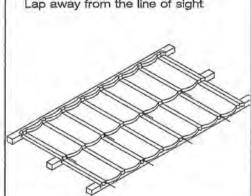




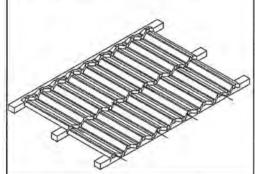
16 NAILING POSITIONS

GERARD COLORTILE

Nailing points 4 per tile. Lap away from the line of sight

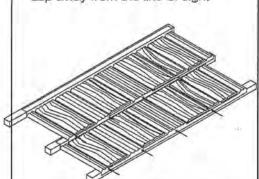


GERARD TUFFCOAT TILE Nailing points 4 per tile. Lap away from the line of sight



GERARD CORONA SHAKE

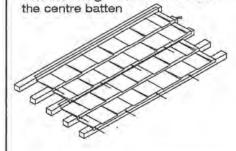
Corona Shakes laid staggered. Nailing points 4 per shake. Lap away from the line of sight



GERARD OBERON SHINGLE

Oberon Shingles laid staggered. Nailing points 4 per shingle plus 1 nail at lap of centre batten. Note: Same nalling for Gerard

Senator Shingle without the nail at



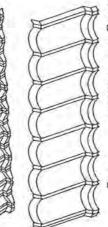


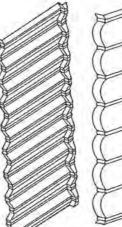
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TILE DIMENSIONS

GERARD COLORTILE
AND GERARD TUFFCOAT TILES
Width of Cover
Length of Cover Colortile 1257 mm
Length of Cover Tuffcoat 1270 mm
Overall Length
1320 mm Roof Cover 0.46m2

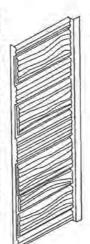
Tile per m²
Weight per tile Satin
Weight per m² Satin
Weight per tile Textured
Weight m² Textured Upstand 25mm 2,2 2,1 kg 4,7 kg 3,2 kg 7,0 kg





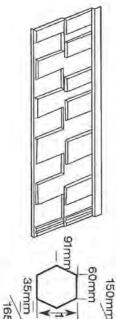
Width of Cover 370 mr

Tile per m²
Weight per tile Satin
Weight per m² Satin
Weight per tile Textured
Weight m² Textured Length of Cover Overall Length Roof Cover Upstand 4.8 kg 3.2 kg 7.0 kg 1250 mm 1310 mm 0.46m² 1.9 kg 25mm 2.2 370 mm



GERARD SENATOR SHINGLE

Tile per m²
Weight per tile Satin
Weight per m² Satin
Weight per tile Textured
Weight m² Textured Length of Cover Overall Length Roof Cover Upstand Width 0 Cover 3.2 kg 7.0 kg 1260mm 1320 mm 0.46m² 2.2 16mm 370 mm

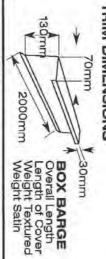


Weight per tile Satin Weight per m² Satin Weight per tile Textured Weight m² Textured Length of Cover Overall Length Roof Cover Width of Cover Tile per m² Upstand SHINGLE 1230 mm 1310 mm 0.39m² 25mm 2.54 2.8 kg 7.0 kg 320 mm

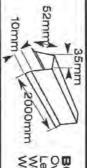


TRIM DIMENSIONS

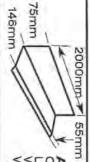
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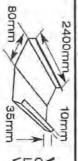
2000mm 1900mm 2.5kg 1.7kg



40mm 65mm 2000mm (11mm in height) BOX TRIM
Overall Length
Length of Cover
Weight Textured
Weight Satin Overall Length
Length of Cover
Weight Textured
Weight Satin SIDE FLASHING 2000mm 1900mm 1.4kg 1.0kg 2000mm 1200mm 2.0kg 1.2kg



Overall Length 2000mm
Length of Cover 1900mm
Weight Textured 4.2kg
Weight Satin 2.8kg



VALLEY
Overall Length
Length of Cover
Weight Satin

2400mm 2300mm 0.9kg

150mm 157mm 150mm 400mm 40mm Overall Length
Coverall Length
Length of Cover
Weight Textured
Weight Satin
Barrel Trim End
Diameter

150mm

94mm

15mm

85mm

400mm 370mm 0.6kg 0.35kg

405mm ANGLE TRIM
Overall Length
Length of Cover
Weight Textured
Weight Satin
Angle Trim End
Width

405mm 370mm 0.5kg 0.35kg 157mm

165mm

GERARD

=

TILE COVERAGE TABLE

Rafter Length*

To suit full course of Tiles**	Number of Tile courses	type of barge finishing detail you decide to use. To calculate the most efficient roof lengths for full tiles calculate using the formulas provided.
mm		
0.330m	1	BOX BARGE, BARREL TRIM, ANGLE TRIM
0.695m	2	ON GABLE ENDS.
1.065m	3	For the first gable end tile allow tile overall length les
1.435m	4	40mm (for the turn up on the tile) plus 65mm (for th
1.805m	5	trim)
2.175m	6	
2.545m	7	For each tile in the body of the roof allow the tile
2.915m	8	length of cover.
3.285m	9	iongar of octon
3,655m	10	For the other gable end tile allow tile length of cover
4.025m	71	less 40mm plus 65mm.
4.395m	12	iodo sommi pido commi
4.765m	13	eg. The ideal span of roof with a gable at both ends
5.135m	14	using 10 full Gerard Colortiles would be:
5.505m	15	using to fail defaile oblighting would be.
5.875m	16	First gable end tile
6.245m	17	1,320mm -40mm +65mm = 1,345mm
6.615m	18	Body of roof tiles
6.985m	19	8 tiles x 1257mm = 10,056mm
7.355m	20	Other gable end tile
7.725m	21	1,257mm -40mm +65mm = 1,282mm
8,095m	22	1,25711111 -40111111 +05111111 = 1,262111111
8.465m	23	= 12,683mm
8.835m	24	= 12,000(1)(1)
9.205m	25	
9.575m	26	KLASS FASCIA OR GABLE ENDS
9.945m	27	For the first gable end tile allow the overall length les
10.315m	28	50mm (for the turn up under Klass Fascia).
10.685m	29	Suffill (for the turn up drider klass Fascia).
11.055m	30	For each tile in the body of the roof allow the tile
11.425m	31	그 사람이 살아 가장 아니는 아이들이 얼마나 아이들이 얼마나 아이들이 얼마나 아니는
11.795m	32	length of cover.
12.165m	33	For the other gable end tile allow the length of cover
12.535m	34	less 50mm
12.905m	35	less sommi
13.275m	36	eg. The ideal span of roof with a gable at both ends
13.645m	37	using 12 full Gerard Corona Shakes would be:
14.015m	38	using 12 full derard corona shakes would be.
14.385m	39	First gable and tile
14.755m	40	First gable end tile 1310mm -50mm = 1,260mm
15.125m	41	
15.495m	42	Body of roof
15.865m	43	10 tiles x 1,250mm = 12,500mm Other gable end
16.235m	44	1,250mm -50mm = 1,200mm
16.605m	45	1,200mm = 1,200mm
16.975m	46	= 14,960mm
17.345m	47	= 14,900mm
17.715m	48	
18.085m	49	
18.455m	50	
G.C. G.C.	T.(7)	

ENDS.

OVERALL ROOF LENGTH FOR GABLE

The overall roof length for gable ends depends on the

Technical Freephone 0800 104 868 Freefax 0800 766 324



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^{*} To be used for estimating purposes only. Tile course quantities for rafter lengths allow for 40mm tile overhang into the eaves gutter. For steep pitch roofs and for some gutter systems this figure may have to be increased. When using Barrel Trim or Angle Trim accessories, the ideal rafter length allowing for full courses of tiles is 50mm longer than specified above,

** Note dimensions for Gerard Oberon Shingle will be different as the tile width is only

1 GENERAL

This Section details the non-specific installation information required for the Firth RibRaft Floor System (the system). Full information on the non-specific details and design procedures, and requirements for the site assessment are described in Section 1 of this Manual (Design Information).

2 SITE REQUIREMENTS

2.1 General

The site requirements of this Manual are concerned solely with the soil conditions under or immediately adjacent to the system. If a site does not comply with this Manual, the system shall be subject to specific design.

This Section shall only apply for building sites such that:

- · the ground is as specified in the Section 1 of this Manual;
- any system erected at the top of a slope (whether fill or natural ground) shall be located as shown in Figure 1 so that the finished ground is always outside the dashed line shown. (The vertical distance, V, shall be measured to 50mm below the underside of the slab).

Where the finished ground does not comply with Figure 1, the slope shall be retained by a specifically designed retaining wall.

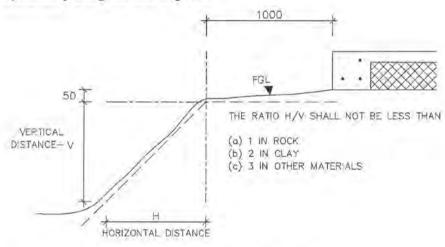


Figure 1: Relationship of RibRaft to Sloping Ground Surface

2.2 Temporary Excavations

No excavation shall take place at a location or in a manner where the stability of the foundation material is likely to be compromised. The backfilled material shall match the compaction and strength of, and have similar properties to, the surrounding material. The sides of the excavation shall be propped as necessary.

FIRTH RIBRAFT FLOOR SYSTEM MANUAL

Temporary excavations shall be open for no longer than 48 hours and shall take place only above the critical depth line as shown on Figure 2. Should temporary excavations be required below this line, specific engineering design is required.

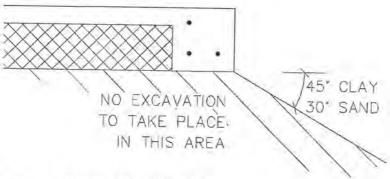


Figure 2: Temporary Excavation Limits

2.3 Surface water

Surface water from the site shall not flow across the slab platform. For example, on cut and fill sites the ground uphill from the system shall be graded to direct any surface run-off away from the system as shown in Figure 3.

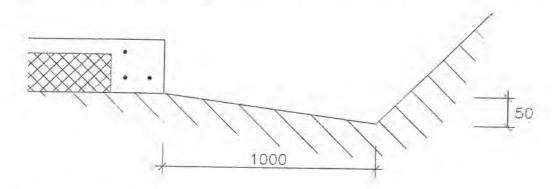


Figure 3: Site Grading

3 INSTALLATION PROCEDURE

3.1 Site Preparation

All vegetation, topsoil and other organic or deleterious material shall be removed from the area to be covered by the building (formation area) prior to commencing construction of the system.

3.2 Earthworks

The formation area shall be cut or filled to a level approximately 330mm below finished floor level. Where fill is required to achieve this level, the fill shall be certified by a geotechnical engineer (outside the scope of this Manual) or shall be in accordance with Clause 7.5.3 of NZS 3604:1999 "Timber Framed Buildings".

The formation area shall also extend a minimum of 1000mm beyond the slab perimeter as shown in Figure 4 below. The installer shall confirm the acceptability of the ground over the entire building platform before proceeding with the construction. Refer to Clause 3.5 of Section 1 (Design Information) for requirements.

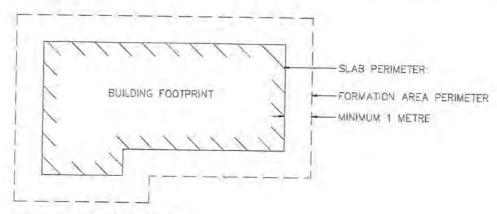


Figure 4: Plan of Formation Area

3.3 Shear Keys

Where shear keys are required, the holes shall be drilled following the site clearing and earthworks, in accordance with Clause 4 below, and prior to the construction of the system commencing.

3.4 Plumbing and Services

Any plumbing and services required beneath the system shall be conveyed underground to their plan location then brought up through the system. The trenching, placing, and bedding of the pipes/ducts and the backfilling of the trenches shall conform to the requirements of the consent documentation. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. The maximum diameters of the services/ducts shall be as dictated in Section 1.

Where required, the services shall be installed by removing unnecessary polystyrene and placing pipes within the pod depth. All pipes shall be held firmly in place and have temporary end covers. Any services crossing ribs or the edge beam (either horizontally or vertically) shall be placed only within the middle third of the member. At no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the ribs. The pods shall be cut to allow for this and if necessary, the spacing of the ribs shall be decreased locally. There shall be 600mm minimum spacing in each direction between penetrations through the system.

At all locations where services pass through the system, they shall be placed centrally within a sleeve 50mm greater in diameter than the service duct/pipe. This is to allow seismic tolerances to prevent shearing of the services during a seismic event. Where the services pass through the top of the system, the ducts shall be sealed with Denso tape and a type of easily compressible foam, or similar, to prevent materials entering the subfloor cavities.

3.5 Sand Blinding

A layer of sand shall be placed, screeded and compacted over the building platform, extending to at least 500mm beyond the system perimeter - refer Figure 5. The maximum thickness of this blinding layer shall be 50mm. The surface shall be level and a minimum of 305mm below finished floor level. A small plate compactor, vibrating roller or similar, should be used to compact the sand blinding layer. The sand is required to be level to ensure that pods remain stable throughout the installation of the slab.

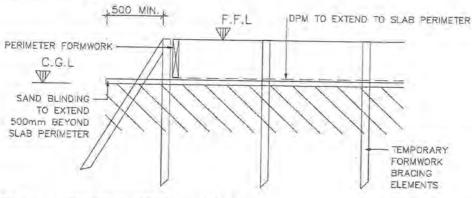


Figure 5: Sand Blinding/DPM/Formwork Details

3.6 Damp Proof Membrane

The damp proof membrane (DPM) material shall be in accordance with NZS 3604:1999. The DPM shall be laid over the entire building platform on top of the sand blinding layer, extending to the outside of the edge beam - refer Figure 5 above. The joints shall be lapped not less than 150mm and sealed with pressure sensitive tape. All penetrations of the DPM by plumbing and services shall also be sealed with pressure sensitive tape.

The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork. The installer shall ensure a square and tidy finish at the underside and at all corners of the edge beam.

3.7 Edge Formwork

The edge formwork shall be constructed ensuring that the requirements of NZS 3109:1997 "Concrete Construction" are adhered to. The formwork shall be adequately supported and braced to prevent any buckling or warping. If the wall is to be constructed in brick veneer, formwork for a brick veneer rebate should be adequately fixed to the perimeter formwork.

Thorough cleaning of re-useable formwork and the use of release agents enhances the life and performance of formwork and maintains a quality surface finish.

3.8 Laying the Pods and Spacers

The Firth polystyrene pods shall be laid out over the DPM in a regular waffle pattern. The Firth 300mm spacers for the edge beam shall be placed at a maximum of 1200mm centres along the perimeter of the slab and one per pod or part pod. Except where there is a loadbearing wall, each

FIRTH RIBRAFT FLOOR SYSTEM MANUAL

The concrete shall be poured in such a way to ensure that the pods remain in position during placing (Firth recommends that small amounts of concrete be placed on top of the pods prior to the ribs being filled). The concrete shall be compacted with the use of an immersion vibrator around all steel and into all corners of the formwork.

3.10.2 Finishing

Screeding with the aid of a level shall commence immediately after compaction. Unless specifically installed as a screeding datum, the top of the formwork shall not be assumed as level and thus shall not be used for screeding purposes. Final finishing with a trowel shall take place after all the bleed water has evaporated. Edge of slab and rebates shall be tooled to prevent chipping of top of slab. The surface shall be a blemish free surface to class U3 finish (refer NZS 3114:1987 "Specification for Concrete Finishes").

3.10.3 Curing

Proper curing of the concrete must take place immediately after finishing the concrete. One of the following methods of curing is recommended:

Ponding or continuous sprinkling of water.

- Placing a wet covering or plastic membrane over the slab

The use of liquid membrane curing compounds.

3.11 Shrinkage Control Joints

Shrinkage control joints shall be installed in exactly the same manner and locations as would be required for a conventional slab on ground. The joints shall be cut to a depth of 25mm and shall be cut no later than 24 hours in summer, or 48 hours in winter, after the concrete is placed. Shrinkage control joints shall be installed in accordance with Clause 7.5.8.6.4 of NZS 3604:1999.

3.12 Removal of Formwork

The formwork shall not be removed prior to 12 hours after the slab has been finished. No installation loads are to be placed on the slab before adequate curing has taken place.

3.13 Brick Veneer

Where the building is to be clad with brick veneer, the rebate in the edge beam shall be waterproofed with a bituminous sealer due to the possibility of ponding of water. Firth recommends a Flintcote® or equivalent coating on both the vertical and horizontal faces of the rebate.

3.14 Landscaping/Paving

Landscaping and/or paving adjacent to the slab shall be kept the minimum required distance below FFL, as per the requirements of NZS 3604:1999. The landscaping shall allow for large trees to be kept sufficiently away from the edge of the slab. This is to prevent the tree roots from disturbing the soil moisture conditions under the slab. As a guide, trees should be as far away from the edge of the slab as they are tall.

3.15 Ongoing Maintenance

The building owner shall ensure that the ground surrounding the system be maintained so that the integrity of the system is not jeopardised. In other words, at no time shall the ground immediately adjacent to system be allowed to settle away to expose the underside of the slab.

This can also be ensured by maintaining the landscaping or providing a paved surface or similar around the edge of the building.

4 SHEAR KEYS

Shear keys shall be provided to conform to the requirements of Section 1 of this Manual.

Holes for the shear keys shall be drilled at least 1000mm deep. Into the bottom of each hole a RibRaft Shear Key Support shall be placed. Every precaution shall be taken to ensure that the shear key support is laid level and at the base of the hole. The minimum depth of concrete placed on the support shall be 900mm.

The connection steel (2HD10) shall be secured in place and held during pouring to ensure the bars are correctly located. The concrete for the shear keys shall be placed separately to the rest of the floor and shall be finished level to the top of the sand blinding layer.

The top surface of the shear key shall be finished rough to ensure a good join to the Raftmix concrete in the system and the DPM shall be neatly cut around the shear keys.

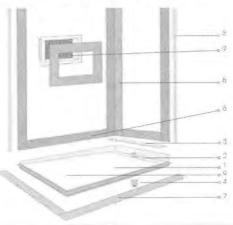
END OF SECTION 2





Firth Industries' RibRaff Floor System is accredited by the Building Industry Authority as complying with certain provisions of the New Zealand Building Gode. The Authority's accreditation is binding on territorial authorities and building certifiers.

Linea Quattro | lessential structure and connections



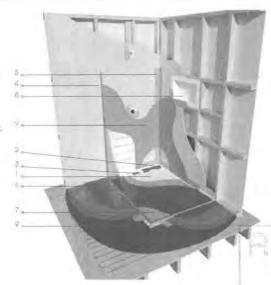
- Shower base
- 2. Channel drain
- 3. Stainless steel drain cover
- 4. Waste outlet (40mm / 50mm)
- 5. Glazing channels
- 6. Base to wall reinforcement band
- 7. Base to floor reinforcement band
- 8. Corner connection band
- 9. (Optional) EasyNiche accessory
- 10. Fully frameless screen (& hardware)
- 11. (Optional) Atlantis self-adhesive sheet membrane for the full shower wall area.

Waterproofing

The 100% waterproof Atlantis shower base and connections are compliant with the requirements of the New Zealand Building Code.

The shower system is compatible with any compliant waterproofing membrane used on the walls and for the rest of the bathroom floor.

- 1. Shower base
- 2. Channel drain and stainless steel cover
- 3. Waste outlet
- 4. Glazing channels
- 5. Corner reinforcement band
- 6. Reinforcement band connections
- 7. Adhesion layer
- (Optional) EasyNiche accessory
- 9. Liquid waterproofing (by others).



SHOWER BASE

- Structurally solid pre-formed base made of lamingread GPP material - already 100% waterproof.
- Ready-to-file gelcoat surface accepts a wide range of (specified) cament-based file adhesives.
- No structural alterations to (timber) foot required (where fall side. is less than 1000mm).
- Base support structure for level placement on floor or bedding into a concrete surry
- Can also be installed to achieve low-step entiry on any existing.
- Minimum 70mm high upstand for secure connection to wall membrane:
- Factory-filted glass receiver channels on base.
- Guaranteed fall (1:80) to waste.
- Single plane to channel drain surface accepts tiles up to 19/mm thick (standard).
- Tricker files can be accommodated by special request
- Base underside adhesive supplied (for fixing to floor).
- Weight: 16kg/m².

CHANNEL DRAIN & WASTE

- Integral channel drain located at side (for 2 and 3% walled) showers) and at side or back (for 3-walled)showers.
- · 40mm direct flow vertical waste outlet.
- Maximum flow rate 40 litres per minute.
- Stainless sleet drain in optional polished (standard) of brushed finish.

WATERPROOFING

ESSENTIAL (Standard): Atlantis self-acheeive reinforcement band in supplied for internal corner(s), floor and wall connection.

- Compatible with any complaint squid waterproofing membraries. FULL MEMBRANE: Atlantis sell-adhative AFM WM sheet memorana for shower wall can be supplied as an upgrade botton
- * Optimum controlled I mirri frickness
- Applied membrane immediately ready for tilling.
- Building Code compliant (AS 3740-2004). (BRANZ appraisa) certificate on request)
- 15-year product durability warranty.



PRECISION-FIT NAKED FRAMELESS SCREENS

- 8mm taughened safety glass screens.
- Hinged deprophlen complete with chieme/stanless steel mandles, solid brass hinges and fixing materials.
- Sliding door option complete with stainless steel handles, railer assemblies and installation materials.
- Walk in fixed panel options available in most sizes.
- Satin anodised wall glass receiver channels incorporate mechanical gioss locking system and are machined to lock with base channels.
- High strength aium-hium top rail prace at 2000 mm high above base.
- Screens supplied at 2120mm overal height.
- 5 year durability warranty (screens).
- Subclied with costalcote glass cleanerland surface exclector. (for after purchase application)

EASYNICHE™ PRODUCT SHELF

- . One place unit made of GRP composite.
- Aready 150% waterproof
- # Fits into 90mm wall cavify.
- Available in 10 sizes including lootrest.
- Supplied with satiliadhesive reinforcement band for conflection
- Compatible with all wet area boards
- 25-year croduct warranty.

Surroution of 3 wallost allower chaving Linea Quality. Industriand N sheeksan HZ whinte (ranged abor) option



Specifications subject to change without horizon, Please check www.atlantis.net.nz (or kitas) version.



www.atlantis.net.nz 43



BRANZ Appraised

Appraisal No.461 [2010]

BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL No. 461 (2010)

This Appraisal replaces BRANZ Appraisal No. 461 (2005) issued 4 February 2005.

PROTECTO WRAP AFM®-WM WET AREA MEMBRANE

Marshall Waterproofing NZ/AUS Ltd

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Porirua City
New Zealand
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Product

1.1 Protecto Wrap AFM®-WM Wet Area Membrane is a self adhesive sheet waterproofing membrane for use under ceramic or stone tile finishes in internal wet areas.



Scone

- 2.1 Protecto Wrap AFM®-WM Wet Area Membrane has been appraised for use as a waterproofing membrane for internal wet areas of buildings, within the following scope:
- on floor substrates of concrete, flooring grade particle board, plywood, compressed fibre cement sheet and fibre cement sheet tile underlay, and on wall substrates of concrete, concrete masonry, wet area fibre cement sheet lining systems and wet area plasterboard lining systems; and,
- · when protected from physical damage by ceramic or stone tile finishes; and,
- where floors are designed and constructed such that deflections do not exceed 1/360th of the span.
- 2.2 The use of Protecto Wrap AFM®-WM Wet Area Membrane on concrete slabs where hydrostatic or vapour pressure is present is outside the scope of this Appraisal.
- 2.3 Building structural movement and control joints in the substrate must be carried through to the tile finish. The design and construction of the substrate and movement and control joints are specific to each building, and therefore the responsibility of the building designer and building contractor and are outside the scope of this Appraisal.
- 2.4 Ceramic or stone tile finishes are outside the scope of this Appraisal.
- 2.5 The membrane must be installed by Marshall Waterproofing NZ/AUS Ltd certified installer.

Building Resummen

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Protecto Wrap AFM®-WM Wet Area Membrane if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1 (b) 15 years. Protecto Wrap AFM®-WM Wet Area Membrane meets this requirement. See Paragraph 9.1.

Clause E3 INTERNAL MOISTURE: Performance E3.3.6. Interior wet area floors and walls incorporating Protecto Wrap AFM®-WM Wet Area Membrane will meet this requirement. See Paragraphs 11.1-11.6.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. Protecto Wrap AFM®-WM Wet Area Membrane meets this requirement and will not present a health hazard to people.

This Appraisal appraises an Alternative Solution in terms of New Zealand Building Code compliance.

Toganical Specification

4.1 Materials supplied by Marshall Waterproofing NZ/AUS Ltd are as follows:

Membrane

 Protecto Wrap AFM®-WM membrane is 1 mm thick and consists of a fabric reinforcement laminated to an SBS modified, rubberized, asphalt adhesive membrane with a 50 mm wide peel-and-stick side overlap strip. It is available in rolls 900 mm wide x 23 m long.

Accessories

- AFM500 Detail Tape is a 1 mm thick unreinforced conformable tape used for detailing internal corners, drains, posts and penetrations. The tape is installed prior to installation of the membrane.
- #6000 Primer is a water-based primer for use on indoor applications. It is used at full strength.
- JS160H Mastic is a rubberized, adhesive, liquid membrane used as a sealant at membrane terminations and at end laps; for seam sealing and for membrane repairs.

Handling and Storage

5.1 All materials must be stored inside, up off concrete floors, in dry conditions, out of direct sunlight, at temperatures between 10°C and 32°C. Materials must not be removed from the packaging until ready to use. The membrane product has a shelf life of 2 years from date of manufacture in the original unopened packaging. Once opened, the products must be used within 3 months.

Technical Merature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Protecto Wrap AFM®-WM Wet Area Membrane. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

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General

7.1 Protecto Wrap AFM®-WM Wet Area Membrane is for use in buildings where an impervious waterproof membrane is required to floors and walls to prevent damage to building elements and adjoining areas.

7.2 The membrane must be protected from physical damage by the application of ceramic or stone tile finishes.

7.3 Movement and control joints may be required depending on the shape and size of the building or room, and the tile finish specified. Design guidelines can be found in the BRANZ "Good Practice Guide Tiling".

7.4 Timber framing systems must comply with NZS 3604, or where specific engineering design is used, the framing shall be of at least equivalent stiffness to the framing provisions of NZS 3604, or comply with the serviceability criteria of NZS 4203. In all cases framing must be provided so that the maximum span of the substrate as specified by the substrate manufacturer is met and all sheet edges are fully supported. Timber framing systems supporting the substrates must be constructed such that deflections do not exceed 1/360th of the span. Where NZS 3604 is used, the allowable joist spans given in Table 7.1 shall be reduced by 20%.

Substrates

Plywood

8.1 Plywood must be a minimum of 17 mm thick complying with AS/NZS 2269, CD Grade Structural with sanded C face upwards and treated to H3 (CCA treated). LOSP treated plywood must not be used. The Plywood must be supported with dwangs or framing with a maximum span of 400 mm in each direction, fixed with 10g x 50 mm stainless steel countersunk head screws at 150 mm centres on the edges and 200 mm through the body of the sheets.

Fibre Cement Compressed Sheet/ Fibre Cement Sheet Tile Underlay

8.2 Fibre cement compressed sheet must be manufactured to comply with the requirements of AS 2908.2 and must be specified by the manufacturer as being suitable for use as a wet area substrate. Installation must be in accordance with the instructions of the manufacturer.

Concrete and Concrete Masonry

8.3 Concrete and concrete masonry substrates must be to a specific engineering design meeting the requirements of the NZBC, such as concrete construction to NZS 3101 and NZS 3604 Concrete Slab-On-Ground Floors and Concrete masonry to NZS 4229 and NZS 4230.

Wet Area Wall Linings

8.4 Plasterboard wall linings must be manufactured to comply with AS/NZS 2588, and be covered by a valid BRANZ Appraisal for use in internal wet areas.

8.5 Fibre cement sheet must be manufactured to comply with the requirements of AS 2908.2 and must be specified by the manufacturer as being suitable for use as a wet area lining. Installation must be in accordance with the instructions of the manufacturer.

Durability

Serviceable Life

9.1 Protecto Wrap AFM®-WM Wet Area Membrane, when subjected to normal conditions of environment and use, are expected to have a serviceable life of at least 15 years and be compatible with ceramic or stone tile finishes with a design service life of 15-25 years.

Maintenance

10.1 No maintenance of the membranes will be required provided significant substrate movement does not occur and the tile finish remains intact. Regular checks must be made of the tiled areas to ensure they are sound and will not allow moisture to penetrate. Any cracks or damage must be repaired immediately by repairing the tiles, grouts and sealants.

10.2 In the event of damage to the membranes, the tiling must be removed and the membrane repaired by removing the damaged portion and applying a patch as for new work.

10.3 Drainage outlets must be maintained to operate effectively, and ceramic or stone tile finishes must be kept clean.

Internal Moisture

11.1 Protecto Wrap AFM®-WM Wet Area Membrane is impervious to water and when appropriately designed and installed will avoid the likelihood of water penetrating behind linings or entering concealed spaces.

11.2 Protecto Wrap AFM®-WM Wet Area Membrane is suitable for use to contain accidental overflow to meet NZBC Clause E3.3.2. A means of Code Compliance for overflow is given in NZBC Acceptable Solution E3/AS1 Paragraph 2.

11.3 Surfaces must be finished with ceramic or stone tile finishes. A means of Code Compliance to NZBC Clause E3.3.3 and E3.3.4 is given in NZBC Acceptable Solution E3/AS1 Paragraph 3.1.1 (b), 3.1.2 (b) and 3.3.1 (b).

11.4 Falls in showers and shower areas must be a minimum of 1 in 50. In unenclosed showers, falls must extend a minimum of 1500 mm out from the shower rose. Floor wastes must be provided and the floor must fall to the outlet.

11.5 The waterproofing membrane must completely cover shower bases, and for unenclosed showers it must extend a minimum of 1500 mm out from the shower rose. Further design guidance on waterproofing wet areas, including waterproofing walls and junctions can be obtained from AS 3740, BRANZ "Good Practice Guide Tiling", and flooring and wallboard manufacturers.

11.6 Where water resistant wall finishes such as prefinished sheet materials are used, they must flash over the membrane a minimum of 30mm.

Installation Internation

Installation Skill Level Requirement

12.1 Installation of the membranes must be completed by Marshall Waterproofing NZ/AUS Ltd certified installer.

12.2 Installation of substrates must be completed by tradespersons with an understanding of internal wet area construction, in accordance with instructions given within the Marshall Waterproofing NZ/AUS Ltd Technical Literature and this Appraisal.

Preparation of Substrates

13.1 Concrete slabs and plywood must be dry and sound before installation proceeds. Concrete slabs can be checked for dryness by using a hygrometer as set out in BRANZ Bulletin Number 424. The relative humidity of the concrete surface must be 75% or less, and the moisture content for plywood must be a maximum of 20% before laying the membrane.

13.2 The ambient and substrate temperatures must be between 7°C and 49°C before laying the membrane.

13.3 Surfaces must be smooth and free from sharp edges, dust, dirt or other materials such as oil, grease or concrete formwork release agents. All surface defects must be filled to achieve a smooth and uniform surface.

13.4 Sheet materials must be installed in accordance with the relevant manufacturers instructions. All sheet edges must be supported by framing.

13.5 Substrates must be primed with #6000 Primer and allowed to cure before the membrane is installed. When fully cured the primer is tacky and will not come off the surface.

13.6 Primed surfaces must be covered with the membrane on the same day that the primer is applied, or they must be reprimed.

Membrane Installation

14.1 All corners (floor to wall) and areas around pipes, conduits and any other penetrations through the substrate must be primed with #6000 Primer and then taped with AFM500 Detail Tape. The tape must be formed to fit tightly to the penetrations and the substrate.

14.2 Drain openings must be primed with #6000 Primer and then taped with AFM500 Detail Tape. The tape must extend at least 150 mm beyond the perimeter of the drain.

14.3 The membrane is cut to the length necessary for it to extend 150 mm in all directions beyond the area to be covered. The first edge of the release paper is carefully removed and the membrane is then aligned and pressed into place. The release paper is continuously removed, exposing the adhesive underside, while the membrane is smoothed onto the primed surface. Continuing to smooth the membrane as it comes into contact with the primer is essential to achieving adhesion and preventing the trapping of air.

14.4 Adjoining Protecto Wrap AFM®-WM membrane sheets are aligned with the overlap strip of the installed sheet, giving a 50 mm overlap. The lap joint must be firmly rolled to create a cohesive bond between the two membrane sheets.

14.5 End joints must be lapped a minimum of 150 mm and sealed using JS160H Mastic, in accordance with the Technical Literature.

14.6 After application, the membrane must be inspected, and any defects repaired. If the membrane is damaged or requires repair, the area must be cleaned and lightly primed with #6000 Primer to 150 mm beyond the damaged area. A patch of Protecto Wrap AFM®-WM membrane is cut and rolled on firmly. A troweled bead of JS160H Mastic must be applied to the edges of the patch.

Tiling

15.1 Tiling directly to the Protecto Wrap AFM®-WM Deck and Balcony Membrane may be carried out immediately after the membrane has been laid.

15.2 Tiling must be undertaken in accordance with AS 3958.1 and BRANZ "Good Practice Guide Tiling". The compatibility of the tile adhesive must be confirmed with the adhesive manufacturer or Marshall Waterproofing NZ/AUS Ltd.

Inspections

16.1 Critical areas of inspection are:

- Construction of substrates, including crack control and installation of bond breakers and movement control joints.
- Moisture content of the substrate prior to the application of the membrane.
- Acceptance of the substrate by the membrane installer prior to application of the membrane.
- Installation of the membrane to the manufacturer's instructions, particularly installation to the correct thickness and use of reinforcement.
- Membrane integrity prior to the installation of tiles including protection from damage.

Health and Safety

17.1 Safe use and handling procedures for the membranes are provided in the Technical Literature. The materials must be used in conjunction with the relevant Material Safety Data Sheet.

Educat Appell

The following is a summary of the technical investigations carried out:

Tests

18.1 Tests have been carried out by Ramtech Laboratories Inc. in accordance with ICC Evaluation Services Acceptance Criteria for Waterproof Membranes used under Ceramic Tiles, AC 115 and ANSI 118.10. These tests covered fungus and microorganism growth, seam strength, breaking strength, dimensional stability, waterproofness and shear strength to ceramic tiles. The test results were reviewed by BRANZ experts and found to be satisfactory.

18.2 Testing covering pliability, water resistance, tensile strength, elongation, nail sealability, peel adhesion, UV sunlamp exposure, bursting strength and peel strength have been undertaken by other organisations.

The above test methods and results have been reviewed by BRANZ and found to be satisfactory.

Other Investigations

19.1 An assessment was made of the durability of the Protecto Wrap AFM®-WM Wet Area Membrane by BRANZ technical experts.

19.2 Site visits have been carried out by BRANZ to assess the practicability of installation and to examine completed installations.

19.3 The Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

20.1 The manufacture of Protecto Wrap AFM®-WM membrane has not been examined by BRANZ, but details of the quality and composition of the materials used were obtained and found to be satisfactory. USA evaluation reports have been taken into consideration.

20.2 The quality of manufacture of Protecto Wrap AFM®-WM membrane is the responsibility of the Protecto Wrap Company.
20.3 The quality of supply of the membrane system materials to the market is the responsibility of Marshall Waterproofing NZ/

AUS Ltd.

20.4 Quality on site is the responsibility of the Marshall Waterproofing NZ/AUS Ltd certified installer.

20.5 Designers are responsible for the substrate design, and building contractors are responsible for the quality of construction of substrate systems in accordance with the instructions of the substrate manufacturer, Marshall Waterproofing NZ/AUS Ltd and this Appraisal.

20.6 Building owners are responsible for the maintenance of the tiling or stone finishing systems in accordance with the instructions of Marshall Waterproofing NZ/AUS Ltd.

Sources of Information

- ANSI 118.10: 1999 Load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installations.
- AC 115 Criteria for Waterproof Membranes for Flooring and Shower Liners.
- · AS 2908.2: 2000 Cellulose-cement products flat sheet.
- AS 3740 2004 Waterproofing of wet areas within residential buildings.
- AS 3958.1: 1991 Guide to the installation of ceramic tiles.
- AS/NZS 4858 2004 Wet area membranes.
- · AS/NZS 2269: 2008 Plywood Structural.
- NZS 3101: 1995 The design of concrete structures.
- NZS 3602: 2003 Timber and wood-based products for use in buildings.
- NZS 3604: 1999 Timber framed buildings.
- NZS 4229: 1999 Concrete masonry buildings not requiring specific engineering design.
- NZS 4230: 1990 Code of practice for the design of masonry structures.
- New Zealand Building Code Handbook Department of Building and Housing, Third Edition May 2007,
- The Building Regulations 1992, up to, and including August 2008 Amendment.
- . Good Practice Guide Tiling, BRANZ, March 2004.
- Good Practice Guide Membrane Roofing, BRANZ, October 2003.



In the opinion of BRANZ, Protecto Wrap AFM®-WM Wet Area Membrane is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to Marshall Waterproofing NZ/AUS Ltd, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

- 1. This Appraisal:
- a) relates only to the product as described herein;
- b) must be read, considered and used in full together with the technical literature;
- does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
- d) is copyright of BRANZ.
- 2. Marshall Waterproofing NZ/AUS Ltd:
- a) continues to have the product reviewed by BRANZ;
- shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
- abides by the BRANZ Appraisals Services Terms and Conditions.
- d) Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
- BRANZ makes no representation or warranty as to:
- a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
- the presence or absence of any patent or similar rights subsisting in the product or any other product;
- any guarantee or warranty offered by Marshall Waterproofing NZ/AUS Ltd.
- Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
- BRANZ provides no certification, guarantee, indemnity or warranty, to Marshall Waterproofing NZ/AUS Ltd or any third party.

For BRANZ

Row B

Chief Executive

Date of issue: 14 April 2010



BRANZ Appraised Appraisal No.633 [2009]

BRANZ Appraisals

Technical Assessments of products for building and construction

> BRANZ **APPRAISAL** No. 633 (2009)

GRAPHEX CAVITY SVSTEM

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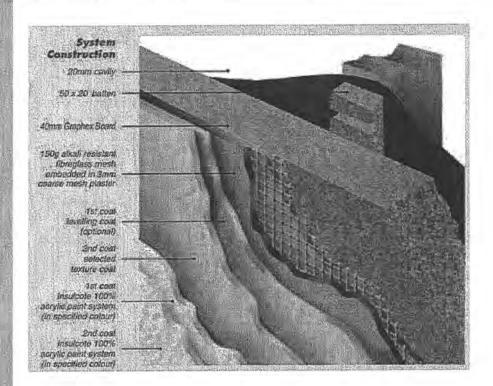


Produci

The Graphex Cavity System is a cavity-based Exterior Insulation and Finishing 1.1 System (EIFS) wall cladding. It is an external wall cladding system for residential and light commercial type buildings where domestic construction techniques are used.

The system consists of Neopor®, a graphite composite board fixed over polystyrene battens to form the cavity. The plaster coating system consists of a 3-4 mm thickness of fibreglass mesh reinforced, polymer-modified, cement-based plaster, which is finished with a cement-based finishing plaster that is then painted with a 100% acrylic-based paint system. The chosen finishing plaster is applied to give a range of different appearances, such as a sponge, patterned, adobe or spray textured finish.

The system incorporates a primary and secondary means of weather resistance (first and second line of defence) against water penetration by separating the cladding from the external wall framing with a nominal 20 mm drained cavity.



Scope

- The Graphex Cavity System has been appraised as an external wall cladding system for buildings within the following scope:
- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- constructed with timber framing complying with the NZBC; and,
- with a risk score of 0-20, calculated in accordance with NZBC Acceptable Solution E2/ AS1, Table 2; and,
- situated in NZS 3604 Building Wind Zones up to, and including 'Very High'.
- The Graphex Cavity System has also been appraised for weathertightness and 2.2 structural wind loading when used for timber and steel framed buildings subject to specific design up to a design differential ultimate limit state (ULS) wind pressure of 2.5 kPa.
- The Graphex Cavity System must only be installed on vertical surfaces (except for tops of parapets, sills and balustrades, which must have a minimum 15° slope and be waterproofed in accordance with the Technical Literature).
- The system is appraised for use with aluminium window and door joinery that is installed with vertical jambs and horizontal heads and sills. (The Appraisal of the Graphex Cavity System relies on the joinery meeting the requirements of NZS 4211 for the relevant Building Wind Zone or wind pressure.)
- Installation of components and accessories supplied by PSL and approved installers must be carried out only by PSL approved installers.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the Graphex Cavity System if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet or contribute to meeting the following provisions of the NZBC:

Clause B1 STRUCTURE: Performance B1.3,1, B1.3.2 and B1.3.4. The Graphex Cavity System meets the requirements for loads arising from self-weight, wind, impact and creep [i.e. B1.3,3 (a), (h), (j) and (q)]. See Paragraphs 10.1 - 10.4.

Clause B2 DURABILITY: Performance B2.3.1 (b), 15 years, B2.3.1 (c), 5 years and B2.3.2. The Graphex Cavity System meets these requirements. See Paragraphs 11.1 and 11.2.

Clause C3 SPREAD OF FIRE: Performance C3.3.5. The Graphex Cavity System meets this requirement. See Paragraphs 14.1 - 14.3.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. The Graphex Cavity System meets this requirement. See Paragraphs 16.1 - 16.5.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Graphex Cavity System meets this requirement and will not present a health hazard to people.

3.2 This is an Appraisal of an Alternative Solution in terms of New Zealand Building Code compliance.

Technical Specification

4.1 System components and accessories supplied by PSL are as follows:

Cavity Battens

 Graphex peel 'n' stick battens are manufactured from high density (Class H) expanded polystyrene (EPS) with an approximate density of 24 kg/m³. The battens are 21 mm thick by 45 mm wide and have a slotted face to allow air movement. The battens are coated on the back face with an acrylic adhesive, which is protected prior to installation by a removable film.

Neopor®

 Neopor® boards are 40 or 60 mm thick with an approximate density of 24 kg/m³. The boards are supplied in lengths ranging from 2.4 to 3.6 m x 1.2 m wide and are manufactured to meet the requirements of AS 1366 Part 3.

Plasters

- Coarse Mesh Render is a polymer-modified, Portland cement-based plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is applied as the base coat in a minimum 2 mm layer followed by the embedment of fibreglass mesh reinforcement in the outer surface. Coarse Mesh Render can also be used to achieve a spray textured finish.
- Ezytex is a polymer-modified, Portland cement-based finishing plaster supplied in 20 kg bags and mixed on site with clean drinking water. It is available in three grades to provide a textured, patterned or sponge finish.

Paint System Specification

At least two coats of a 100% acrylic-based exterior paint
must be used over the finishing plasters to make the system
weathertight and give the desired finish colour to exterior
walls. Insulcote is a 100% acrylic-based exterior paint
formulated for use over cement-based plasters and can be
used over Coarse Mesh Render and Ezytex finishing plasters.
Insulcote is supplied in 4 litre, 10 litre and 20 litre pails.

PSL allows the use of other latex exterior paint systems over Coarse Mesh Render and Ezytex finishing plasters. A latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730 must be used over the finishing plasters to make the system weathertight and give the desired finish colour to exterior walls. Paint colours must have a light reflectance value of 40% minimum regardless of gloss value. Proprietary paint systems not supplied by PSL have not been assessed and are therefore outside the scope of this Appraisal.

Accessories

- Reinforcing mesh alkali-resistant fibreglass mesh with a nominal mesh size of approximately 4 mm square and a weight of 150 g/m² for use in domestic and light commercial situations. Where a greater level of impact resistance is required, 360 g/m² alkali-resistant fibreglass mesh with a nominal mesh size of approximately 3 mm square is available.
- uPVC components sill flashing, jamb flashing and head flashing, base caps, corner beads, cavity vent strip, Z-flashing and horizontal and vertical control joint flashings.
- Neopor® board fixings (timber frame) 90 x 3.6 mm (for 40 mm thick) and 110 x 4.0 mm (for 60 mm thick) hotdipped galvanised flat head nails with 22 or 40 mm diameter washers.
- Neopor® board fixings (steel frame) 8-gauge x 75 mm (for 40 mm thick) and 8-gauge x 95 mm (for 60 mm thick) self-drilling AS 3566 Corrosion Class 3 or 4 screws in NZS 3604 defined Corrosion Zones, 1, 2, 3 and 4 and Grade 304 stainless steel screws in the sea spray zone with 40 mm diameter washers.
- · Washers 22 or 40 mm diameter polypropylene washers.
- 4.2 Accessories used with the system which are supplied by the approved applicator are:
- Waterproof membrane tapes tapes covered by a valid BRANZ Appraisal for use as waterproofing membranes over tops of plastered parapets, balustrades, fixing blocks and the like.
- Flexible sealant sealant complying with NZBC Acceptable Solution E2/AS1, or sealant covered by a valid BRANZ Appraisal for use as a weather sealing sealant for exterior use.
- Adhesive EPS compatible adhesive for gluing uPVC components to the Neopor® boards as and where required.
- 4.3 Accessories used with the system which are supplied by the building contractor are:
- Building wrap paper or wrap complying with NZBC Acceptable Solution E2/AS1 Table 23, or breather-type membranes covered by a valid BRANZ Appraisal for use as wall wraps.
- Building wrap support polypropylene strap for securing the building wrap in place and preventing bulging of the bulk insulation into the drainage cavity where cavity battens are installed at greater than 450 mm centres. (Note: additional vertical battens may also be installed to provide support.)
- Flexible sill and jamb flashing tapes flexible flashing tapes complying with NZBC Acceptable Solution E2/AS1 Paragraph 4.3.11, or flexible flashing tapes covered by a valid BRANZ Appraisal for use around window and door joinery openings.
- Window and door trim cavity airseal air seals complying with NZBC Acceptable Solution E2/AS1 Paragraph 9.1.6, or self-expanding, moisture cure polyurethane foam air seals covered by a valid BRANZ Appraisal for use around window, door and other wall penetration openings.

Handling and Storage

- 5.1 Handling and storage of all materials supplied by PSL or the approved installer, whether on or off site, are under the control of PSL approved installers. Dry storage must be provided on site for the fibreglass mesh and bags of plaster. Neopor® boards, battens, uPVC flashings and profiles must be protected from direct sunlight and physical damage, and should be stored flat and under cover. Liquid components must be stored in frost-free conditions.
- 5.2 Handling and storage of all materials supplied by the building contractor, whether on or off site, are under the control of the building contractor. Materials must be handled and stored in accordance with the relevant manufacturer's instructions.

Technical Literature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the Graphex Cavity System. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed. The Graphex Cavity System listing on the BRANZ website excludes specific details. These details are outside the scope of this Appraisal.

Design Information

Framing

Timber Treatment

7.1 Timber wall framing behind the Graphex Cavity System must be treated as required by NZS 3602.

Timber Framing

- 7.2 Timber framing must comply with NZS 3604 for buildings or parts of buildings within the scope limitations of NZS 3604. Buildings or parts of buildings outside the scope of NZS 3604 must be to a specific design in accordance with NZS 3603 and AS/NZS 1170. Where specific design is required, the framing must be of at least equivalent stiffness to the framing provisions of NZS 3604. In all cases studs must be at maximum 600 mm centres for buildings designed to NZS 3604 and at maximum 400 mm centres for specifically designed buildings situated in Building Wind Zones above NZS 3604 defined 'Very High'. Dwangs must be fitted flush between the studs at maximum 800 mm centres.
- 7.3 Timber framing must have a maximum moisture content of 24% at the time of the cladding application. (If Neopor® boards are fixed to framing with a moisture content of greater than 24% problems may occur at a later date due to excessive timber shrinkage.)

Steel Framing

- 7.4 Steel framing must be to a specific design meeting the requirements of the NZBC.
- 7.5 The minimum framing specification is 'C' section studs and nogs of overall section size of 75 mm web and 32 mm flange. Steel thickness must be minimum 0.55 mm.
- 7.6 For steel framed buildings situated within NZS 3604 defined Building Wind Zones up to, and including, 'Very High', studs must be at maximum 600 mm centres. For all other buildings studs must be at maximum 400 mm centres. Dwangs must be fitted flush between the studs at maximum 800 mm centres.

Neopor® Board Setout

- 7.7 All vertical Neopor® board edges must be supported and fixed through the cavity battens to the framing. Horizontal board edges must be supported at fixing locations with cavity spacers in accordance with the requirements of NZBC Acceptable Solution EZ/AS1, Paragraph 9.1.8.2(f). At the base of the wall, the Neopor® boards must hang 50 mm below the supporting framing.
- 7.8 Additional framing will be required at soffits, internal and external corners and window and door openings for the support and fixing of sheet edges.

General

- 8.1 When the Graphex Cavity System is used for specifically designed buildings up to 2.5 kPa design differential ULS wind pressure, only the weathertightness aspects of the cladding and maximum framing centres and sheet fixing centres are within the scope of this Appraisal. All other aspects of the building need to be specifically designed and are outside the scope of this Appraisal.
- 8.2 Openings in the cavity vent strip provide a minimum ventilation opening area of 1000 mm² per lineal metre of wall in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.3(b).
- 8.3 The ground clearance to finished floor levels as set out in NZS 3604 must be adhered to at all times. At ground level, paved surfaces, such as footpaths, must be kept clear of the bottom edge of the cladding system by a minimum of 100 mm, and unpaved surfaces by 175 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Table 18.
- 8.4 At balcony, deck or roof/wall junctions, the bottom edge of the Graphex Cavity System must be kept clear of any adjacent surface, or above the top surface of any adjacent roof flashing by a minimum of 35 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.3.6.
- 8,5 All buildings must have barriers to airflow in the form of interior linings with all joints stopped, or alternatively, unlined gables and walls must incorporate a rigid sheathing or an air barrier which meets the requirements of NZBC Acceptable Solution E2/AS1, Table 23. Where rigid sheathings are used, the fixing length must be increased by a minimum of the thickness of the sheathing.
- 8.6 Where penetrations through the Graphex Cavity System are wider than the cavity batten spacing, allowance must be made for airflow between adjacent cavities. A minimum 10 mm gap must be left between the bottom of the vertical cavity batten and the flashing to the opening.
- 8.7 Where the system abuts other cladding systems, designers must detail the junction to meet their own requirements and the performance requirements of the NZBC. The Technical Literature provides some guidance. Details not included within the Technical Literature have not been assessed and are outside the scope of this Appraisal.

Electrical Cables

8.8 PVC sheathed electrical cables must be prevented from direct contact with the Neopor®. When cables must penetrate the Neopor® for exterior electrical connections, the cable must be directly supported by passing through an electrical conduit.

Control Joints

- 9.1 Control joints must be constructed in accordance with the Technical Literature, and be provided as follows:
- . Horizontal control joints at maximum 6 m centres.

 Vertical control joints - at maximum 20 m centres; aligned with any control joint in the structural framing; where the system abuts different cladding types, or where the system covers different structural materials.

(Note: Horizontal and Vertical Control joints must be located over structural supports. The design of vertical control joints where the system abuts different cladding types is outside the scope of this Appraisal and is the responsibility of the designer - see Paragraph 8.7.)

Inter-storey Junctions

9.2 Inter-storey drained joints must be provided for walls over 2 storeys in height in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.9.4(b). Inter-storey junctions must be constructed in accordance with the Technical Literature.

(Note: Refer to Paragraph 14.2 for the requirements for barriers to vertical fire spread at inter-storey junctions for buildings of three or more floors.)

Structure

Mass

10.1 The mass of the Graphex Cavity System is approximately 7 kg/m², therefore it is considered a light wall cladding in terms of NZS 3604.

Impact Resistance

10.2 The system has adequate resistance to hard body impacts likely to be encountered in normal residential use. Where a greater level of impact protection is required a heavier grade of reinforcing mesh may be used. The heavy-grade fibreglass reinforcing mesh (360 g/m²) embedded in 5 mm thick plaster provides approximately 4 times the hard body impact strength of the standard grade mesh in 3 mm thick plaster. The likelihood of impact damage to the system when used in light commercial situations should be considered at the design stage, and appropriate protection such as the installation of bollards and barriers should be considered for vulnerable areas.

Wind Zones

10.3 The Graphex Cavity System is suitable for use in all Building Wind Zones of NZS 3604, up to, and including Very High where buildings are designed to meet the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 1.1, or up to 2.5 kPa design differential ULS wind pressure where buildings are specifically designed.

Neopor® Board Fixing

10.4 Neopor® boards must be fixed through the cavity battens and cavity spacers to the wall framing at maximum centres specified in Table 1.

Table 1: EPS Sheet Fixing Centres for Edges and Intermediate Studs

NZS 3604 Building Wind Zone with studs at maximum 600 mm centres	Maximum fixing centres (mm) beyond 1.5 m from an external corner	Maximum fixing centres (mm) within 1.5 m of an external corner
Low	300	300
Medium	300	200
High	300	150
Very High	300	150

Note: One fixing is also required into each dwang at mid-dwang length.

Note: In Low, Medium or High Building Wind Zones, 22 or 40 mm diameter washers may be used. In Very High Building Wind Zones, 40 mm diameter washers must be used.

	igned buildings up to 2.5 wind pressure with studs s.	
Maximum vertical fixing centres (mm) along studs	Maximum horizontal fixing centres (mm) along top and bottom plates	Maximum horizontal fixing centres (mm) along dwangs
150	200	150

Note: 40 mm diameter washers must be used in all situations.

Durability

11.1 The Graphex Cavity System meets code compliance with NZBC Clause B2.3.1 (b), 15 years for the cavity system and plaster finish, and code compliance with NZBC Clause B2.3.1 (c), 5 years for the exterior paint system.

Serviceable Life

11.2 The Graphex Cavity System is expected to have a serviceable life of at least 30 years provided the system is maintained in accordance with this Appraisal, and the Neopor® boards, fixings and plaster are continuously protected by a weathertight coating and remain dry in service.

Maintenance

12.1 Regular maintenance is essential to ensure the performance requirements of the NZBC are continually met and to ensure the maximum serviceability of the system.

12.2 Regular cleaning (at least annually) of the paint coating is required to remove grime, dirt and organic growth and to maximise the life and appearance of the coating. Grime may be removed by brushing with a soft brush, warm water and detergent. Paint systems must be recoated at approximately 5-10 yearly intervals in accordance with the paint manufacturer's instructions.

12.3 Annual inspections must be made to ensure that all aspects of the cladding system, including the coating system, plaster, flashings and any sealed joints remain in a weatherproof condition. Any cracks, damaged areas or areas showing signs of deterioration which would allow water ingress, must be repaired immediately. Sealant, coatings and the like must be repaired in accordance with the instructions of PSL.

12,4 Minimum ground clearances as set out in this Appraisal and the Technical Literature must be maintained at all times during the life of the system. (Failing to adhere to the minimum ground clearances given in this Appraisal and the Technical Literature will adversely affect the long term durability of the Graphex Cavity System.)

Control of Internal Fire and Smoke Spread

13.1 The Neopor® board used with the system meets the flame propagation criteria of AS 1366. The Neopor® board must also be protected from ignition in accordance with the requirements of NZBC Acceptable Solution C/AS1 Part 6, Paragraphs 6.20.11 and 6.20.12. Where required by NZBC Acceptable Solution C/AS1 Part 6, Table 6.3, flame barriers meeting the requirements of C/AS1 Part 6, Paragraph 6.20.13 and Appendix C, Paragraph C10.1 must be provided.

Control of External Fire Spread

14.1 The Graphex Cavity System has a performance level A in accordance with NZBC C/AS1 Table 7.5. The system is suitable for use as an external wall cladding system on buildings in all Purpose Groups, at any distance to the boundary.

14.2 For buildings of three or more floors where the cladding system extends to cover the walls of at least three floors, the requirements for barriers to vertical fire spread in the cladding as set out in NZBC Acceptable Solution C/AS1 Part 7, Paragraphs 7.9.18 and 7.9.19 must be met. These joints are not covered by the Technical Literature, and are outside the scope of this Appraisal. Design of the barrier joint must be specifically detailed by the designer to meet the NZBC, including blocking of the cladding cavity and wall framing cavity, and installation of flashing and sealing systems to collect and direct any moisture to the outside of the cladding system at this point.

Outbreak of Fire

15.1 The Graphex Cavity System must be separated from chimneys and flues in accordance with the requirements of NZBC Acceptable Solution C/AS1, Part 9 for the protection of combustible materials.

External Moisture

16.1 The Graphex Cavity System, when installed in accordance with this Appraisal and the Technical Literature, prevents the penetration of moisture that could cause undue dampness or damage to building elements.

16.2 The cavity must be sealed off from the roof and subfloor space to meet code compliance with Clause E2.3.5.

16.3 The Graphex Cavity System allows excess moisture present at the completion of construction to be dissipated without permanent damage to building elements to meet code compliance with Clause E2.3.6,

16.4 The details given in the Technical Literature for weather sealing are based on the design principle of having a first and second line of defence against moisture entry for all joints, penetrations and junctions. The ingress of moisture must be excluded by detailing joinery and wall interfaces as shown in the Technical Literature. Weathertightness details that are developed by the designer are outside the scope of this Appraisal and are the responsibility of the designer for compliance with the NZBC.

16.5 The use of the Graphex Cavity System where there is a designed cavity drainage path for moisture that penetrates the cladding, does not reduce the requirement for junctions, penetrations, etc to remain weather resistant.

Internal Moisture

17.1 The Graphex Cavity System alone does not meet NZBC Acceptable Solution E3/AS1, Paragraph 1.1.1(a). Buildings must be constructed with an adequate combination of thermal resistance and ventilation, and space temperature must be provided to all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated or may accumulate.

Water Vapour

17.2 The Graphex Cavity System is not a barrier to the passage of water vapour, and when correctly installed will not create or increase the risk of moisture damage resulting from condensation.

17.3 When the Graphex Cavity System is installed over a steel frame, the EPS battens and insulated drainage cavity will act as a thermal break to the steel frame in accordance with NZBC Acceptable Solution E3/AS1.

Energy Efficiency

Building Thermal Envelope

18.1 NZBC Acceptable Solution H1/AS1 or NZBC Verification Method H1/VM1 can be used for housing, communal residential, communal non-residential and commercial buildings.

Determining Thermal Resistance

The thermal resistance (R-values) of building elements may be verified by using NZS 4214. The BRANZ 'House Insulation Guide' Third Edition provides thermal resistances of common building elements and is based on calculations from NZS 4214. Calculations in accordance with NZS 4214 require that the ventilated air gap and the thermal resistance of each layer between the ventilated air gap and outside air be de-rated by a factor of 0.45. Therefore, in the Graphex Cavity System, unless better information is available for a specific case, the R-value of the Neopor® layer must be taken as R0.69 (40 mm thick) and R1.03 (60 mm thick) based on a thermal conductivity (k value) of 0.032 W/m °C.

Installation Information

Installation Skill Level Requirements

19.1 Installation and finishing of components and accessories supplied by PSL and the approved installers must be completed by P.P.C.S. qualified tradepersons, approved by PSL.

19.2 Installation of the accessories supplied by the building contractor must be completed by tradespersons with an understanding of cavity construction, in accordance with instructions given within the Graphex Cavity System Technical Literature and this Appraisal.

System Installation

Building Wrap and Flexible Sill and Jamb Flashing Tape

20.1 The selected building wrap and flexible sill and jamb tape system must be installed by the building contractor in accordance with the wrap and tape manufacturer's instructions prior to the installation of the cavity battens and the rest of the Graphex Cavity System. Building wrap must be installed horizontally and be continuous around corners. The wrap must be lapped 75 mm minimum at horizontal joints and 150 mm minimum over studs at vertical joints. Particular attention must be paid to the installation of the building wrap and sill and jamb tapes around window and door openings to ensure a continuous seal is achieved and all exposed wall framing in the opening is protected.

Aluminium Joinery Installation

20.2 Aluminium joinery and associated head flashings must be installed by the building contractor in accordance with the Technical Literature. A 7.5-10 mm nominal gap must be left between the joinery reveal and the wall framing so a PEF rod and air seal can be installed after the joinery has been secured in place.

Graphex Cavity System

20.3 The system must be installed in accordance with the Technical Literature by PSL approved installers.

20.4 The Graphex plaster system must only be applied when the air and substrate temperature is within the range of +5°C to +30°C.

Inspections

20.5 The Technical Literature must be referred to during the inspection of Graphex Cavity System installations.

Finishing

20.6 Insulcote or other paint manufacturers' instructions must be followed at all times for application of the paint finish. The plaster must be cured for a minimum of 2-3 days and must be dry before commencing painting.

Health and Safety

21.1 Safe use and handling procedures for the components that make up the Graphex Cavity System are provided in the relevant manufacturer's Technical Literature.

Basis of Appraisal

The following is a summary of the technical investigations carried out:

Tests

22.1 The following testing has been completed by BRANZ:

- BRANZ expert opinion on NZBC E2 code compliance for the Graphex Cavity System was based on testing and evaluation of the Insulclad Cavity System incorporating all of the details within the scope and as stated within this Appraisal. The Insulclad Cavity System was tested to E2/VM1. The testing assessed the performance of the foundation detail, window head, jamb and sill details, meter box head, jamb and sill details, vertical and horizontal control joints, internal and external corners and balustrade to wall junction with a plastered cap. In addition to the weathertightness test, the details contained within the Technical Literature have been reviewed, and an opinion has been given by BRANZ technical experts that the system will meet the performance levels of Acceptable Solution E2/AS1 for drained cavity claddings.
- Wind face load and fastener pull through testing for EIFS cladding systems. BRANZ determined design wind suction pressures, and by comparing these pressures with NZS 4203 pressure coefficients, the fixing requirements were determined for timber and steel framed walls.
- Cone Calorimeter testing of the Graphex plaster system over 40 mm EPS. The testing was carried out in accordance with AS/NZS 3837.

Other Investigations

- 23.1 The performance of Insulclad External Insulation and Finishing Systems in New Zealand since 1985 has been considered.
- 23.2 Structural and durability opinions have been given by BRANZ technical experts.
- 23.3 Site visits have been carried out by BRANZ to assess the practicability of installation, and to examine completed installations.
- 23.4 The manufacturer's Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

24.1 The manufacture of the plasters has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

24.2 The quality management system of PSL is covered by the Nuplex Industries Ltd quality management system which has been assessed and registered as meeting the requirements of AS/NZS ISO 9001:2000 by Telarc Limited, Registration Number 158.

24.3 Quality on site is the responsibility of the PSL approved installers.

24.4 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing systems and joinery, building wraps, flashing tapes, air seals and joinery head flashings in accordance with the instructions of PSL.

24.5 Building owners are responsible for the maintenance of the Graphex Cavity System in accordance with the instructions of PSL.

Sources of Information

- AS 1366.3 1992 Rigid cellular plastic sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS-M)
- AS 3566 2002 Self-drilling screws for the building and construction industries.
- AS/NZS 1170: 2002 Structural design action General principles.
- AS/NZS 3837: 1998 Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- · NZS 3603: 1993 Timber Structures Standard.
- NZS 3604: 1999 Timber framed buildings.
- NZS 4211: 2008 Specification for performance of windows.
- NZS 4214: 2005 Methods of determining the total thermal resistance of parts of buildings.
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992, up to, and including August 2008 Amendment



In the opinion of BRANZ, the Graphex Cavity System is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to Nuplex Industries Ltd, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

- 1. This Appraisal:
- a) relates only to the product as described herein;
- b) must be read, considered and used in full
- together with the technical literature; c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
 d) is copyright of BRANZ.
- 2. Nuplex Industries Ltd:
- a) continues to have the product reviewed by BRANZ;
- shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed:
- c) abides by the BRANZ Appraisals Services Terms and Conditions.
- Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
- 4. BRANZ makes no representation or warranty as to:
- a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship.
- b) the presence or absence of any patent or similar rights subsisting in the product or
- any other product,
 c) any guarantee or warranty offered by
 Nuplex Industries Ltd.
- 5. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
- BRANZ provides no certification, guarantee, indemnity or warranty, to Nuplex Industries Ltd or any third party.

For BRANZ

P Burghout Chief Executive

Date of issue: 30 October 2009



INSTALLERS CHECKSHEET

NOTE: Please have this form completed by the installer and $\underline{\text{ready for our Building Inspector to collect}}$ when doing the final inspection

INSTALLERS NAME: (Please Print) BC Number
A.J (TONY) WARD - TRADESMAN BOWERMAKER/WELDER
Address: 35 B KCTARE ST - WAIKANAE Ph: 04 293 7203
FREESTANDING FIRE OR INBUILT FIRE INSTALLED AT:
Address: 35 B KOTARE ST - WAIKHWHE
For: TONY & LORALA MARD
The following requirements under NZS 7421:1990 or AS/NZ 2918:2001 have been met and the solid fuel burning domestic appliance type and model <u>SOLID FUEL BURNING</u> <u>BOUFER - ATTACK</u> F. Has been installed in accordance with the manufacturer's installation instructions. MODEL FD 32 SUPPLIED BY CIENTARA HEATING N. CHRISTCHURCH
The Chimney has been Cleaned NEW The Chimney is in a sound condition NEW
The Chimney is of pumice and correct dimensions to comply with BRANZ zero clearance certificates TASULATED STAINLY The Chimney is ventilated to manufacturer's requirements GREATER VENTILATION THAN REQUIRED The appliance is restrained against seismic activity (freestanding & fireplace heaters)
The Inbuilt heating appliance has been approved by BRANZ as complying with their zero clearance certificate
The hearth is an approved type according to the manufacturer's requirements
The hearth is restrained against seismic activity
The fire-surround at its connection to the fire place is fully insulated with approved material [see BRANZ Building Information Bulletin 248 (1986)]
The ash hearth is of correct dimensions according to the installation instructions
Signed: ag Wend Date: 2014/12

KCDC Form 129 ver 1

Názov	name	Name	Nombre	dės	gnation
Тур	type	Тур		type	
Výrobně číslo	production number	Produk	PRODUCED OF		ation
Rok výroby	year of production	Baujal	ATTACK		ation
Maximálny prevádzkový tlak	maximum operation pressure	Maxin	1-Názov Dielenská Kritina 1-Názov). Jžná	vall maximale
Maximálna prevádzková teplota	maximum operation temperature	Maxir	1-Názov 038 61 Vrútky	/	s travalle maximale
Objem vody	volume of water	Was	Kotol ne		
Elektrické pripojenie	electrical connection	Elek	Kotol na pevné palivá ATTACK FD32		actrique
Elektrický príkon	electrical input power	Elel	JECD .	_	7
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Palivo	fuel	Br	-Rok výroby 2011		
drevo	wood	H	2011 O TILLIAM		7
drevo / uhlle / koks	wood, carbon, coke	h	-Max. prev. tlak 400 kPa 10 Triad of the Max.		ron, coke
polely	pellets	F	Max prev to 1		1
Menovitý výkon	nominal output	I	100 C		nominale
Minimalny výkon	minimum output	Ţ	11-Palivo		e minimale
Trieda NOx	class N0x	7.	12-Menovitý výkon	7	0x
Objem zásobníka	volume of the storage tank	9	13-Minimaloussis	=	du réservoir
Stupeň elektrického krytia	degree of electrical coverage	-	9.5kW, 15kW, 13kW	_	le couverture électrique
Pripájací tlak paliva	connection fuel pressure		- TSKW	J	tion pressure de combustible
Maximálny príkon	maximum input power				ince absorbée maximale
Mininimálny príkon	minimum input power	_			ance absorbée minimala
Maximálny výkon	maximum output			1	ance maximale
Menovilý tepelný príkon	nominal caloric input power		- (x) 0	1	sance absorbée nominale de cha
Zhotovenie	Model				le
Kategória	Category	Kateg	013		égorie
Upozornenie	Warning	Warnt	Предупреждение		ertissement



DOKIAD o preskišania a kompletaosii vyrobka ATTACK

DOCUMENT of testing and completases of ATTACK boiler

Deer priftages und volksiändigkeistenkunde vom Vergaser kessed ATTACK

CEPTIFICAT de la révision et de l'état complet du produit ATTACK

CEPTIFICAT de la révision et de l'état complet du produit ATTACK

DOCUMENT ou privire la verificar si integritatea a produsului ATTACK

DOCUMENT ou privire la verificar si integritatea a produsului ATTACK

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No. Barticatos de la disassifiere

Tiple decadires:

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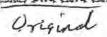












KCDC Building Consent Authority **Building Consent Documentation Filed**

BC No.	110397	
Street Address,	35 B Kotare St	
	Tick indicates document(s) included in this Building C	Consent
	Building Consent Application,	VX
	Application checksheet,	0
	Costing schedule,	1
	Plans and specifications,	1
	Invoice and receipt,	1
	Processing records/checksheets,	1
	Inspection page printouts 1-21, 25-45, 131-134, 138-171, Building consent and memorandum,	253
	Inspection reports,	
	Application for CCC,	1
	Code of Compliance Certificate.	
	Producer statements and supporting documentation,	

This form comprises part of the Building Consent documentation and indicates the contents of the Building Consent File. Refer KCDC Policy 029.

Requests for further information and other correspondence,

Peer review documents, Fire design documents,

Supplementary information, Energy work certificates,

Amendments,

Notices to Fix.

Form 436

BC.10397

PROCESSING CHECKLIST

	No = Plans, specifications & documentation not complying with the Building Code &/or Bld. Act (The reason specified alongside each prompt) Yes = Plans, specifications & documentation complying with the Building Code &/or Bld. Act (The reason specified alongside each prompt) N/A = Not Applicable to this application. (The deletion of whole sections as N/A is permitted) For alternatives comment below each section. Note — The further information requests are identified by hand written numbers and corresponding on FIR letters / e-mails sent
1	Site Plan (NZS 3604 Sec 3.4, 4,5 Code clB1, B2,E1, E2 F1&F2 Sect. 72, 75 BA04)
1 1	N/A NO YES Comments
	I
	Specific Design (Verified Online PS2 B1 B2 VMI) Comments
ž.	The property of the property o
	Recompaction. Total Span Garage. Tony ward CPEng.
	Concrete / Foundation Plan (NZS 3604 NZS 4210 & 4229 E2/4S1) Layout Layout dimensions
noter O-	Section Depth & width
Harry	> Recompaction certificate to be provided by Engineer
	Ribraft slab

	er / Subfloor Plan (NZS3604 NZS 3602 & 3640, B1,B2)	
N/A	NO YES	
1	□ □ Layout dimensions □ □ Bearers detailsB1; B2	, and a second and a
1	□ □ Bearers detailsB1; B2	
F	H Alternativespecify reason	minute in the second se
Section		The second secon
中	☐ ☐ Foundation type/sizeNZS 3604;B2NZS 36043602;3640;	B2
7	☐ ☐ Piles post sizes & treatment NZS 36043602;3640; ☐ ☐ Pile c/c NZS 3604	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
7	п р Fixing NZS 3604:В2	
4	□ □ Coatings(durability)	
Th	☐ ☐ Ventilation& Access to sub floor spaces	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
4		
16	the addition is an upper storey show details on upgrading existing founda	tions, joints, piles, etc (may require Engineer design)
Floor	r plans / layout <i>(B1, B2, C1-4, D1, B3, F7, G1, G2, G12 G3, G5</i>	p, G11, G13) Comments
Gener	ral	
N/A	NO YES	
1 5 5	Room dimensions	
I	Sectional lines	
1	All designated spaces	defails Pardo
1	Lintels	defails Pardo
7	Beams NZS 3604, B2 by engineer manner	Ommunication and the second se
1	Point loads by engineer or prenaller	
	Smoke detectors	ica Quello sharer system Prote
	□ □ Wet areas / WGs	
	specify reason	
	de la proposición dela proposición de la proposición de la proposición de la proposición dela proposición de la proposic	sed floor plans
	Changes to existing work requires both an existing floor plan & a propos Facility provided for washing utensils / food G3, Section 1.1 & Figure 1:	
	Facility provided for washing utensits 1 jour 43, Beeten, and 1,5 Preparation Area and Access to Facility Paragraphs 1,1,2 and 1,5	
Wa	all / Framing B1,B2,B3	Comment
	and /	
Ger	neral Definitify engineering / Structural items/ portals,	LB2 John John John John John John John John
	By prenailer or to NZS 3604	
15	Elving types NZS 3004	
1	Building wrap	valagate building paper
1	Building Wrap	V. Markey Park
	Alternativespecify reason	
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1	11 Exerce Stud	SOACINGS

Tennead I by pren	3604,3602 &3640 BIB2E2 E2/ASI			Comments	1
lingsed in biblio	aller or Framed roof NZS 3604		444	- Hannager	- 1
N/A NO YES	fixing layout & detailsBI B2	Paralow	ale stails		
>0 0 0	fixing layout & detailsBI B2				
3000	Fixing layout & detailsB1 B2 Correct layoutB1				
>000	Max span (12m or Engineer)	17			
	Rafters / BeamsBI B2 Alternativespecify reas	:01			
Roof cladding - N	letal ; Profiled Metal; Masonry, Me Pltch / profile	mbranes Code E2, E2/ASI B2			.,,,,,,,,,
	Pltch / profile	sviniminani aminimi aminimi	and the second s		
000	UnderlayE2E3; FlashingsE3;E2B1	B2		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	****
	FlashingsB1 E2 B2 ParapetsB1 E2 B2				
- 0 0	Parapets	Code E2/ASI B2	***************************************		******
005/	Membrane Roofs and substrate (Gutters, Barges & Fascias detail I	Refer E2, section 8.3, ol 8.3.9			
	Alternativespecify rea	SON	THE CASE OF THE PARTY OF THE PA	O'I I I I I I I I I I I I I I I I I I I	
2000	at the standing shall be but	rained installers, approved by th	e tile manufacturer or l	NZ agent. In some cases expe	erienced
builders undertak	installation, refer E2, section 8.4, cl	8,4.2 'General'.			
-			Mashing d	latale	
0	lartibe details	provided with	glashing of	equily	
Pa	der Roof system	1	. 0		
1119	1				
,	odeB1 & B2_E2/ASI,Branz good prac	Cuiden & Woodher tightner.	Vol 12&3	Comments	
Claddings	Risk matrix Cavity or direct	ALTERNATION OF THE PARTY OF			
	- Profiled Metal E2 Metal	Roofing Practice; B2	e; B2	and the second second second second	
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	Plywood	; B2 cod practice guide; B2 ; B2 ; B2 E2`; B2			
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ht & Ventilation B1 G4, Clause 1.2; G4, clause 1.3 G7,G9 F2	
neral	Comments
N/A NO YES U U Vent 5%	
Sulation BRANZ Home Insulation Guide, NZS 4218, AS/NZS 2918	Comments
D Floor	of complance
Stairs / Landings / Handrails DI, sec 4	
Decks / Balconies / Barriers DI, F4 & NZS 3604, Section 6 & 7, D D Barrier & deck fixing durabilityD1 B1 B2	Comments B1 B2

re (Residential)	NZBC F7;Cdoc	Comments
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	Travel distances max 24m	
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C 0 0	Wood burners	The state of the s
	Garage fire wall detailsC7 (C7.10 C7.8)	annous de la company de la com
	Alternative	
		Comments
wimming P	ool & Fencing Fencing of Swimming Pools Act 1987	AVAILABLE DE LA CONTRACTION DE
400	Refer to Compliance for sign off	
p 0 0	Descriptory system/design	The second secon
p 0 0	Castlen leganstruction	
	beet healthrash discharging the sewer	
# 0 0	Fence height	
# II I	gate(s) / door(s) open outward	
	44.74.74	Comments
Ambiguity / C	Contradictions Manufacturers Specs	
	Manufacturers open Engineer compared with Designer/Architect Any Other contradictions	
		· ·
Alternativ	ve Solutions	to the day by they believe the
Record proposi evident	assessment, decision and reasons for decisions below at complies with the building code? Is there a determina	w. Has the designer substantiated why they believe the nation on a similar proposal? Has corroborative fillon)? Include reference to comparison with acceptable I publications, expert opinion, determinations, including code objectives. Refer BRANZ Bulletin # 456
1		
	*	

This sheet relevant to plumbing & drainage onl	Comments
eneral	
N/A NO YES	
☐ ☐ ☐ Kitchen areaG3/AS1	AND
Bathrooms	
□ □ ■ Location of sanitary fixtures	
Drainlayers Reg no	TBA
Plumber's Reg no	
	Comments
iffluent Disposal Systems	Comments
□ □ Engineering Site Investigation	1
	as a total total
I dean symbols Loading calculation, sit	te evaluation, soil profile, site characteristics.
The design criteria should include; Capacity based on bearoon humbers, for town Jews	er
Water Supplies Solar hol water T and	Comments
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RCDC Form 436 V6

Page 6 of 11

essibility D1; NZS 4121	Comments
IO YES	
Car parks Car parks Projections Kerb Ramps Footpaths/Ramps / Landings Entrances Entrances Entrances Dublic Facilities Stairs Stairs Controls Places of assembly/entertainment/Recreation Places of assembly/entertainment/Recreation Controls Con	
- ti	
	Comments
e report C1,C2, C3, C4	· · · · · · · · · · · · · · · · · · ·
D Purpose group PHO	(0.00.00.00.00.00.00.00.00.00.00.00.00.0
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Fire cell separation /use of building Fire cell separation /use of building Frating S-rating Occupancy numbers	
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Alternatives	
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Set Status
Complete checklist
Addenda
Section 72 / ponding
Set inspections

	Record Information requested , info received , records / reference of communication expounter / fax State the content of discussion III	Initials
ate /time	State the content of	CV
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Change O	f Use - Sec 114; (record decisions and b	easis for decisions – confirm whether sec 115 applies)	manic
Date			1
		11111	
***	C E L C L D W W C L L L L L L L L L L L L L L L L L		
Alteration 1 118 applies and	to Existing Building – Seq 112: (reco. If so, has it been complied with?). List conditions /	rd decisions and basis for decisions – confirm whether sec communications / actions:	
Date	N/ N	W	
		1/2	
Ḥazards -	Sec 71-74: (record decisions and basis for	decisions – see under "site plan above already done")	
Date:			
Compliance copy of replica of schedule will be	compliance schedule. Ensure that note is recorded	new / amended compliance schedule required, and attach on building consent that new / amended compliance	
Date		17	
	4.		
prompt above Plan check (request for	o the associate code clause along side each for compliance or reason of decision ked yet Unsatisfactory urther information- see attached copy) gnature, name & date	I am satisfied on reasonable grounds that the provisions of the Building Code are met and the Building consent may be granted (react Sec 49(1)) All previous Further Information Requests now satisfied by the Bldg Signature, name & date Bldg Signature, name & date Plumbing Signature is listed below) Plumbing Signature is listed below (for all pages except those listed below)	ne efer Bld
Fire		Fire(As listed on page 7 of 11)	4.

Addenda to Form 436

Allocation of work to approvals officer outside current competency

	Circle appropriate category 0 1	2	/3
Building Category	Circle appropriate category		1
		-	/
		/	

 Authorized by Team leader or delegate 	Level of supervision reqd	Reason for decision
Name, Signature &date	Coaching Mentoring Peer review on completion	In training Vetting one level above competency Other
2) Approval Officer undertaking training	Record of Learning	Decision
Name, Signature & date Current competency level		I am satisfied on reasonable grounds that the provisions of the Building Code are met and the building consent may be granted (refer Bld Act 49(1))
Category 0,1or 2 3) Coach/Mentor/Peer reviewer	Training needs identified	Comments
Name, Signature & date Current competency level Category 1,2 or 3		I am satisfied on reasonable grounds that the provisions of the Bullding Code are met and the bullding consent may be granted (refer Bid Act 49(1))

Allocation notes

- Categories of building are determined on receipt of application
- All applications are re assessed for the category and allocated to each appropriate Officer at the
 earliest opportunity and then placed in processing shelves accordingly
- Approvals staff are aware of their own competency level and check the allocation of work.
- Approvals staff may select, for training purpose, a consent 1 (one) category higher than their current competency for the purpose of increasing their skill level provided they gain approval from the Team Leader Building Consent Approvals. Once approval is given the Team Leader Building Consent Approvals will arrange for the appropriate supervision and final peer review.

Building Consent Application — use this Checksheet for: Single Residential Dwelling and Accessory Buildings

 including single stand-alone dwellings, dwelling additions and/or alterations, repiling, garages, decks, gazebos, sheds, retaining walls etc.

An Application Form is attached to this checksheet —
 (Please include this checksheet with your application)

Addr	ess of	project: 35 B Lowe Steet Waixanse
attach	heckshe 2 copi ation fo	eet shows you the information that has to be supplied with your building consent application. Please of the following information (unless otherwise specified) with your completed Building Consent rm.
your a	pplication	elevant box in the Customer Use column as you attach the information. If the box is not relevant to on, write NA across the box. Please check each section carefully and complete those sections that by your project.
applic		ave attached all the required information, please check for completeness as an incomplete or lack of any supporting information will mean that your application cannot be accepted for
CUST	OMER	USE invergetion report KCDC USE
~	7700000	ete this section for all applications
	a.	Building Consent Application Form (1 copy)
	b.	Proof of ownership (1 copy)
		One recent copy of <u>current</u> certificates/s of title (i.e. not older than 3 months) or where applicable one copy of purchase agreement (if recently purchased) or one copy of relevant portions of current lease
	C.	Locality Plan (1:500) showing:
		Physical location of the subject building in relation to streets or landmarks, north point, name of building and lot and DP number.
7	d.	Site Plan (1:100) showing:
		Dimensions of all boundaries, north point, finished floor levels, ground contours (extended to boundaries) and/or levels, site area, street name and number, lot and DP number, outline of building, distance to boundaries and the position of swimming or spa pools. Include on the site plan the designated wind zone of the site (e.g. specific design, very high, high, medium or low).
	e.	Application Fee
		Applications will not be accepted without payment of the appropriate fees. Fees payable are set out in the published fee schedule of the council that has jurisdiction over the project site.
For off	ice use c	inly Receiving Officer: All infurnation supplied of accept

2. CHANGE OF USE Complete for all existing buildings where the proposal involves forming a household unit where one did not exist before	
Example: the conversion of a garage or shed into a residential unit	T4/A
a. Assessment of the building for compliance with the building code	NA
Section 115(a) of the Building Act 2004 requires that the building, in its new use, complies fully with all clauses of the building code.	
b. Reasonably practicable	NA
The above assessment must relate to all building code clauses. If the proposal is for the project to meet anything less than full compliance with any clauses, your application must clearly state your reasoning, with supporting documentation, and show how you will meet the highest level of compliance that can be considered reasonably practicable.	
3. FOUNDATIONS / FLOOR Complete for all new buildings, for existing buildings where the footprint of the building will change or where an additional storey is being added.	
a. Foundation Plan (1:100 / 1:50) showing:	
 Dimensions of all new foundations Sub-floor, including bracing Footing details If a concrete slab, show basic details including reinforcing and contractions joints Piles and footing If the addition is an upper storey show details on upgrading existing foundations, joints, piles etc Indicate ventilation to sub floor spaces 	
b. Subfloor bracing	-
Provide subfloor bracing plan and calculations for all piled structures. Where the structure is specifically engineered, this should be included with the structural calculations. Subfloor bracing plan and calculations are required where an additional storey is to be added.	
4. CONSTRUCTION	
Complete for all new structures or alterations to existing structures.	
a. Existing floor plan (1:100 / 1:50) showing:	4
 (For additions and alterations only) All levels All designated spaces All removals Sanitary fixtures Smoke detectors 	

b. Proposed floor plans (1:100 / 1:50) showing: Room dimensions Location of partitions All designated spaces All floors (new or altered) Location of sanitary fixtures Stairs, barriers, handrails, floor joists and beams Floor joist layout for each level with timber floors Smoke detectors Note where wall will form part of the swimming pool fence c. Pre-nail Truss and Frames: Specific design wall framing requires clarification Truss layout must be supported by design certification and design of fixing details, including consideration of load paths to ground Lintels carrying point loads, such as from girder trusses, require specific engineering design d. Wall bracing plan (1:100 / 1:50) showing: Bracing details and calculations for wall bracing (also required for existing lower storeys where an additional storey is being added) Sub-floor bracing for decks projecting more than 2m from the house Location, type and number of bracing elements to indicate compliance with NZS 3604:1999 (include calculations) If the bracing was specifically designed by a structural engineer, provide calculations (required for specific design wind zones and lateral distribution of upper floor loads where lower storey bracing is provided in walls beyond the upper storey footprint) e. Sections and details (1:50 / 1:20 / 1:10) showing: Foundation details involving reinforcing and connections Stairs, handrails, decks and decking Insulation systems and materials to floors, walls and roof Barriers providing safety from falling. Specific engineering design required where detail does not comply with NZBC B1/AS2 Framing sizes, beams, lintels Roof cladding, eaves, fascias, gutters Flashings to openings Fire rated systems on all walls - closer than 1 metre to boundary Stud heights of rooms and total height from lowest ground floor level to top of ridge Window and door installation details Retaining wall details e.g. type, height of retained ground, relationship to boundary, waterproof membrane and proposed drainage

	f.	Fire Report:	
		For domestic dwellings of 4 storeys or more, or buildings providing more than one household unit	
5.	EXTE	ERNAL	
Co	mplete	for new buildings or existing buildings with alternations to the external shell	
	a.	Elevations (1:100 / 1:50) showing:	
		Accurate lines form boundary to boundary on each elevation, relevant District Plan daylight control lines, the maximum height on each elevation, location of door and window openings, fixed and opening sashes, sill heights, floor levels in relation to ground levels, exterior cladding nominated to all elevations, down pipes and spouting, ventilators to sub-floor area (suspended floors only)	
	b.	Risk assessment	
		(Risk matrix in E2/AS1 may be used for buildings within scope) Consider exposure, design and detailing to support appropriate selection of cladding	
	c.	Cladding details (1:50 / 1:20 / 1:10)	
		Provide details around all penetrations, joinery and other junctions at a level appropriate to the level of risk e.g. roof/wall, balcony/wall, junction of different types of cladding, back flashing details for cavity systems	el
	d.	Production certification	W)
		Supply copies of product certificates relied on as compliance documents	A
	e.	Alternative solutions	
		If the proposal uses products or systems that are not covered in the Acceptable Solutions of claus E2 of the building code provide supporting current information including test results (fully signed reports), case studies, expert opinion (including evidence of experience/qualification, basis for forming opinion and statement of independence) etc to demonstrate compliance.	е
		VICES for all projects with new installations or alteration of plumbing or drainage services	
7	a.		
		 Note: if you have supplied drainage details for surface water disposal on the site plan, no drainage plan is required. Sizes of pipe work and drains Fixtures and fittings, hot water system(s) If the building is more than one storey with sanitary fittings on upper floors, provide an isometric layout showing wastes, pipes and falls Drainage layout with inspection bends and junctions indicated for both sewer and storm wate Any other drainage on site including council mains and retaining wall field drains Ventilation of sanitary rooms Calculations for sizing of down pipes 	
		Gully traps including overflow relief gullies	

	7. STRUCTRAL	
	Complete for all projects incorporating specific structural design	
		/
_	a. Structural calculations	
	If any design work required the services of a structural engineer, attach 2 copies of the calculations with this. The calculations must be prefaced with information explaining the design philosophy and	
	justification of assumptions and methodologies used in analysis	
		-/
	b. Expert Opinion (Producer Statements):	1
	b. Expert Opinion (1 Toudeor Outements).	
	If this application for consent relies on any expert opinion including producer statements certifying compliance with the New Zealand Building Code, a copy must be attached with this application. (Note all structural producer statements are required to have accompanying calculations)	
	8. SPECIFICATIONS Complete for all applications	
	Note: the specification must be specific to the project and cover all aspects of the proposed work.	
1	a. Specification: General	/
	 Elements of structure (size, spacing, timber treatment) 	
	Finish or fixings to meet durability requirements	
	 Plumbing and drainage materials and design that installation is to comply with 	
	Wet area surfaces	
	Ventilation systems	
	 Flooring slip resistance for access routes 	
	Glazing	
	 Type of smoke detectors (including existing smoke detectors where they will remain) 	
	b. External claddings	V
	For each of the following claddings provide details of the product name, manufacturer, maintenance	
	requirements and warranties offered	
	Building wraps	
	Wall claddings	
	Roof claddings	
	Membranes (roof and decks)	
	Tanking	
	Joinery	
	9. DEMOLITION / REMOVAL	
	Complete for all projects involving demolition of significant parts of buildings or the demolition or remo of whole buildings.	val
	Manager of heartened to a the attention of the second seco	P
	a. <u>Means of barricading the site</u>	
	Provide details of temporary barriers, gates which swing inwards or other means of restricting public access to the area	
		£ - 1
	b. Proposed tipping location for demolition materials (address/landfill)	

c. Hazardous building material
Provide safety plan detailing the safe handling and disposal of hazardous materials
d. Site management plan covering
Management to control silt runoff, noise and dust
Management to control six runon, noise and dust
e. Proposed destination for relocate building
A
f. Access to and from the site including (use of kerb crossings)
The state of the s
g. Specify termination of existing services
. Motor
Water Sewer
Storm water
- Otom water
h. Detelle about the building such as
h. Details about the building such as:
Number of storeys, type of materials the building is constructed (Photographs of the building
would be useful)
Note
Note You will need to contact the relevant service authorities specified below to advise them of the
extent of your work:
Electricity, gas, drainage, water, transport, telecommunications, cable television or any other
services that may be affected.
Transportation of relocated building
You will be required to contact and provide details to Councils Transportation and Traffic
Department.
10. OTHER APPROVALS
Please check territorial authority regarding the requirement for other approvals required and fees payable.
These may include:
These may include.
Consents under the Resource Management Act
Approvals under bylaws including earthworks, vehicle crossings, road openings and
water connections.
/ Water commissions:
Show the location of swimming or spa pools on the property and describe how compliance with the
fencing of Swimming Pools Act will be achieved.
The issue of a building consent does not relieve the owner of any duty or
responsibility under any other act.
responsibility under any other act.
The falls also Councille developed this absolute at the state of the fall of the state of the st
The following Councils developed this checksheet in partnership: Kapiti Coast District, Porirua City, Wellington City, Hutt City, and Upper Hutt City

Checklist for Water Demand Management Declaration of Compliance

The Kapiti Coast District Council now requires any new or relocated homes in residentially zoned areas that have access to full reticulated water supplies to install water saving devices.

As part of these requirements, the applicant needs to complete and submit the Water Demand Management Declaration of Compliance document with their Project Information Memorandum (PIM)/Building consent.

Please note that the applicant's manifold or toby may need replacing with a new manifold restrictor unit. This will be at the applicant's expense and the Council will invoice the applicant.

CUSTOM	CUSTOMER USE	
1)	Please complete the following	
	Water Demand Management Declaration of Compliance form (1 copy) completed and signed by the owner or by the agent on behalf of the owner	
	b. If your section has an existing water connection, this may need to be modified to accommodate the rainwater tank top-up connection. The cost will be invoiced to the home owner.	

Planning Processing Check Sheet

Building Consent Number: BC 110397

		Property Information	
Property Address	122 W 1 2 1 1 1		
Legal Description	104	I DP. 409453. 1496	nel- 0-616
Planning Zone	Postdontal 93		
Building Project	House e Carale.		
	Yes No	Antina mond	Action
Certificate of Title	Yes No	Action reqd	Action
Easements		Refer too CAT attached.	
Section 221	1	Include copy	09
			· re
	Dis	trict Plan Items to Check	
	Yes No	Action Reqd	Actioned
Designations			
Heritage Register			
Flood Hazards			1
Min Floor Level			
Other Hazards		LIVALIS Cadas I lass A	
EQ Faults		HV Transmission Lines.	la-bad
Services		Refer to info o 31.8.2011 (UC	31 115
Eco-site/Native Veg		01.6.2011 (44	TL) LIMI
	Complies?	Action Reqd	Actioned
Yards (+water bodies)		Neighbours Approval??	
HIRB			
Max Height			
Site Coverage	1		
Permeable Surface			
Earthworks	-		
Water Tank / Siting			
Parking			

Building Consent Number: BC / 10397 Fences/Retaining Wall Airport Noise 45dbl **Other Provisions** Yes No Action regd Actioned Does the building straddle Title/crosslease boundary **Existing Resource** 050238 Consent? 100/44 Resource Consent Apply Section 37 and advise Plan Vetting Required? Section 72 or 77 Advise Plan Vetting Team and send letters \$118.00 Required? Section 221 Advise Plan Vetting Team **Consent Notice** Advise Plan Vetting Team and send letter DIF Required? out. Calculate DIF Fees Amount 2nd Comm / Ind Floor area X \$12.65 Non-residential 0.002 X area Invoice codes RM Water Supply 8456.57 RM Sewage 491,37 RM 79 **Community Facilities** 530.76 RM Roads RM Flood Mitigation RM Reserves Send DIF letter out * All work shall be corried out in accordance with RMsløg 144 & approved approval from Transpaver RM: 100144) (re any plans submitted with Transpower approval received 2.9.11 & Decision (delete item that does not apply) Application complies with District Plan requirements Application does not comply with District Plan - BC to be issued subject to \$37 * Dif Fees: \$1,478.

KCDC Form 161 ver. 3 04/2/2011

Officer's Name & Signature:

Date:







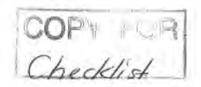
Kāpiti Coast District Council

Private Bag 60 601 Paraparaumu 5254 New Zealand Tel (04) 296 4700 or 0800 486 486

Fax (04) 296 4830

kapiti.council@kapiticoast.govt.nz

www.kapiticoast.govt.nz



RESOURCE CONSENT UNDER PART VI OF THE RESOURCE MANAGEMENT ACT 1991 CONSENT NO: RM100144

APPLICANT:

Mr A J Ward

LOCATION OF ACTIVITY:

35B Kotare Street, Waikanae (Lot 1 DP 409453)

DESCRIPTION OF ACTIVITY:

To undertake earthworks to form a driveway & building platform & to construct a dwelling & garage within 20m of the Mangahao-Paekakariki A

& B 110kV overhead transmission lines.

DECISION:

Granted subject to conditions on 12 November 2010.

The following conditions were imposed under Section 108 of the Resource Management Act 1991:

Conditions:

Monitoring and Review

- The consent holder shall notify the Council's Compliance Officer of the start and completion dates of the works in writing 48 hours before the works are carried out. The consent holder shall fill out and return (by fax (04) 2964-830 or by post to Private Bag 60601, Paraparaumu) the form that is attached to the decision letter.
- 2. The consent holder shall pay to the Kapiti Coast District Council the actual and reasonable costs associated with the monitoring of conditions (or review of consent conditions), or supervision of the resource consent as set in accordance with Section 36 of the Resource Management Act 1991. These costs* may include site visits, correspondence and the actual costs of materials or services which may have to be obtained.

*Please refer to Kapiti Coast District Council's current schedule of Resource Management fees for guidance on the current hourly rate chargeable for Council's staff.



General

3. The activity shall be undertaken in accordance with the plans and information submitted with the application. No variation or amendment to the submitted building plans will be approved by the Council without the submission of a satisfactory and comprehensive assessment by a suitably qualified and experienced electrical engineer. In the event that an amendment or variation is proposed by the consent holder, Transpower shall be provided with a copy of the electrical engineer's assessment and given the opportunity to review and comment on their assessment.

Any comment made by Transpower must be included with the electrical engineer's assessment when that is provided to the Council.

Construction Management/Earthworks

- 4. All activities undertaken on the site, including the construction of new buildings/structures, earthworks (filling and excavations), and/or the operation of mobile plant shall comply with the New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP 34:2001). Construction Management Plan.
- 5. The consent holder shall submit a Construction Management Plan (CMP) for the approval of the Kapiti Coast District Council's Subdivision Engineer. The CMP must include procedures, methods and measures to be applied to address the following:

(a) Earthworks.

(b) Maintenance at all times of adequate clearances between mobile plant and the overhead transmission lines (refer Clause 5.2 of NZECP34:2001).

(c) Provisions to enable the existing high voltage infrastructure to be accessed for maintenance at all reasonable times, or emergency works at all times, whilst construction

activities associated with the building development are occurring.

(d) Pre-construction site survey and layout to ensure that the building will be constructed and the earthworks undertaken in compliance with the relevant separation distances specified in NZECP34:23001, and the relevant provisions of the Council's Subdivision & Development Principles & Requirements 2005.

(e) The CMP shall specify the name, experience and qualifications of a person, or persons, nominated by the owner to supervise the implementation of, and adherence to, the CMP; and shall include details of the contractor's liability insurance held to cover any costs, direct or indirect, associated with damage to the Mangahao - Paekakariki A and B transmission lines directly or indirectly caused by activities undertaken to give effect to the consent.

(f) No construction activities shall be undertaken without the CMP being first approved by the Council's Subdivision Engineer, and all construction activities are to undertaken in accordance with the approved plan

Note: The CMP is required because Transpower's Mangahao – Paekakariki A & B 110 kV transmission lines and two support structures (Poles 744 and 745) are located within the site and without appropriate management during construction, giving effect to the consent has the potential to cause adverse effects on the electricity infrastructure.

- Without limiting the generality of Condition 5 the consent holder shall:
- (a) not deposit any excavated or other material under or near the Mangahao Paekakariki A and B transmission lines where the vertical distance from the ground to the conductors

would be reduced to less 6.5 metres (Note: This applies to all activities including possible temporary stockpiles);

(b) not undertake any excavation near Pole 744 or 745 that would not comply with the

restrictions specified in Clause 2.2.1 of NZECP34:2001;

(c) not operate or allow to be operated any mobile plant in a manner that the minimum safe separation distance of 4 metres between the machinery and the conductors is not maintained; and,

(d) manage dust or particulate matter emissions so that it does not create any dust hazard or nuisance to the Mangahao – Paekakariki A and B transmission lines or Poles 744 and

745 and associated insulators.

- The consent holder shall ensure that soil support is not removed from adjacent lots, and that all batters are self supporting.
- 8. Where the existing landform or vegetative cover is disturbed, suitable ground cover shall be established as soon as practicable following earthworks or within five days of completion of the works, whichever occurs first. For the avoidance of doubt, 'suitable cover' means in the application of basecourse, topsoil, grass or mulch, or an alternative if approved by the Council's Subdivision Engineer.
- The consent holder shall pay Council Engineering Fees of \$211 (GST inclusive) for work that may be required to assess the CMP; and for site inspections and consent compliance monitoring.

NB: Additional fees may apply in accordance with the Engineering Fees Schedule adopted by Council from 1 July 2010. Note that the current charge out rate is \$105 per hour (GST inclusive).

Should a waahi tapu or other cultural site be unearthed during an excavation work, the contractor and/or the consent holder shall:

(a) Cease operations;

(b) Inform local at Te Ati Awa ki Whakarongotai Charitable Trust;

(c) Inform the New Zealand Historic Places Trust (NZHPT) and apply for an authority if required;

(d) Take appropriate action, after discussion with Iwi, the NZHPT, and the Council to

remedy damage and/or restore the site.

NB: In accordance with the Historic Places Act 1993, where an archaeological site is present (or uncovered), an authority from the NZHPT is required if the site is to be modified in any way.

Landscaping

 Any landscaping undertaken on the site shall consist of species that do not have the ability to reach such a height that it is able to;

(a) encroach into the growth limit zone under the Electricity (Hazards from Trees)

Regulations 2003; or,

(b) fall within 5 metres of the conductors on the Mangahao – Paekakariki A and B transmission lines.

NB: The Electricity (Hazards from Trees) Regulations 2003:

Define safe separation distances between trees and overhead lines;

Specify responsibilities for ensuring clearances are maintained; and

 Place potential liability on tree owners, if any damage or accidents occur due to trees touching the overhead lines.

As-Built

11. Before the dwelling is used for residential activities, the consent holder shall submit an as-built plan to the Council's Subdivision Engineer for written approval. This must be accompanied by a report by a suitably qualified and experienced electrical engineer confirming that building construction and the excavations comply with the relevant separation distances specified in NZECP34:2001.

Advice Notes:

 Under Section 125 of the Resource Management Act 1991, this resource consent will lapse in five years, unless it is given effect to within that time.

It is the consent holder's responsibility to comply with any conditions imposed on this
resource consent prior to and during (as applicable) exercising this resource consent.

 Please note that a resource consent is not a consent to build. A building consent must be issued prior to any building work being undertaken.

 All costs arising from the exercise of any of the above conditions are the responsibility of the consent holder.

 This resource consent does not grant the holder any exemption from the requirements of NZECP 34:2001 "New Zealand Electrical Code of Practice for Electrical Safe Distances".
 Such legislation is administered by Transpower New Zealand Limited whose formal permission will be required should any part of the development fail to comply with those regulations.

Reasons for Decision:

In accordance with Sections 104 and 104B of the Resource Management Act 1991 the actual and potential effects associated with the proposed activity have been assessed and are outlined in the report. It is considered that the adverse effects of the proposed activity on the environment will be minor and that the proposed activity is not contrary to the relevant Objectives, Policies and Assessment Criteria of the Kapiti Coast District Plan.

Colin Bridges

Senior Resource Consents Planner

Kapiti Coast District Council Private Bag 601 Paraparaumu 5254

> Tel. (04) 296 4700 Fax (04) 296 4830

E: kapiti.council@kapiticoast.govt.nz W: www.kapiticoast.govt.nz



CONSENT NOTICE **PURSUANT TO SECTION 221 OF** THE RESOURCE MANAGEMENT ACT 1991

IN THE MATTER OF A PLAN LODGED FOR **DEPOSIT UNDER NUMBER 409453** AND RESOURCE CONSENT NO. RM 050238

(BEING THE SUBDIVISION OF LOTS 3 & 4 DP 64335 AND LOT 8 DP 80628), AT 35D KOTARE ST, WAIKANAE FORT&LWARD

The Regional Regulatory Titles Officer at Wellington

PURSUANT to Section 221 of the Resource Management Act 1991 the Kapiti Coast District Council hereby gives notice that it has consented to the subdivision and with respect to Lot 3 only, the following conditions are to be complied with on a continuing basis:

- Foundation design and construction for any new building or additions 1. and alterations to a building shall take into account the findings and recommendations from on site testing of soil conditions by a suitably qualified person, for example, a Chartered Engineer. The details of any site tests and findings shall accompany any application for a consent to build.
- A Fire Fighting water supply tank with a capacity of at least 22,000 litres 2. dedicated specifically for fire fighting purposes shall be established and maintained in full working order at all times. The Fire Fighting water supply tank shall be:
 - supplied from the public water main system; and
 - provided with a connection to New Zealand Fire Service requirements not more than 3 metres from the side of the driveway access.

Issued in respect of application No. RM 050238 on this 14th day of January, 2009.

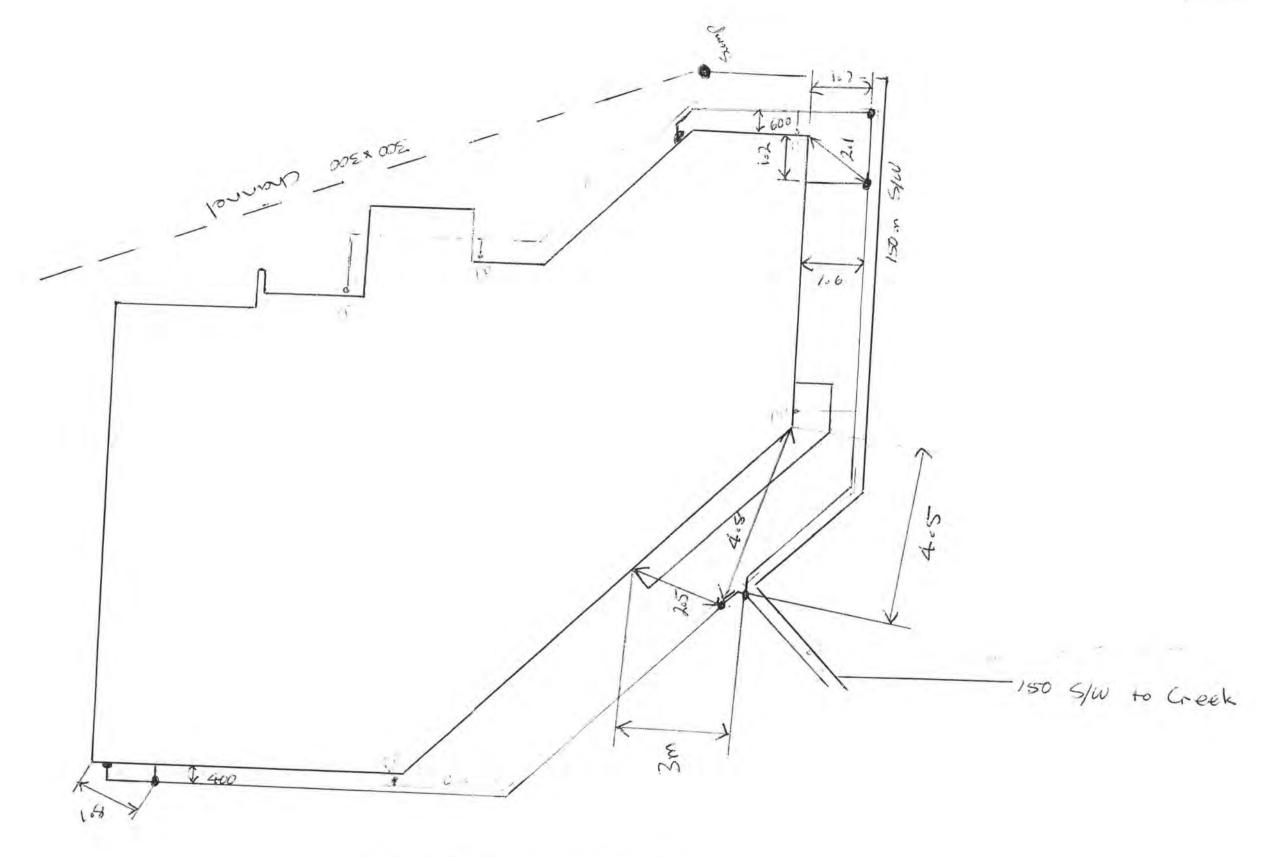
David Wayne Gair AUTHORISED OFFICER Natasha Jane Belt AUTHORISED OFFICER

KAPITI COAST Mehuri whakamuri, ka titiro whakamuw OISTRICT COUNCHD

KAPITI COAST DISTRICT COUNCIL

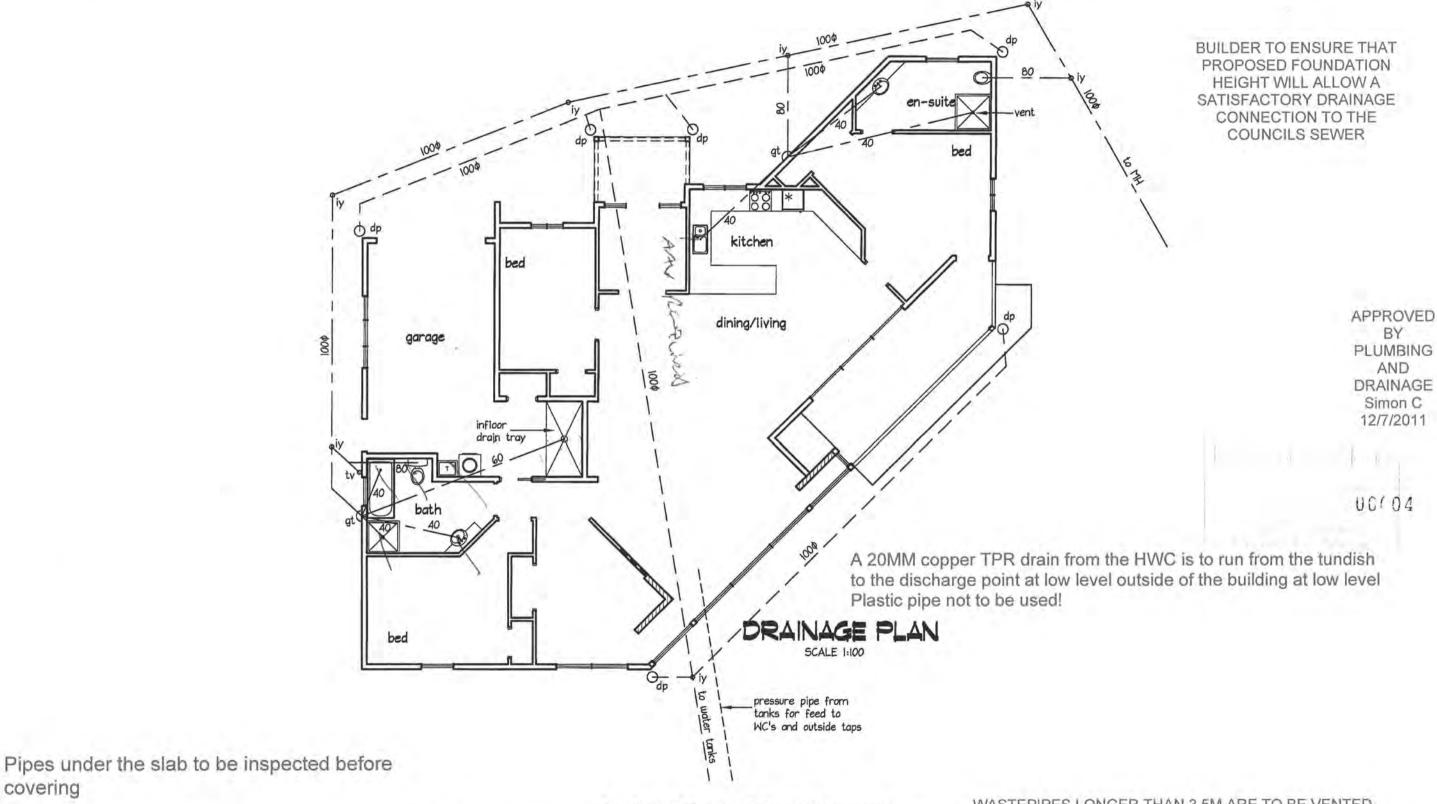
APPLICATION FOR SEWER CONNECTION AND BUILDING CONSENT

Word	********************	(full name)	
	PLEAS	E PRINT	
hereby apply for an ordinary co	nnection to the Kapiti Coast	t District Council Sewer from the premises owned by me at:	
(if different from above)			
LotDF	409453		
Fees payable (on application)		Note: All dwelling units to pay full inspection fees. The connection fee to be divided equally between dwelling unit situated the same lot sharing a common lot.	
Inspection \$ Connection \$ Total \$Tolog M	o d		
		Date	
Т	THIS PART TO BE COM	PLETED BY DRAINLAYER	
I,		(full name)	
of		e premises mentioned above to the Kapiti Coast District	
NB: Connection NOT permitte	d until consent obtained.		
(Signature)	(Licence No)	(Date)	
-	OFFICE 1	USE ONLY	
BUILDING CONSENT NO	JOB INSPECTED	BUILDING REGISTER ENTRY	
Date Issued	Connection Recorded		



35 B Kotare ST Walkanne





covering

Civil, Structural and Building design http://www.designscape.net.nz email info@designscape.net.nz

Allan Pullenger AIPENZ CertETn 298 Rosetta Road sunny Raumati

phone & fax 04 902 8528 Mob 027 442-0486

the contractor shall check and verify dimensions before construction

WARD HOUSE 35B KOTARE ST-WAIKANAE PROPOSED DWELLING

WASTEPIPES LONGER THAN 3.5M ARE TO BE VENTED

scale 1:100 date June 2011 Stuart Jackson drawn designed Allan Pullenger

plan number 2690-01 Sheet 04 of 21 3500

2620

2860

900wx1800h

90 903

17546

2360

all work must be carried out to conform to the relevant sections of The New Zealand Building Code and New Zealand

Standards, particularly NZS3604:1999 for

light timber framed construction.



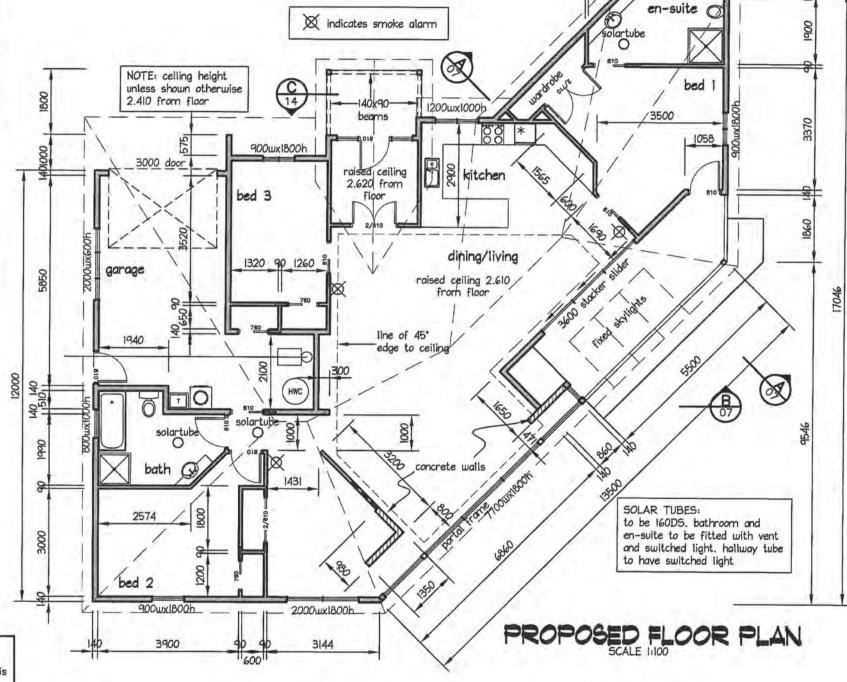
BOTTOM PLATE FIXING:
10mm dia. cast in @ max 900 crs
12mm dia. cast in @ max 1400 crs
approved anchors (fixed to manufacturers
instructions.) Ramset AS12150H anchours
for connections with 15kN requirements



TOP PLATE FIXING:

where walls are supporting trusses the top plate must be fixed to the supporting member (e.g. studs and lintels) as per table 8.18 NZS3604:1999





OCLO

ENGINEERS DESIGN:

this project contains elements specifically designed by an engineer, the owner/builder is required to ensure the engineer inspects the work and provides the local body with written evidence of the inspection.

designscape

Civil, Structural and Building design http://www.designscape.net.nz email info@designscape.net.nz Allan Pullenger AIPENZ CertETn 298 Rosetta Road sunny Raumati

phone & fax 04 902 8528 Mob 027 442-0486 the contractor shall check and verify dimensions before construction

WARD HOUSE 35B KOTARE ST-WAIKANAE PROPOSED DWELLING

scale 1:100
date June 2011
drawn Stuart Jackson
designed Allan Pullenger

2690-01

plan number

Sheet 05 of 21