

**CHAPTER 5**  
**INSTALLED RADIATION: DETERMINING HEAT LOAD**

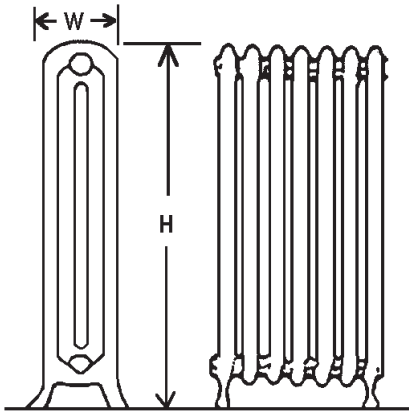
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**SIZING OBSOLETE RADIATION - CAST IRON RADIATORS**

The output of a radiator is measured in square feet of radiation. To determine the number of square feet of radiation in a radiator:

1. Measure the height of the radiator.
2. Count the number of columns in a section.
3. Count the number of sections.
4. Multiply the total number of sections by the number of square feet per section as shown in the following tables:

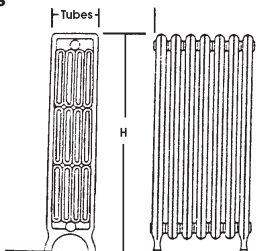
**Column Type Radiators**



Sq. Ft. Radiation per Section					
Height (inches)	4-1/2" W One Column	7-1/2" W Two Column	9" W Three Column	11-1/2" W Four Column	13" W Five Column
13	—	—	—	—	3
16	—	—	—	—	3-3/4
18	—	—	2-1/4	3	4-1/4
20	1-1/2	2	—	—	5
22	—	—	3	4	—
23	1-2/3	2-1/3	—	—	—
26	2	2-2/3	3-3/4	5	—
32	2-1/2	3-1/3	4-1/2	6-1/2	—
38	3	4	5	8	—
45	—	5	6	10	—

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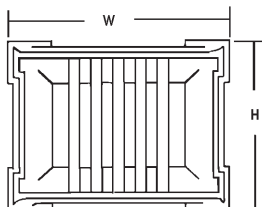
### Tube Type Radiators



Sq. Ft. Radiation per Section					
Height Inches	5" Three Tube	7" Four Tube	8-3/4" Five Tube	9-3/4" Window Six Tube	12-1/2" Seven Tube
14	—	—	—	—	2-1/2
17	—	—	—	—	3
20	1-3/4	2-1/4	2-2/3	3	3-2/3
23	2	2-1/2	3	3-1/2	—
26	2-1/3	2-3/4	3-1/2	4	4-3/4
32	3	3-1/2	4-1/3	5	—
38	3-1/2	4-1/4	5	6	—

### Wall Type Radiators

Wall radiators are measured by their height, length and thickness. The following table shows the number of square feet of heating surface per section.



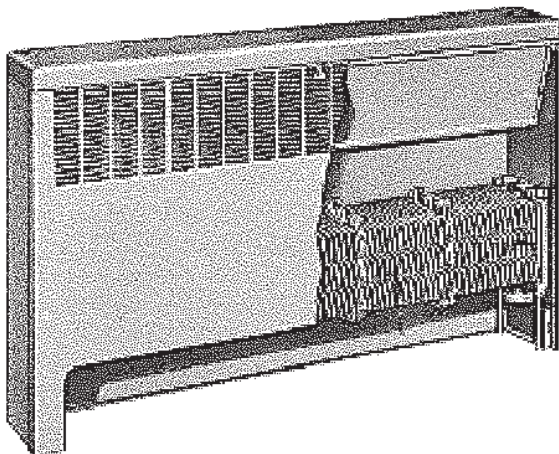
Sq. Ft. Radiation per Wall Radiator Section Heating				
Type of Section	Height (inches)	Length or Width (inches)	Thickness (inches)	Sq. Ft. Radiation
5-A	13-5/16	16-5/8	2-7/8	5
7-A	13-5/16	21-7/8	2-7/8	7
7-B	21-7/8	13-3/16	3-1/16	7
9-A	18-5/16	29-1/16	2-7/8	9
9-B	29-1/16	18-5/16	3-11/16	9

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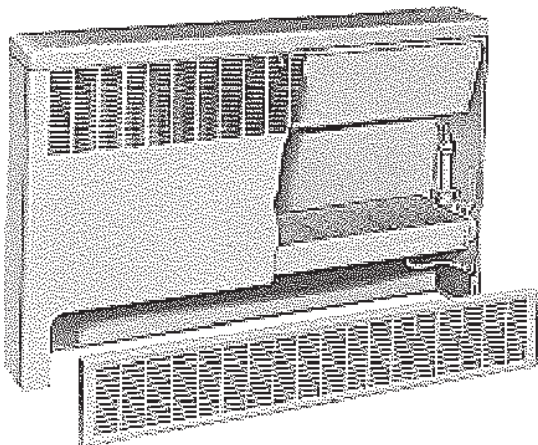
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**Convectors**

**Cast Iron - Ratings: Page 53**



**Copper - Ratings: Page 54**



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**SIZING: CONVECTORS - CAST IRON**  
**RATINGS - SQUARE FEET OF RADIATION**

Front Outlet and Sloping Outlet Type Units Cabinet Height - Floor Type							
Cabinet Depth (inches)	Cabinet Length (inches)	18	20	24	26	32	38
4-1/2"	18-1/2	8.4	9.1	10.5	11.0	11.8	12.3
	23-1/2	10.9	11.8	13.5	14.2	15.2	15.9
	28-1/2	13.3	14.4	16.5	17.4	18.6	19.4
	33-1/2	15.8	17.1	19.7	20.6	22.1	23.0
	38-1/2	18.2	19.7	22.7	23.8	25.5	26.5
	43-1/2	20.6	22.3	25.7	26.9	28.9	30.1
	48-1/2	23.1	25.0	28.7	30.1	32.3	33.6
	53-1/2	25.5	27.6	31.8	33.3	35.7	37.2
	58-1/2	28.0	30.3	34.8	36.5	39.1	40.7
	63-1/2	30.5	33.0	37.9	39.7	42.5	44.3
6-1/2"	18-1/2	12.3	13.5	15.4	16.2	17.5	18.2
	23-1/2	15.9	17.4	19.9	20.9	22.6	23.5
	28-1/2	19.5	21.3	24.4	25.6	27.7	28.8
	33-1/2	23.1	25.2	28.9	30.4	32.9	34.1
	38-1/2	26.7	29.2	33.4	35.1	38.0	39.4
	43-1/2	30.3	33.1	37.9	39.8	43.1	44.7
	48-1/2	33.9	37.0	42.4	44.5	48.1	50.0
	53-1/2	37.5	40.9	46.8	49.2	53.3	55.3
	58-1/2	41.1	44.8	51.3	53.9	58.4	60.6
	63-1/2	44.7	48.7	55.8	58.7	63.5	65.9
8-1/2"	18-1/2		17.1	19.4	20.4	22.5	23.7
	23-1/2		22.2	25.0	26.4	29.1	30.6
	28-1/2		27.2	30.7	32.4	35.7	37.5
	33-1/2		32.2	36.4	38.4	42.3	44.5
	38-1/2		37.2	42.1	44.3	48.9	51.4
	43-1/2		42.3	47.8	50.3	55.5	58.4
	48-1/2		47.3	53.5	56.3	62.0	65.3
	53-1/2		52.3	59.2	62.3	68.6	72.3
	58-1/2		57.3	64.9	68.3	75.2	79.2
	63-1/2		62.3	70.6	74.3	81.8	86.1
10-1/2"	18-1/2		20.6	23.4	24.6	27.3	28.8
	23-1/2		26.7	30.3	31.8	35.3	37.2
	28-1/2		32.8	37.2	39.1	43.3	45.7
	33-1/2		38.9	44.2	46.3	51.4	54.2
	38-1/2		45.0	51.1	53.6	59.5	62.7
	43-1/2		51.1	58.0	60.8	67.5	71.2
	48-1/2		57.2	64.9	68.1	75.6	79.6
	53-1/2		63.3	71.8	75.4	83.6	88.1
	58-1/2		69.4	78.7	82.6	91.6	96.6
	63-1/2		75.5	85.6	89.8	99.7	105.1

## CHAPTER 5 INSTALLED RADIATION: DETERMINING HEAT LOAD

### SIZING: CONVECTORS - COPPER FRONT OUTLET TYPE UNITS RATINGS - SQUARE FEET OF RADIATION

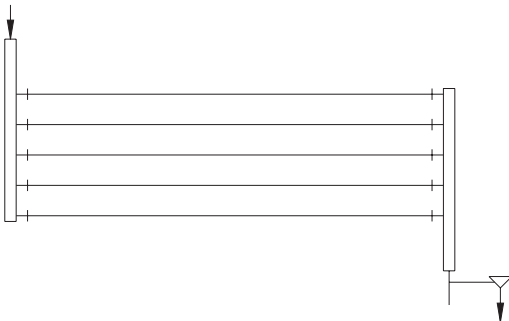
Front Outlet and Sloping Outlet Type Units Cabinet Height - Floor Type							
Cabinet Depth (inches)	Cabinet Length (inches)	18	20	24	26	32	38
4-1/2"	20-1/2	10.4	11.3	13.1	13.4	14.0	14.6
	24-1/2	12.8	13.9	16.1	16.4	17.2	18.0
	28-1/2	15.2	16.5	19.2	19.5	20.4	21.3
	32-1/2	17.6	19.1	22.2	22.5	23.6	24.6
	36-1/2	19.7	21.7	25.2	25.6	26.8	28.0
	40-1/2	22.3	24.3	28.2	28.6	30.0	31.3
	44-1/2	24.7	26.9	31.2	31.7	33.2	34.7
	48-1/2	27.1	29.5	34.2	34.7	36.4	38.0
	56-1/2	31.9	34.7	40.2	40.8	42.8	44.7
64-1/2	36.6	39.9	46.2	46.9	49.2	51.7	
6-1/2"	20-1/2	15.3	16.3	18.4	18.8	19.6	20.6
	24-1/2	18.8	20.1	22.6	23.1	24.1	25.3
	28-1/2	22.3	23.8	26.9	27.4	28.6	30.1
	32-1/2	25.8	27.6	31.1	31.7	33.2	34.8
	36-1/2	29.3	31.3	35.4	36.0	37.7	39.6
	40-1/2	32.8	35.1	39.6	40.3	42.2	44.3
	44-1/2	36.3	38.9	43.8	44.6	46.7	49.0
	48-1/2	39.8	42.6	48.1	48.9	51.2	53.8
	56-1/2	46.8	50.1	56.6	57.5	60.3	63.3
64-1/2	53.9	57.7	65.0	66.2	69.3	72.7	
8-1/2"	20-1/2	18.7	20.0	22.5	23.0	24.4	25.8
	24-1/2	22.9	24.5	27.7	28.2	30.0	31.7
	28-1/2	27.2	29.1	32.8	33.5	35.6	37.7
	32-1/2	31.5	33.7	38.0	38.8	41.2	43.6
	36-1/2	35.8	38.3	43.2	44.1	46.8	49.5
	40-1/2	40.1	42.9	48.3	49.4	52.4	55.5
	44-1/2	44.3	47.4	53.5	54.6	58.0	61.4
	48-1/2	48.6	52.0	58.7	59.9	63.6	67.3
	56-1/2	57.2	61.2	69.0	70.5	74.8	79.2
64-1/2	65.7	70.3	79.4	81.0	86.0	91.0	
10-1/2"	20-1/2	20.4	22.0	25.0	25.7	27.4	29.3
	24-1/2	25.2	27.1	30.9	31.7	33.8	36.2
	28-1/2	30.0	32.3	36.8	37.7	40.2	43.1
	32-1/2	34.8	37.4	42.6	43.7	46.6	50.0
	36-1/2	39.6	42.6	48.5	49.8	53.1	56.9
	40-1/2	44.4	47.7	54.4	55.8	59.5	63.7
	44-1/2	49.2	52.9	60.3	61.8	65.9	70.6
	48-1/2	53.9	58.0	66.1	67.8	72.3	77.5
	56-1/2	63.5	68.3	77.9	79.9	85.2	91.2
64-1/2	73.1	78.6	89.6	91.9	98.0	105.0	

## CHAPTER 5 INSTALLED RADIATION: DETERMINING HEAT LOAD

### STEEL PIPE COILS - Sq Ft of Radiating Surface Per Linear Ft of Coil

Nominal Pipe Size (inches)	Number of Rows of Pipe in Coil							
	1	2	3	4	5	6	8	10
1	.57	1.09	1.53	1.90	2.20	2.44	2.83	3.14
1-1/4	.71	1.36	1.91	2.37	2.74	3.04	3.52	3.90
1-1/2	.81	1.55	2.18	2.70	3.12	3.46	4.02	4.45
2	.95	1.81	2.55	3.17	3.66	4.05	4.71	5.22

- Notes:**
1. Based on 70°F room temperature.
  2. Pipes are positioned level, on vertical wall.
  3. For coils positioned along floor or ceiling.
- Multiply chart value for 1 row of pipe x no. of rows of pipe.



### CORRECTION FACTORS IF ROOM TEMPERATURE IS OTHER THAN 70°F DIVIDE SQ. FT. OF RADIATION BY

Room Temp.	80°	75°	70°	65°	60°	55°	50°
Divisor	1.10	1.05	1.00	0.96	0.92	0.88	0.85

Heat Emissions for Cast Iron Radiators			
Design or Average Water Temperature	Heat Emission Rates Btuh per Sq. Ft.	Design or Average Water Temperature	Heat Emission Rates Btuh per Sq. Ft.
110°	30	180°	170
120°	50	185°	180
130°	70	190°	190
140°	90	195°	200
150°	110	200°	210
160°	130	205°	220
170°	150	210°	230
175°	160	215°	240

## CHAPTER 5 INSTALLED RADIATION: DETERMINING HEAT LOAD

### HEAT LOSSES FROM BARE STEEL PIPE

Based On 70° Surrounding Air

Diameter of Pipe (inches)	Temperature of Pipe °F					
	100	120	150	180	210	240
	Heat Loss per Lineal Foot of Pipe - BTU per Hour					
1/2	13	22	40	60	82	106
3/4	15	27	50	74	100	131
1	19	34	61	90	123	160
1-1/4	23	42	75	111	152	198
1-1/2	27	48	85	126	173	224
2	33	59	104	154	212	275
2-1/2	39	70	123	184	252	327
3	46	84	148	221	303	393
3-1/2	52	95	168	250	342	444
4	59	106	187	278	381	496
5	71	129	227	339	464	603
6	84	151	267	398	546	709
8	107	194	341	509	697	906
10	132	238	420	626	857	1114
12	154	279	491	732	1003	1305
14	181	326	575	856	1173	1527
16	203	366	644	960	1314	1711
18	214	385	678	1011	1385	1802
20	236	426	748	1115	1529	1990

### HEAT LOSSES FROM BARE TARNISHED COPPER TUBE

Based On 70° Surrounding Air

Diameter of Pipe (inches)	Temperature of Pipe °F					
	100	120	150	180	210	240
	Heat Loss per Lineal Foot of Pipe - BTU per Hour					
1/4	4	8	14	21	29	37
3/8	6	10	18	28	37	48
1/2	7	13	22	33	45	59
5/8	8	15	26	39	53	68
3/4	9	17	30	45	61	79
1	11	21	37	55	75	97
1-1/4	14	25	45	66	90	117
1-1/2	16	29	52	77	105	135
2	20	37	66	97	132	171
2-1/2	24	44	78	117	160	206
3	28	51	92	136	186	240
3-1/2	32	59	104	156	212	274
4	36	66	118	174	238	307
5	43	80	142	212	288	373
6	51	93	166	246	336	432
8	66	120	215	317	435	562
10	80	146	260	387	527	681
12	94	172	304	447	621	802

## CHAPTER 5

### INSTALLED RADIATION: DETERMINING HEAT LOAD

Heat Losses from Covered Pipe 85% Magnesia Type BTU per Linear Foot per Hour per °F Temperature Difference (surrounding air assumed 75°F)					
Pipe Size	Insulation, Thickness (inches)	Maximum Temperature of Pipe Surface °F			
		125	175	225	275
1/2	1	.145	.150	.157	.160
3/4	1	.165	.172	.177	.180
1	1	.190	.195	.200	.203
	1-1/2	.160	.165	.167	.170
1-1/4	1	.220	.225	.232	.237
	1-1/2	.182	.187	.193	.197
1-1/2	1	.240	.247	.255	.260
	1-1/2	.200	.205	.210	.215
2	1	.282	.290	.297	.303
	1-1/2	.230	.235	.240	.243
	2	.197	.200	.205	.210
2-1/2	1	.322	.330	.340	.345
	1-1/2	.260	.265	.270	.275
	2	.220	.225	.230	.237
3	1	.375	.385	.395	.405
	1-1/2	.300	.305	.312	.320
	2	.253	.257	.263	.270
3-1/2	1	.419	.430	.440	.450
	1-1/2	.332	.339	.345	.352
	2	.280	.285	.290	.295
4	1	.460	.470	.480	.492
	1-1/2	.362	.370	.379	.385
	2	.303	.308	.315	.320
5	1	.545	.560	.572	.585
	1-1/2	.423	.435	.442	.450
	2	.355	.360	.367	.375
6	1	.630	.645	.662	.680
	1-1/2	.487	.500	.510	.520
	2	.405	.415	.420	.430
8	1	.790	.812	.835	.850
	1-1/2	.603	.620	.635	.645
	2	.495	.507	.517	.527