WEIL-McLAIN®

BOILER REPLACEMENT GUIDE

Step-by-step procedures for properly sizing hot water and steam replacement boilers for homes and small commercial buildings

BOILER REPLACEMENT GUIDE

INTRODUCTION

This booklet is designed to give the quality-conscious hydronic heating contractor a step-by-step procedure for properly sizing hot water and steam replacement boilers. It is intended primarily for use in sizing boilers for homes, but in many cases can also be used for small commercial buildings.

All too often replacement boilers are sized simply by matching the rating of the old boiler. This can result in an oversized boiler which wastes fuel—or an undersized unit which will not heat the building.

By following the procedures in this booklet, the heating contractor will be able to accurately size replacement boilers, sell more replacement jobs, assure energy-efficient installations, and render better service for customers.

SIZING HOT WATER BOILERS – Page 3

There is only one accepted method for determining the proper size of a replacement hot water boiler: THE HEAT LOSS OF THE BUILDING MUST BE CALCULATED. By following the steps in this booklet, the total heat loss of the average house can be calculated in five or ten minutes. In most cases it should not be necessary to make a detailed calculation but, if it is required for any reason, use or the latest ASHRAE Handbook.

SIZING STEAM BOILERS – Page 9

To properly size a replacement steam boiler DETERMINE THE TOTAL BTU CAPACITY OF THE CONNECTED RADIATION. This method is necessary in order to assure adequate steam pressure to fill all parts of the system.

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SECTION 1
PROCEDURE FOR SIZING HOT WATER BOILERS

STEP 1: COMPLETE A JOB SURVEY FORM

Certain key information is required for each boiler replacement job in order to calculate the heat loss, select the proper boiler and determine the selling price. Figure 1 is a Job Survey Form (part of a Weil-McLain Boiler Replacement Worksheet) to aid in recording the required information. It will serve as a checklist of the basic data for the existing installation and a permanent record for your job file. Boiler Replacement Worksheets to be used with this booklet are available through Weil-McLain distributors and sales representatives.

FIGURE 1: JOB SURVEY FORM

WEIL-McLAIN®

BOILER REPLACEMENT WORKSHEET
JOB SURVEY FORM

CUSTOMER NAME: _____ PHONE: _____

ADDRESS: _____

PREPARED BY: _____ DATE: _____

PRESENT HEATING SYSTEM: _____

TYPE OF RADIATION: _____

HEATING MEDIUM: ☐ Hot Water ☐ Steam

FUEL NOW USED: ☐ Natural Gas ☐ Propane ☐ #2 Oil ☐ Electricity

FUEL TO BE USED: ☐ Natural Gas ☐ Propane ☐ #2 Oil ☐ Electricity

IS SYSTEM HEATING SATISFACTORILY? ☐ Yes ☐ No

If no, what is the problem? _____

How can it be corrected? _____

RELOCATE BOILER? ☐ Yes ☐ No If yes estimate time _____ Materials _____

Corrosive Atmosphere?

PRESENT SOURCE OF DOMESTIC WATER: ☐ Tankless Heater ☐ Indirect Tank ☐ Other _____

WILL NEW BOILER HAVE A WATER HEATER? ☐ Yes ☐ No Type _____

HOUSE CONSTRUCTION:

GLASS: _____

WALLS: _____

CEILING: _____

SLAB: _____

HOUSE DIMENSIONS (Use sketch for accuracy):

High Altitude _____ Ft. Elevation

Basement _____' H x _____' L x _____' W = _____ Sq. Ft.

First Floor _____' H x _____' L x _____' W = _____ Sq. Ft.

Second Floor _____' H x _____' L x _____' W = _____ Sq. Ft.

DESIGN TEMPERATURE DIFFERENCE _____ °F

NEW THERMOSTAT(S) REQUIRED ☐ Standard ☐ Programmable

STEP 2: CALCULATE TOTAL HEAT LOSS

The form shown in Figure 2 (Part of the Weil-McLain Boiler Replacement Worksheet) can be used for calculating total heat loss by following these steps.

1. Based on the type of construction, amount of insulation, etc., select the Construction Design Number from Table A below which most nearly matches each of the areas (levels) to be heated.
2. Determine the total square footage of each area to be heated from the Job Survey Form. Round to the nearest hundred.
3. Based on the Construction Design Number selected and the square footage of each area, determine the heat loss (at 70°F design temp. diff.) from Table B (page 5). NOTE: Do not add in heat loss for basements which are not to be heated; ignore crawl spaces which are open to basement areas.
4. If the Outdoor Design Temperature of the city is unknown, refer to back page. If the design temperature difference is other than 70°F, multiply the heat loss for each area by the appropriate correction factor from Table C (page 6). Round to the nearest ten.
5. If it is a two story house, multiply the heat loss of the first level by the appropriate Ceiling Correction Factor from Table D (page 6). Round to nearest ten.
6. Add the adjusted heat loss for each area to determine the Total Heat Loss.

FIGURE 2: HEAT LOSS CALCULATION FORM

LEVEL	CONSTRUCTION NUMBER	SQ. FT.	HEAT LOSS (AT 70°F DESIGN TEMP. DIFF.)	CORRECTION FACTOR AT ____ °F	TOTAL	CEILING CORRECTION FACTOR	ADJUSTED HEAT LOSS
FIRST LEVEL			____ x	____ =	____ x	____ =	____
SECOND LEVEL			____ x	____ =	____	→	____
BASEMENT			____ x	____ =	____	→	____
SLAB			____ x	____ =	____	→	____

TOTAL HEAT LOSS _____

TABLE A: CONSTRUCTION CHARACTERISTICS

FRAME CONSTRUCTION				BRICK CONSTRUCTION		
CONSTRUCTION DESIGN NUMBER	WEATHERSTRIPPED GLASS	INSULATION THICKNESS WALL	INSULATION THICKNESS CEILING	CONSTRUCTION DESIGN NUMBER	WEATHERSTRIPPED GLASS	CEILING INSULATION
	Without basement or crawl space				With 4″ brick & 4″ lightweight block**	
1	single	1″	2″	14	single	2″
2	double	1″	2″	15	double	2″
3	single	1″	3″	16	single	3″
4	double	1″	3″	17	double	3″
5	double	2″	3″		With 8″ brick**	
6	double	3″	3″	18	single	2″
	With full basement or crawl space			19	double	2″
7	double	3″	6″*	20	single	3″
8	double	3″	6″	21	double	3″
9	double	3″	9″	22†	For Basements- Concrete or block walls 8′ high, 6 1/2′ below grade (stray heat from boiler & piping included). Or for unheated crawl spaces	
10	double	3″	12″			
11	double	6″	6″			
12	double	6″	9″	23‡	4″ concrete slab with 1″ perimeter insulation	
13	double	6″	12″			

* With 2″ Floor Insulation.
** Furred, lath & plaster.
† Use for basement heat losses WITHOUT fully exposed walls and for floor losses over closed unheated crawl spaces. For basements with fully exposed walls use FIRST FLOOR heat loss.
‡ Use for grade level slab construction.

TABLE B: HEAT LOSS TABLE (in BTU/Hr.)
(Calculated at 70°F Design Temperature Difference

FLOOR AREA SQ. FT.	CONSTRUCTION DESIGN NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
500	28,750	23,900	27,350	22,510	18,080	16,860	17,910	16,160	15,460	15,110	15,360
600	32,300	27,030	30,620	25,350	20,520	19,200	20,460	18,360	17,520	17,100	17,490
700	35,860	30,150	33,900	28,190	22,970	21,540	23,010	20,560	19,580	19,090	19,610
800	39,840	33,590	37,600	31,350	25,640	24,080	25,760	22,960	21,840	21,280	21,920
900	43,340	36,680	40,820	34,160	28,050	26,380	28,270	25,120	23,860	23,230	24,010
1000	46,890	39,800	44,090	37,000	30,500	28,720	30,820	27,320	25,920	25,220	26,140
1100	50,450	42,920	47,370	39,840	32,940	31,060	33,370	29,520	27,980	27,210	28,270
1200	54,000	46,040	50,640	42,680	35,390	33,400	35,920	31,720	30,040	29,200	30,400
1300	56,640	48,470	53,000	44,830	37,340	35,300	38,030	33,480	31,660	30,750	32,120
1400	60,200	51,590	56,280	47,670	39,790	37,640	40,580	35,680	33,720	32,740	34,240
1500	62,830	54,030	58,630	49,830	41,740	39,540	42,690	37,440	35,340	34,290	35,970
1600	65,530	56,490	61,050	52,010	43,730	41,480	44,840	39,240	37,000	35,880	37,730
1700	68,590	59,250	63,830	54,490	45,910	43,570	47,140	41,190	38,810	37,620	39,630
1800	71,720	62,040	66,680	57,000	48,130	45,710	49,490	43,190	40,670	38,410	37,950
1900	73,930	64,150	68,600	58,830	49,860	47,410	51,400	44,750	42,090	40,760	43,120
2000	77,050	66,940	71,450	61,340	52,080	49,550	53,750	46,750	43,950	42,550	45,070

TABLE B (continued)

FLOOR AREA SQ. FT.	CONSTRUCTION DESIGN NUMBER											
	12	13	14	15	16	17	18	19	20	21	22	23
500	14,660	14,310	30,360	25,520	28,960	24,120	32,780	27,940	31,380	26,540	5,130	4,350
600	16,650	16,230	34,060	28,790	32,380	27,110	36,690	31,420	35,010	29,740	6,150	4,730
700	18,630	18,140	37,760	32,050	35,780	30,090	40,600	34,890	38,650	32,930	7,180	5,220
800	20,800	20,240	41,920	35,670	39,680	33,430	45,040	38,790	42,800	36,550	8,210	5,600
900	22,750	22,120	45,560	38,910	43,040	36,390	48,890	42,240	46,370	39,720	9,230	5,980
1000	24,740	24,040	49,260	42,170	46,460	39,370	52,810	45,720	50,010	42,920	10,250	6,370
1100	26,730	25,960	52,960	45,430	49,880	42,350	56,720	49,190	53,640	46,110	11,300	6,750
1200	28,720	27,880	56,660	48,690	53,300	45,330	60,630	52,670	57,270	49,310	12,330	7,150
1300	30,300	29,390	59,360	51,200	55,720	47,560	63,450	55,290	59,810	51,650	13,340	7,330
1400	32,280	31,300	63,060	54,460	59,140	50,540	67,360	58,760	63,440	54,840	14,370	7,720
1500	33,870	32,820	65,770	56,970	61,570	52,770	70,180	61,380	65,980	57,180	15,400	7,920
1600	35,490	34,370	68,540	59,500	64,060	55,020	73,050	64,020	68,570	59,540	16,420	8,110
1700	37,250	36,060	71,710	62,370	66,950	57,610	76,390	67,050	71,630	62,290	17,440	8,400
1800	39,060	37,800	74,950	65,270	69,910	60,230	79,780	70,110	74,740	65,070	18,480	8,690
1900	40,460	39,130	77,190	67,410	71,870	62,090	82,080	72,300	76,760	66,990	19,500	9,270
2000	42,270	40,870	80,420	70,310	74,820	64,710	85,470	75,360	79,870	69,760	20,600	9,560

NOTE: The BTU figures in this table are based upon AHRI NET calculations where ceiling height is 8 ft. and where total window and door areas do not exceed 20 percent of the GROSS wall area. For 9 ft. ceiling height add 11 percent to heat loss; for 10 ft. ceiling height, add 22 percent. For lower levels ONE HALF or LESS below grade level, use FIRST FLOOR heat loss.

TABLE C: DESIGN TEMPERATURE CORRECTION FACTORS (For other than 70° Design Temperature Difference)

DESIGN TEMP. DIFFERENCE	FACTOR	DESIGN TEMP. DIFFERENCE	FACTOR	DESIGN TEMP. DIFFERENCE	FACTOR
25°F	.35	55°F	.78	90°F	1.29
30°F	.42	60°F	.85	95°F	1.36
35°F	.50	65°F	.92	100°F	1.43
40°F	.57	75°F	1.07	105°F	1.50
45°F	.64	80°F	1.15	110°F	1.57
50°F	.71	85°F	1.20	115°F	1.64

Note: Conversion factor for "in between" temperatures can be determined by interpolation between the closest tabulated values. Example: the outdoor design temperature in Philadelphia, PA is 14°F. Indoor minus outdoor temperature equals 56°F. Interpolated factor equals 0.79 (rounded).

TABLE D: CEILING CORRECTION FACTORS (For first floor heat loss in two story structure)

CONSTRUCTION DESIGN NO.	FACTOR	CONSTRUCTION DESIGN NO.	FACTOR	CONSTRUCTION DESIGN NO.	FACTOR	CONSTRUCTION DESIGN NO.	FACTOR
1	.82	7	.88	13	.94	19	.82
2	.79	8	.86	14	.83	20	.89
3	.88	9	.91	15	.80	21	.88
4	.86	10	.94	16	.88	22	-
5	.83	11	.86	17	.87	23	-
6	.82	12	.91	18	.84		

STEP 3: SELECT THE BOILER

The size of the replacement boiler will be based on the Total Heat Loss of the building calculated in Step 2. The boiler should be selected based on its AHRI NET Rating in BTU/Hr. For example, if the Total Heat Loss of the house is 85,000 BTU/Hr. then the AHRI NET Rating of the replacement boiler must be at least 85,000. It can be more- but **never** less.

For convenience, Table E (opposite page) shows the Net AHRI NET water ratings for current Weil-McLain gas and oil boilers for homes and small commercial buildings.

STEP 4: DETERMINE THE BID PRICE

Figure 3 (opposite page) is a general checklist of the materials which may be required for a boiler replacement job (also part of the Weil-McLain Boiler Replacement Worksheet). This list can be used to figure the cost of all materials as well as labor, overhead, and profit.

TABLE E: AHRI NET RATINGS IN BTU/HR. FOR WEIL-McLAIN BOILERS
NOTE: Always consult product manual for details

Evergreen®		
MODEL	WATER RATING	AFUE
EVG 110	88,000	95.0
EVG 155	124,000	95.1
EVG 220	179,000	95.0
EVG 299	243,000	95.0
EVG 399	333,000	96.5*

Ultra™		
MODEL	WATER RATING	AFUE
ULT 80	62,000	93.5%
ULT 105	81,000	94.0%
ULT 155	123,000	94.0%
ULT 230	183,000	94.1%
ULT 299	234,000	92.5%
ULT 399	317,000	91.7%*

ECO® Tec		
MODEL	WATER RATING	AFUE
ET 80-H	64,000	95%
ET 110-H	87,000	95%
ET 150-H	121,000	95%
ET 199-H	160,000	95%
ET 110-C	87,000	95%
ET 150-C	121,000	95%
ET 199-C	160,000	95%

AquaBalance®		
MODEL	WATER RATING	AFUE
AB-80H	65,000	95%
AB-120H	97,000	95%
AB-155H	125,000	95%
AB-80C	65,000	95%
AB-120C	97,000	95%
AB-155C	125,000	95%

GV90+®		
MODEL	WATER RATING	AFUE
GV90+3	56,000	91.9%
GV90+4	84,000	91.2%
GC90+5	113,000	91.4%
GV90+6	140,000	91.0%

CGi		
MODEL	WATER RATING	AFUE
CGi-25	35,000	84%
CGi-3	42,000	84%
CGi-4	66,000	84%
CGi-5	88,000	84%
CGi-6	117,000	84%
CGi-7	140,000	84%
CGi-8	164,000	84%

CGa		
MODEL	WATER RATING	AFUE
CGa-25	27,000	84%
CGa-3	48,000	84%
CGa-4	73,000	84%
CGa-5	98,000	84%
CGa-6	122,000	84%
CGa-7	147,000	84%
CGa-8	172,000	84%

EG - Water		
MODEL	WATER RATING	AFUE
EG-30	55,000	84.3%
EG-35	73,000	83.6%
EG-40	91,000	84.0%
EG-45	110,000	83.5%
EG-50	128,000	83.8%
EG-55	146,000	83.8%
EG-65	183,000	84.0%
EG-75	217,000	82.7%

80	
MODEL	WATER RATING
380	242,000
480	344,000
580	448,000
680	551,000
780	655,000
880	758,000
980	862,000
1080	965,000
1180	1,069,000
1280	1,172,000

SVF™		
MODEL	WATER RATING	AFUE
SVF 750	657,000	96.3%*
SVF 1000	842,000	96.8%*
SVF 1100	957,000	97.1%*
SVF 1500	1,259,000	96.5%*
SVF 2000	1,672,000	96.2%*
SVF 2500	2,104,000	96.8%*
SVF 3000	2,499,000	95.8%**

SLIM FIT®		
MODEL	WATER RATING	AFUE
SF-550	450,000	93.9%*
SF-750	610,000	93.6%*
SF-1000	833,000	95.8%*
SF-1500	1,250,000	95.9%*
SF-2000	1,657,000	95.8%*

* Indicates Thermal Efficiency Rating
** Indicates Combustion Efficiency Rating

FIGURE 3: MATERIAL LIST

QTY	ITEM	AMOUNT	QTY	AFUE	AMOUNT
	Boiler No.			Copper Pipe: ½"	
	Thermostats			¾"	
	Zone Valves			1"	
	Balancing Valves			1¼"	
	Expansion Tank			1½"	
	Flow Control Valve			Fittings	
	Low Limit or Reverse Acting Control				
	Pressure Reducing Valve				
	Flue Pipe				
	Extra Valves				
	Gas Piping			Electric Wiring	
	Oil Tank, Pipe and Fittings			Freight and Cartage	
	Insulated Domestic Water Storage Tank				
	Domestic Water Coil				
	Pipe			Incidentals	
	Fuel Valves				
	Circulators			TOTAL COST OF MATERIAL	
	Relay			Labor	
	Circuit Braker (or fuse) Panel			Profit	
	240v. Disconnect Switch			Overhead	
	240v. 3-Wire Service Cable				
	SUB-TOTAL			BID PRICE	

SAMPLE PROBLEM

STEP 1: COMPLETE A JOB SURVEY FORM

A properly completed Job Survey Form is shown in Figure 4. The Key Information:

- Two story house with unheated basement-816 sq. ft. of floor space each level.
- Construction: 4" brick and 4" light weight block, furred, lath and plaster; 3" ceiling insulation; double glass, weatherstripped.
- 80°F design temperature difference.
- Type of System: series loop.
- Type of Radiation: convector baseboard.
- Owner wants to replace his old boiler with a new high efficiency gas fired water boiler. Owner wants night set-back thermostat.

FIGURE 4: JOB SURVEY FORM

WEIL-McLAIN®

BOILER REPLACEMENT WORKSHEET

JOB SURVEY FORM

CUSTOMER NAME: C. L. Jones PHONE: 327-9489

ADDRESS: 18075 Ski Run Drive, Monroe

PREPARED BY: RKT DATE: 2/15

PRESENT HEATING SYSTEM: Series loop

TYPE OF RADIATION: Convector BSBD

HEATING MEDIUM: ☒ Hot Water ☐ Steam

FUEL NOW USED: ☒ Natural Gas ☐ Propane ☐ #2 Oil ☐ Electricity

FUEL TO BE USED: ☒ Natural Gas ☐ Propane ☐ #2 Oil ☐ Electricity

IS SYSTEM HEATING SATISFACTORILY? ☐ Yes ☐ No

If no, what is the problem? _____

How can it be corrected? _____

RELOCATE BOILER? ☐ Yes ☒ No If yes estimate time _____ Materials _____

Corrosive Atmosphere? no

PRESENT SOURCE OF DOMESTIC WATER: ☐ Tankless Heater ☐ Indirect Tank ☒ Other Separate

WILL NEW BOILER HAVE A WATER HEATER? ☐ Yes ☒ No Type _____

HOUSE CONSTRUCTION:

GLASS: double glass, weatherstripped

WALLS: 4" brick, 4" block – furred, lath & plaster

CEILING: 3" insulation

SLAB: wood over bsmt.

HOUSE DIMENSIONS (Use sketch for accuracy):

High Altitude _____ Ft. Elevation

Basement 8 ' H x 34 ' L x 24 ' W = 816 Sq. Ft.

First Floor 8 ' H x 34 ' L x 24 ' W = 816 Sq. Ft.

Second Floor 8 ' H x 34 ' L x 24 ' W = 816 Sq. Ft.

DESIGN TEMPERATURE DIFFERENCE 80 °F

NEW THERMOSTAT(S) REQUIRED ☐ Standard ☒ Programmable

STEP 2: CALCULATE TOTAL HEAT LOSS

The Total Heat Loss for the example is calculated on the form shown in Figure 5 based on the following steps:

1. The construction of the house matches Construction Design Number 17 in Table A (page 4).
2. Each of the two levels is rounded to 800 sq ft (the basement is not heated).
3. From Table B (page 5) Construction No. 17 at 800 sq ft has a heat loss of 33,430 BTU/Hr.
4. Table C (page 6) shows a 1.15 correction factor for 80°F Design Temperature Difference. Therefore, the heat loss for each area is 38,450 BTU/Hr. (33,430 x 1.15 rounded).
5. Since it is a two story house, the first floor does not have a ceiling loss. Table D (page 6) indicates a Ceiling Correction Factor for Construction Number 17 of .87. Therefore, the total adjusted heat loss for the first floor is 33,450 BTU/Hr. (38,450 x .87 rounded).
6. The total heat loss for the two levels is 71,900 BTU/Hr.

STEP 3: SELECT THE BOILER

The Total Heat Loss of 71,900 BTU/Hr. calculated in Step 2 is the minimum AHRI NET Rating of the new boiler. The owner wants a high efficiency gas boiler. Therefore, from Table E (page 7) the Ultra 105, WM97+ 110, ECO 110, GV90+ 4, CGi-5, CGa-4, or EG 40 could be selected. The Model Number of the boiler would be recorded on the Materials List. (Figure 3, page 7). The list would then be used to calculate material cost; add labor, overhead and profit; and determine the selling price.

FIGURE 5: HEAT LOSS CALCULATION FORM

LEVEL	CONSTRUCTION NUMBER	SQ. FT.	HEAT LOSS (AT 70°F DESIGN TEMP. DIFF.)		CORRECTION FACTOR AT 80 °F		TOTAL		CEILING CORRECTION FACTOR		ADJUSTED HEAT LOSS
FIRST LEVEL	17	800	33,430	x	1.15	=	38,450	x	.87	=	33,450
SECOND LEVEL	17	800	33,430	x	1.15	=	38,450	→			38,450
MID-LEVEL				x		=		→			
BASEMENT				x		=		→			
SLAB				x		=		→			

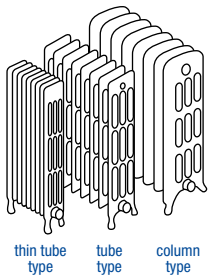
TOTAL HEAT LOSS 71,900

SECTION 2
PROCEDURE FOR SIZING STEAM BOILERS

To properly size a replacement steam boiler, determine the total BTU capacity of the connected radiation in the building. This method is necessary so that the new boiler will produce adequate steam to fill the entire system. To make the calculations, determine the number of square feet of direct radiation in **each** radiator connected to the existing boiler. Follow these steps:

1. Identify the style of the radiator. Figure 6 shows the relative sizes of three different radiator styles. All are four tube, eight section radiators but the rating of each is different.
2. Measure the height and width of the radiator.
3. Count the number of tubes in each section.
4. Count the number of sections.
5. Determine the square feet of radiation in each section. See Table F (page 10).
6. Multiply the square feet of radiation in each section by the number of sections.
7. Total the square feet of radiation for all the radiators in the building.

FIGURE 6



8. Convert the total square feet of radiation to BTU/Hr. Each square foot of steam radiation is based on a heat emission of 240 BTU/Hr. with standard 70°F air temperature and 215°F steam temperature in the radiator.
9. Size the replacement steam boiler by selecting a unit with a AHRI NET Steam rating equal to or greater than the BTU/Hr. capacity of the radiation.

EXAMPLE:

FIGURE 7

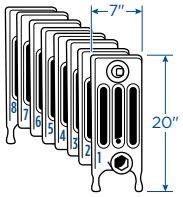


Figure 7 is a tube type radiator, 20" high by 7" wide. There are 4 tubes per section and 8 sections. Table F shows this size tube type radiator has 2 ¼ square feet of radiation per section. 2 ¼ times 8 (the number of sections) equals 18 square feet of direct radiation. 18 times 240 (BTU/Hr.) equals 4,320 BTU/Hr. for this radiator.

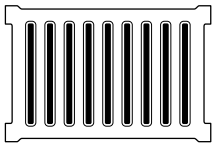
TABLE F: SQUARE FEET OF RADIATION PER RADIATOR SECTION

OLD STYLE COLUMN RADIATORS						
	NO. OF TUBES OR COLUMNS					
	1	2	3	4	5	6
WIDTH (IN.)	4½	7⅜	9	11½	12½	12½
HEIGHT (IN.)						
45	3½	5	6	10	–	–
38	3	4	5	8	10	–
32	2½	3⅓	4½	6½	8½	–
26	2	2⅔	3¾	5	7	7
23	1⅔	2⅓	3¼	4½	–	–
22	1⅔	2¼	3	4	6	6
20	1½	2	2¾	3½	5	5
18	1⅓	1¾	2¼	3	5	4⅓
17	–	–	–	–	–	4
16	–	–	–	–	4	3¾
15	–	1½	–	–	–	–
14	–	–	–	–	4	3
13	–	–	–	–	3	3

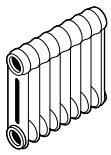
TUBE TYPE RADIATORS					
	NO. OF TUBES				
	3	4	5	6	7
WIDTH (IN.)	5	7	8¾	9¾	12½
HEIGHT (IN.)					
38	3½	4¼	5	6	–
36	3½	4¼	5	6	7
32	3	3½	4⅓	5	6
26	2⅓	2¾	3½	4	5
23	2	2½	3	3½	4½
22	–	–	–	–	4½
20	1¾	2¼	2⅔	3	3⅔
18	–	–	–	–	3½
17	–	–	–	–	3
16	–	–	–	–	3
14	–	–	–	–	2½

THIN TUBE RADIATORS					
	NO. OF TUBES				
	2	3	4	5	6
WIDTH (IN.)	3½	4	4¾	6	7⅞
HEIGHT (IN.)					
38	2½	2⅔	–	–	–
32	2	2⅓	–	–	3⅔
26	–	–	2⅓	3	3
25	1½	1⅔	2	–	3
23	–	–	–	2	–
22	1⅓	1⅓	1⅘	–	–
20	–	–	1⅘	–	2⅓
19	1	1¼	1⅔	–	2⅓
17	–	–	–	2	–

WALL TYPE RADIATORS	
SIZE	SQ. FT. PER RADIATOR
13½" x 17" x 3"	5
13½" x 21" x 3"	6
13½" x 22" x 3"	7
13½" x 29" x 3"	9



SECTIONAL WALL TYPE RADIATORS	
HEIGHT (IN.)	SQ. FT. RADIATION PER SECTION
37	2½
26½	1⅘
21½	1½
15	1
13⅞	¾



CAST IRON BASEBOARD	
HEIGHT (IN.)	SQ. FT. RADIATION
7	2.40
9	3.35

APPENDIX
OTHER CONSIDERATIONS IN BOILER REPLACEMENT

1. INSTALLATION INSTRUCTIONS

In order for the warranty on a new boiler to be honored, the boiler must be installed in strict accordance with the manufacturer's installation instructions. It is imperative that the heating contractor follows the instructions furnished with the equipment. If questions arise, the heating contractor should contact the distributor.

2. GRAVITY SYSTEMS

Adding a circulator to a gravity system may improve circulation in areas that had poor circulation; however the circulator will not increase the amount of heat available per unit of time. The circulator should be operated with a reverse acting control to turn it ON when system water temperature reaches 110-120°F; OFF at about 90-100°F.

3. STEAM HEATING SYSTEMS

Be sure to check the following:
(a) total square feet of installed radiation,
(b) modifications to the system from its original condition,
(c) physical condition of the system,
(d) condensate return time (slow?),
(e) if the low water cutoff is activated frequently
(f) if there is a pump control to operate the condensate pump,
(g) the possibility of buried (leaking) piping.
Also, check the boiler water for contaminants by boiling two water samples in separate pans-one sample of tap water and one of boiler water. If the boiler water foams over like boiled milk, the water is contaminated and should be treated accordingly.

4. CLEANING STEAM BOILERS

The proper cleaning of new steam boilers is perhaps the most neglected step in steam boiler replacement. It is also a factor many installers overlook when estimating the cost of the job. After installation, a steam boiler should be cleaned and flushed. Chemical additives for cleaning or water treatment must be carefully considered. When in doubt, consult a reputable water treatment firm, or Weil-McLain since most chemicals generally cause more problems than they solve and can void the warranty. Never use petroleum products. In addition, a thorough check of the valves, vents and traps should be made to be sure they are in good working order and are the type and size needed for the application.

5. CLEANING HOT WATER SYSTEMS

Old hot water systems may have mud, sludge or other accumulation which could affect the operation of a new boiler. If there is any evidence of deposits in the old boiler when it is removed, the piping and radiation should be flushed with cold water before the material hardens.

6. EXPANSION TANKS

New water boilers must be installed with a properly sized expansion tank in order to avoid the loss of system water during each warm-up cycle and the replacement of the lost water with fresh makeup water with the pressure reducing valve. The frequent addition of makeup water to a heating system can cause severe damage and must be prevented.

7. THERMOSTATS

Modern controls on a new boiler will usually require a different heat anticipator setting for the thermostat. Many older thermostats either have fixed-heat anticipators-or none at all. For proper boiler operation and owner satisfaction, the thermostat heat anticipator must be set properly. Follow instructions.

OUTDOOR DESIGN TEMPERATURES FOR SELECTED CITIES

ALABAMA
- Anniston 22
- Birmingham 21
- Mobile 29
- Montgomery 25

ALASKA
- Anchorage . . . . . -18
- Fairbanks . . . . . -47
- Juneau 1
- Nome . . . . . -27

ARIZONA
- Flagstaff 4
- Phoenix 34
- Tucson 32
- Winslow 10
- Yuma 39

ARKANSAS
- Fort Smith 17
- Little Rock 20

CALIFORNIA
- Bakersfield 32
- Eureka 33
- Fresno 30
- Los Angeles 43
- Oakland 36
- Sacramento 32
- San Diego 44
- San Francisco 38
- San Jose 36

COLORADO
- Denver 1
- Grand Junction 7
- Pueblo 0

CONNECTICUT
- Hartford 7
- New Haven 7

DELAWARE
- Dover 15
- Wilmington 14

DISTRICT OF COLUMBIA
- Washington 14

FLORIDA
- Jacksonville 32
- Miami 47
- Pensacola 29
- Tampa 40

GEORGIA
- Atlanta 22
- Augusta 23
- Macon 25
- Savannah 27

IDAHO
- Boise 10
- Coeur D'Alene . . . . . -1
- Lewiston 6
- Pocatello . . . . . -1

ILLINOIS
- Chicago 0
- Moline . . . . . -4
- Peoria . . . . . -4
- Springfield 2
- Urbana 2

INDIANA
- Fort Wayne 1
- Indianapolis 2

IOWA
- Davenport . . . . . -5
- Des Moines . . . . . -5
- Dubuque . . . . . -7
- Mason City . . . . . -11
- Sioux City . . . . . -7

KANSAS
- Dodge City 5
- Topeka 4
- Wichita 7

KENTUCKY
- Louisville 10

LOUISIANA
- New Orleans 33
- Shreveport 25

MAINE
- Augusta . . . . . -3
- Bangor . . . . . -6
- Caribou . . . . . -13
- Portland . . . . . -1

MARYLAND
- Baltimore 13

MASSACHUSETTS
- Boston 9
- Nantucket 0
- Springfield 0
- Worcester 4

MICHIGAN
- Battle Creek 5
- Detroit 6
- Flint 1
- Grand Rapids 5
- Lansing 1
- Sault St. Marie . . . . . -8

MINNESOTA
- Duluth . . . . . -16
- Minneapolis . . . . . -12
- Hibbing . . . . . -20

MISSISSIPPI
- Meridian 23
- Vicksburg 26

MISSOURI
- Columbia 4
- Kansas City 6
- St. Louis 6

MONTANA
- Billings . . . . . -10
- Butte . . . . . -17
- Helena . . . . . -16
- Kalispell . . . . . -7
- Miles City . . . . . -15

NEBRASKA
- Lincoln . . . . . -2
- North Platte . . . . . -4
- Omaha . . . . . -3

NEVADA
- Las Vegas 28
- Reno 10
- Winnemucca 3

NEW HAMPSHIRE
- Concord . . . . . -3
- Manchester . . . . . -3

NEW JERSEY
- Atlantic City 13
- Newark 14
- Trenton 14

NEW MEXICO
- Albuquerque 16
- Roswell 18

NEW YORK
- Albany . . . . . -1
- Binghamton 1
- Buffalo 6
- Massena . . . . . -8
- New York 15
- Rochester 5
- Syracuse 2

NORTH CAROLINA
- Asheville 14
- Charlotte 22
- Greensboro 18
- Raleigh 20
- Wilmington 26

NORTH DAKOTA
- Bismarck . . . . . -19
- Fargo . . . . . -18

OHIO
- Akron 6
- Cincinnati 6
- Cleveland 5
- Columbus 5
- Dayton 4
- Sandusky 4
- Toledo 1

OKLAHOMA
- Oklahoma City 13
- Tulsa 13

OREGON
- Baker 6
- Eugene 22
- Medford 23
- Portland 23
- Salem 23

PENNSYLVANIA
- Erie 9
- Harrisburg 11
- Philadelphia 14
- Pittsburgh 5
- Scranton 5

RHODE ISLAND
- Providence 9

SOUTH CAROLINA
- Charleston 27
- Columbia 24
- Greenville 22

SOUTH DAKOTA
- Huron . . . . . -14
- Pierre . . . . . -10
- Rapid City . . . . . -7

TENNESSEE
- Chattanooga 18
- Knoxville 19
- Memphis 18
- Nashville 14

TEXAS
- Abilene 20
- Amarillo 11
- Austin 33
- Brownsville 39
- Corpus Christi 35
- Dallas 22
- Del Rio 31
- El Paso 24
- Ft. Worth 22
- Galveston 36
- Houston 32
- Port Arthur 31
- San Antonio 30

UTAH
- Salt Lake City 8
- Vernal 0

VERMONT
- Burlington . . . . . -7

VIRGINIA
- Lynchburg 16
- Norfolk 22
- Richmond 17
- Roanoke 16

WASHINGTON
- Seattle 26
- Spokane 2
- Yakima 5

WEST VIRGINIA
- Elkins 6
- Parkersburg 11

WISCONSIN
- Green Bay . . . . . -9
- La Crosse . . . . . -9
- Madison . . . . . -7
- Milwaukee . . . . . -4

WYOMING
- Cheyenne . . . . . -1
- Lander . . . . . -11
- Sheridan . . . . . -8

CANADA

ALBERTA
- Calgary . . . . . -23
- Edmonton . . . . . -25
- Grand Prairie . . . . . -37
- McMurray . . . . . -39

BRITISH COLUMBIA
- Kamloops . . . . . -10
- Prince George . . . . . -31
- Vancouver 19
- Victoria 23

MANITOBA
- Churchill . . . . . -39
- Dauphin . . . . . -26
- Winnipeg . . . . . -27

NEW BRUNSWICK
- Edmunston . . . . . -16
- Fredericton . . . . . -11
- Moncton . . . . . -7
- St. John . . . . . -8

NEWFOUNDLAND
- Gander . . . . . -1
- Goose Bay . . . . . -25
- St. Johns 7

NOVA SCOTIA
- Halifax 5
- Yarmouth 9

ONTARIO
- Hamilton 1
- Kenora . . . . . -28
- London 0
- Ottawa . . . . . -13
- Sault Ste Marie . . . . . -15
- Timmins . . . . . -28
- Toronto . . . . . -1

PRINCE EDWARD ISLAND
- Charlottetown . . . . . -4

QUEBEC
- Montreal . . . . . -10
- Quebec . . . . . -12
- Sept Illes . . . . . -22
- Vald'Or . . . . . -27

SASKATCHEWAN
- Prince Albert . . . . . -35
- Regina . . . . . -29
- Saskatoon . . . . . -31

YUKON
- Whitehorse . . . . . -43

NOTE: These values are the 97½% figures recommended in energy conservation standards, like ASHRAE 90A-1980. Adjustments may be made to reflect local climates which differ from the tabulated temperatures, or local weather experience.

WEIL-McLAIN®

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