CROWN BOILER

DESIGNED TO LEAD

Mega-Stor™

Stainless Steel, Indirect Water Heaters

- INSTALLATION AND OPERATING INSTRUCTIONS
- ENGINEERING MANUAL
- MAINTENANCE
- PARTS

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I. PRODUCT DESCRIPTION

The Crown MS series indirect water heater is designed to generate domestic hot water in conjunction with a hot water boiler using forced boiler water circulation. This indirect water heater consists of a 430 Ti Stainless Steel tank in which a smooth 304 stainless steel coil is located. Boiler water is pumped through the coil and heats the water in the tank. This tank is not intended for use in pool heating applications or for heating any other fluid other than water. It is also not intended for use in gravity hot water heating systems.

IMPORTANT NOTE

Some localities require indirect water heaters having a relief valve capacity in excess of 200,000 BTU/hr to be constructed and stamped in accordance with ASME requirements. Check with the local authority having jurisdiction before installing an MS-79 or MS-119 with a boiler or boilers having a total gross output in excess of 200,000 BTU/hr.

II. SPECIFICATIONS

TABLE 1: PERFORMANCE SPECIFICATIONS

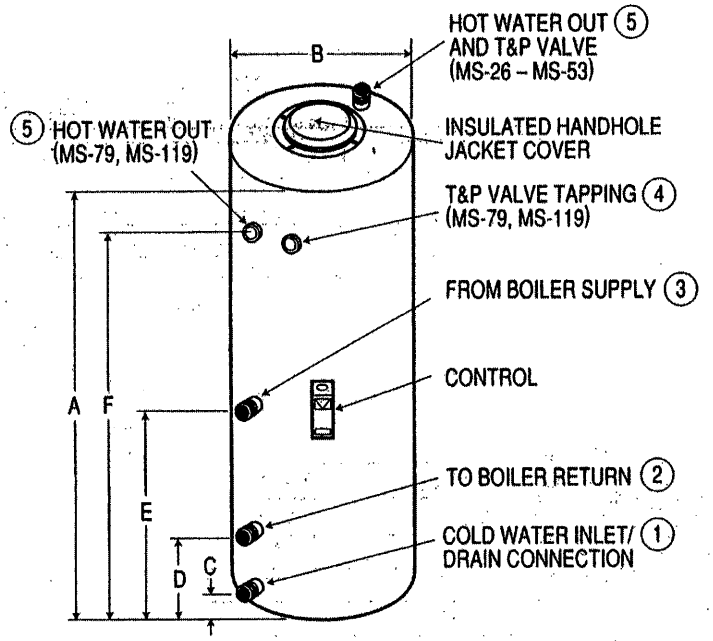
Model	First Hour Rating (Gal/hr) at:		Gross Boiler Output (BTU/hr)	Boiler Water Through Coil	
	140° F	115° F		Min Flow (Gal/min)	Head Loss (ft w.c.)
MS-26	142	197	110,000	8.0	2.5
MS-40	166	230	120,000	8.0	3.0
MS-40*	175	242	133,000	11.4	6.1
MS-53	224	259	146,500	8.0	4.5
MS-79	253	350	190,000	10.6	8.4
MS-119	350	409	386,000	15.4	11.6
MSH-40H	135	173	470,301	8.0	4.5

*Standard MS-40 with higher flow rate through coil and higher gross boiler output.
Conditions: 50°F domestic water in, 200°F boiler limit setting.

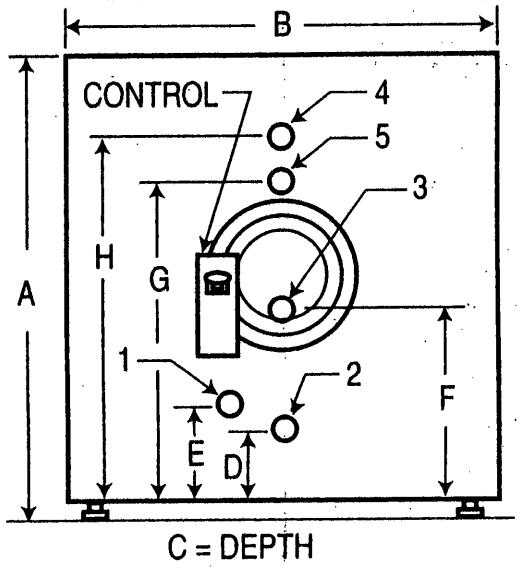
Pressure Ratings:

Maximum Allowable Tank Working Pressure - 150 psi
Design Hydrostatically Tested to 300 psi

FIG. 1: MEGA-STOR INDIRECT WATER HEATER



MS-26 - MS-119



MSH-40H

TABLE 3: PHYSICAL SPECIFICATIONS

Model	Volume (Gal.)	Dimensions in Inches								Coil Surface (Sq. Ft.)	Weight	
		A	B	C	D	E	F	G	H		Net	Full
MS-26	26.4	38 3/4	20-1/4	2.0	9-3/4	22-1/2	-	-	-	6.5	57	269
MS-40	39.6	54-3/4	20-1/4	2.0	9-3/4	25-3/4	-	-	-	8.6	77	396
MS-53	52.8	47-7/8	23 7/8	2.0	9-7/8	26-3/4	-	-	-	10.1	103	522
MS-79	79.3	69-1/4	23-3/4	1-5/8	10-1/4	29-1/4	59-1/4	-	-	15.1	204	831
MS-119	119.4	66	29-1/2	2-1/2	12-3/4	39-1/4	52-3/4	-	-	24.3	218	1178
MSH-40H*	37.6	24-3/8	23 7/8	34-11/16	3-5/8	5	10-1/8	16-7/8	19-3/8	6.7	127	449

*MSH-40H Horizontal Tank

TABLE 4: CONNECTIONS

Key #	Description	Size (NPT)			
		MS-26 - MS-53	MSH-40H	MS-79	MS-119
1	Cold Water Inlet	3/4M	3/4M	1M	1-1/4M
2	To Boiler Return	3/4M	3/4M	3/4M	1-1/4M
3	From Boiler Supply	3/4M	3/4M	3/4M	1-1/4M
4	T&P Valve Tapping	-	3/4F	1F	1F
5	Hot Water Out	3/4M	3/4M	1F	1-1/4F

III. DESIGNING A MEGA-STOR SYSTEM

IMPORTANT

The following procedures are used to size indirect water heaters based on the amount of hot water which will be required during a given hour. In doing so it is assumed that this demand will be evenly spread out over the course of the entire hour.

THESE SIZING PROCEDURES ARE PROVIDED AS A GUIDE TO ASSIST THE PROFESSIONAL CONTRACTOR IN SIZING MEGA-STOR TANKS. BECAUSE OF THE LARGE VARIETY OF DEMAND SITUATIONS ENCOUNTERED IN THE FIELD, CROWN BOILER CANNOT GUARANTEE THE SUITABILITY OF THESE PROCEDURES TO ALL INSTALLATIONS.

Three steps must be taken to properly design a Crown Mega-Stor system:

1) Determine the domestic hot water requirements
2) Select a Mega-stor/boiler combination
3) Select a pump, zone piping size, and control system to provide adequate and timely boiler water flow through the Mega-stor coil.

This manual presents three methods of sizing Mega-Stors:

Method A: "Quick" Residential
Method B: "Detailed" Residential
Method C: Commercial

NOTE: For whirlpool (Jacuzzi) sizing see Appendix A

Method A: "Quick" Residential

Table 5 shows some typical applications into which most single residence applications can be classified. This procedure will provide satisfactory results most of the time. Where greater accuracy is desired, use Method B.

1) Find the description that best fits the job and select the Mega-stor called for. Also note the required boiler output under column (f).

2) The Mega-Stor must be installed with a boiler having a Gross Output (DOE heating Capacity) GREATER THAN OR EQUAL to that shown in column (f) of Table 5. If the Mega-Stor is to be used with a boiler having a Gross Output LESS than that shown in Table 5, use Method B.

   * If a boiler is to be installed with the Mega-Stor, first find a boiler which will handle the space heating load alone. If this boiler has a DOE Heating Capacity GREATER than that shown in column (f) of Table 5, do not add anything to the boiler selected for the Mega-Stor.

   * If the boiler required for space heating alone has a DOE Heating Capacity LESS than that called for in column (f) of Table 5, increase the size of the boiler selected to one with a DOE Heating Capacity equal to that shown in column (f).

3) If a "yes" appears in column in column (g), consider prioritizing the Mega-Stor zone. See page 20 for circulator sizing and other information on designing a Mega-Stor zone system.

TABLE 5:
MEGA-STOR "QUICK" SIZING TABLE

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
Description	Occupants	Baths	Dishwasher	Clothes Washer	Mega-stor	Gross Boiler Output	Consider Prioritizing Zone?
Efficiency Apt.	1	1	No	No	MS-26	50,000	Yes
Small Office	<10	1/2-1*	No	No	MS-26	30,000	No
Apartment	1/2	1-1 1/2	No	Yes	MS-26	80,000	Yes
House	1-3	1-1 1/2	Yes	Yes	MS-40	80,000	No
House	3-5	2-2 ½	Yes	Yes	MS-40	120,000	Yes

* No showers.

Method B: "Detailed" Residential

1) Record the total number of each type of fixture in column (c) of Worksheet 1.

   * If a shower head is installed over a bathtub, count both the bathtub and shower head even though only one fixture will be used at a time.

   * If a whirlpool (Jacuzzi) is on the job, record all fixtures EXCEPT the whirlpool faucet.

2) For each line multiply the quantity entered in column (c) by the corresponding number in column (b). Enter the result in column (d).

3) Total column (d). This is the PEAK HOUR DEMAND.

4) Multiply the Peak Hour Demand by 1.20. This is the ADJUSTED PEAK HOUR DEMAND.

5) Select the Mega-stor:

   a) If a boiler is to be installed with the Mega-Stor:

   * Go to Table 1 and select a Mega-Stor which has a 140F First Hour Rating greater than or equal to the Adjusted Probable Maximum Demand calculated above.

   * Use the appropriate graph in Figure 4 (page 16-18) to determine the Gross Output (DOE Heating Capacity) needed to generate the required First Hour Rating.

   * Determine the boiler required to satisfy the space heating requirement alone. Note the Gross Output of this boiler.

   * Install the Mega-Stor with a boiler having the larger of the above two Gross Outputs.

   b) If the Mega-Stor is to be installed with an existing boiler:

   * Go to Table 1 and select a Mega-Stor which has a 140F First Hour Rating greater than or equal to the Adjusted Probable Maximum Demand calculated above.

   * Use the appropriate graph in Figure 4 (page 16-18) to find the First Hour Rating that can be expected with the boiler on the job.

   * If this First Hour Rating is unacceptable, the boiler on the job is too small.

6) If a whirlpool is on the job, see Appendix A.

7) See page 20 for circulator sizing and other information on designing the Mega-Stor zone system.

WORKSHEET 1: SINGLE FAMILY RESIDENCE

(a)	(b)		(c)		(d)
DESCRIPTION Shower:	140F WATER PER FIXTURE (Gal)		TOTAL NUMBER FIXTURES		TOTAL (Gal)
(3 GPM Head)	21.0	X	_____	=	_____
(5 GPM Head)	35.0	X	_____	=	_____
(7 GPM Head)	49.0	X	_____	=	_____
Bath (30 Gal. Tub)	21.0	X	_____	=	_____
Vanity	2.8	X	_____	=	_____
Clothes Washer	48.0	X	_____	=	_____
Dishwasher	15.0	X	_____	=	_____
Kitchen Sink or Utility Tub	10.0	X	_____	=	_____

Peak Hour Demand = Total Column (d) = _____

Peak Hour Demand x 1.20 = Adjusted Peak Hour Demand = _____

1) Boiler Gross Output Required For Mega-Stor = _____ BTU/hr

2) Boiler Gross Output Required for Space Heating = _____ BTU/hr

Select a boiler with a Gross Output equal to (1) or (2), whichever is GREATER

Note: This Worksheet is based on the following assumptions:

a) 10 minute shower use per shower head per hour.
b) All other fixtures are used once during the hour.

Example 1: A Mega-Stor is to be installed with a new Crown BWF series boiler. The residence has the following fixtures

Bath #1:	Bath #2
3 GPM Shower Head	Vanity
30 Gal Bathtub	
Vanity	

Kitchen:	Laundry:
Kitchen Sink	Clothes Washer
Automatic Dishwasher	

The heat loss of the house is 80,000 BTU/hr

Solution: The completed Worksheet 1 for this example is shown in Figure 2. The Adjusted Peak Hour Demand is 145 Gallons per Hour. From Table 1 we see that a MS-40 is required.

Use Figure 4c to determine the boiler size required to achieve a 145 GPH First Hour Rating with an MS-40. In this example we will assume that we are going to use the MS-40 rating which is based upon 8 GPM through the coil. From Figure 4c we see that a Gross Boiler Output of approximately 105,000 BTU/hr is required to generate 145 GPH First Hour Rating.

Select a BWF 128 which has a DOE heating capacity of 106,000 BTU/hr.

Example 3 (page 22) shows the correct method for sizing piping and a circulator for this installation.

EXAMPLE 1: USE OF FIGURE 4 GRAPHS

FIG 4c: MS-40 FIRST HOUR RATING AT 8.0 AND 11.4 GPM THROUGH COIL AT DIFFERENT GROSS OUTPUTS

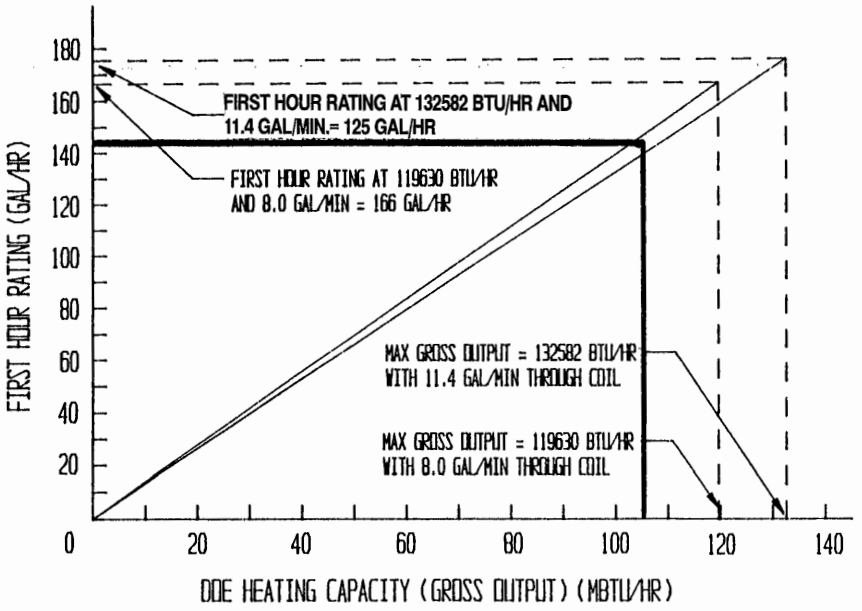


Figure 2:
Use of Worksheet 1

WORKSHEET 1: SINGLE FAMILY RESIDENCE

(a)	(b)		(c)		(d)
DESCRIPTION Shower:	140F WATER PER FIXTURE (Gal)		TOTAL NUMBER FIXTURES		TOTAL (Gal)
(3 GPM Head)	21.0	X	1	=	21.0
(5 GPM Head)	35.0	X		=	
(7 GPM Head)	49.0	X		=	
Bath (30 Gal. Tub)	21.0	X	1	=	21.0
Vanity	2.8	X	2	=	5.6
Clothes Washer	48.0	X	1	=	48.0
Dishwasher	15.0	X	1	=	15.0
Kitchen Sink or Utility Tub	10.0	X	1	=	10.0

Peak Hour Demand = Total Column (d) = 120.6

Peak Hour Demand x 1.20 = Adjusted Peak Hour Demand = 144.7

1) Boiler Gross Output Required For Mega-Stor = 110,000 BTU/hr

2) Boiler Gross Output Required for Space Heating = 80,000 BTU/hr

Select a boiler with a Gross Output equal to (1) or (2), whichever is GREATER

Note: This Worksheet is based on the following assumptions:
a) 10 minute shower use per shower head per hour.
b) All other fixtures are used once during the hour.

Method C: COMMERCIAL

IMPORTANT

Do not attempt to use Method C to size a Mega-Stor for a single family residence.

1) Tables 6 and 7 show demands for various fixtures found in commercial buildings in gallons per hour. To determine the hot water requirements of the building:

   a) Using Worksheet 2, determine and record the total number of each type of fixture in the building under Column (2).

   b) Use Tables 6 and 7 to find the number of gallons of 140F water used per hour per fixture. Record this value for each fixture in column (1).

   c) Multiply each line in column (1) by the number in column (2). The result is the total amount of water used for each type of fixture type per hour. Record this in column (3).

   d) Total column (3). The result is the total amount of water used by all fixtures per hour. This is the POSSIBLE MAXIMUM DEMAND.

   e) The demand factor shown in line 12 of Table 6 is intended to take into consideration the fact that not all fixtures will be in use at the same time. Multiply the total demand calculated in step (d) by this factor. The result is the PROBABLE MAXIMUM DEMAND.

   f) If a commercial dishwasher or laundry is on the job, determine the maximum amount of 140F water which could be used in an hour. This will depend upon the number of machines, the amount of water used per machine, and the way in which the equipment is to be used. Consult the machine manufacturer and the building owner for this information. Once the maximum hourly usage is known for this equipment, enter it in the spaces provided under Column (3).

   g) Add the hourly usage for dishwashers and washing machines to the Probable Maximum Demand. This is the ADJUSTED PROBABLE MAXIMUM DEMAND.

2) Select the Mega-Stor:

   a) If a boiler is to be installed with the Mega-Stor:
   * Go to Table 1 and select a Mega-Stor which has a 140F First Hour Rating greater than or equal to the Adjusted Probable Maximum Demand calculated in (1g).
   * Use the appropriate graph in Figure 4 (page 16-18) to determine the Gross Output (DOE Heating Capacity) needed to generate the required First Hour Rating.
   * Determine the boiler required to satisfy the space heating requirement alone. Note the Gross Output of this boiler.
   * Install the Mega-Stor with a boiler having the larger of the above two Gross Outputs.

   b) If the Mega-Stor is to be installed with an existing boiler:
   * Go to Table 1 and select a Mega-Stor which has a 140F First Hour Rating greater than or equal to the Adjusted Probable Maximum Demand calculated in (1g).
   * Use the appropriate graph in Figure 4 (page 16-18) to find the First Hour Rating that can be expected with the boiler on the job.
   * If this First Hour Rating is unacceptable, the boiler on the job is too small.

3) Several Mega-Stors may be used together to provide a greater first hour rating than the largest available single tank if needed. If this must be done keep the following in mind:

   * The first hour ratings of several Mega-Stors may be added together to give a first hour rating for the total system.

   * The gross boiler outputs for each individual Mega-Stor must be totaled to provide the gross boiler output required for the system.

   * The boiler water flow rate on which each indi vidual Mega-Stor's First Hour Rating is based must be developed through the coil of each tank.

   * Use Mega-Stors of equal size (do not mix tanks of different sizes on the same manifold).

   * See the "Piping" and "Wiring" sections of this manual for proper installation of a manifold system.

FIGURE 3:

WORKSHEET 2: COMMERCIAL TANK SIZING

Description	(1) 140F Water Gal/hr-fixture		(2) Number Fixtures		(3) Fixture Total Gal/hr.
Basins, Private Lavatory	_____	x	_____	=	_____
Basins, Public Lavatory	_____	x	_____	=	_____
Bathtubs	_____	x	_____	=	_____
Showers	_____	x	_____	=	_____
Circular Wash Sinks	_____	x	_____	=	_____
Semi Circular Wash Sinks	_____	x	_____	=	_____
Foot Basins	_____	x	_____	=	_____
Laundry, Stationary Tubs	_____	x	_____	=	_____
Kitchen Sink	_____	x	_____	=	_____
Dishwasher in Apartment	**15.0**	x	_____	=	_____
Clothes Washer in Apartment	**48.0**	x	_____	=	_____
Commercial Kitchen Fixtures:					
Vegetable Sink	**45**	x	_____	=	_____
Single Pot Sink	**30**	x	_____	=	_____
Double Pot Sink	**60**	x	_____	=	_____
Triple Pot Sink	**90**	x	_____	=	_____
Prescrapper (Open Type)	**180**	x	_____	=	_____
Preflush (Hand Operated)	**45**	x	_____	=	_____
Preflush (Closed Type)	**240**	x	_____	=	_____
Recirculating preflush	**40**	x	_____	=	_____
Bar Sink	**30**	x	_____	=	_____

Total Column (3) Possible Maximum Demand	=	_____
Demand Factor	=	x _____
Probable Maximum Demand	=	_____
Hourly Dishwasher Requirement	=	+ _____
Hourly Laundry Requirement	=	+ _____
Adjusted Probable Maximum Demand	=	_____

4) Before settling on the choice of Mega-stor made above, keep in mind the following:

* Many building's peak demands result from the constant use of one type of fixture or machine for a relatively short period of time (showers in a gymnasium, for example). The procedure outlined above may not provide adequate hot water in these cases. The best way to size Mega-stors for this type of application is to determine the total flow rate of all fixtures which are, or could be, in use at once and select a Mega-stor from Table 8 which will provide hot water at this flow rate for the period of time required.

* Crown does not recommend the use of a Mega-Stor tank to generate 180F water for commercial dish washers. Use the Mega-Stor to generate 140F water and a preheater to boost the water for the dish washer to 180F.

Example 2 (Commercial): An MS tank is to be sized for a motel with 20 rooms. Each of these rooms has the following Fixtures:

(1) Vanity
(1) Shower
(1) Bath

In addition, 5 rooms have an additional vanity. Also there is utility sink used by the staff for cleaning and a laundry with two machines.

Solution: Use Table 6 and the fixture count to complete worksheet 2 (Fig. 3). Note that we treated the vanities as "Private Lavatory Basins" and the utility tub as a "Laundry Tub". From discussions with the washing machine manufacturer and the motel owner, we find that 100 Gal/hr of 140F water is used in the Laundry. This usage is recorded on the "Laundry Line" at the bottom of Worksheet 2. The demand factor of 0.25 for a Hotel is on line 12 of Table 6. The Probable Maximum Demand is 0.25 x 1978 = 494.5 Gal/hr. To this we add the 100 Gal/hr laundry usage for an Adjusted Probable Maximum Demand of 594.5 Gal/hr.

Select the most cost effective combination of equal size Mega-stors which will satisfy this requirement. The total gross boiler output required is equal to the requirement for each Mega-stor multiplied by the total number of Mega-stors. Likewise, their total boiler water flow through the Mega-stor zone is equal to the requirement for each Mega-stor times the total number of Mega-stors.

FIGURE 3: COMMERCIAL SIZING EXAMPLE

WORKSHEET 2: COMMERCIAL TANK SIZING

Description	(1) 140F Water Gal/hr-fixture		(2) Number Fixtures		(3) Fixture Total Gal/hr.
Basins, Private Lavatory	2	x	25	=	50
Basins, Public Lavatory		x		=	
Bathtubs	20	x	20	=	400
Showers	75	x	20	=	1500
Circular Wash Sinks		x		=	
Semi Circular Wash Sinks		x		=	
Foot Basins		x		=	
Laundry, Stationary Tubs	28	x	1	=	28
Kitchen Sink		x		=	
Dishwasher in Apartment	150	x		=	
Clothes Washer in Apartment	480	x		=	
Commercial Kitchen Fixtures:					
Vegetable Sink	45	x		=	
Single Pot Sink	30	x		=	
Double Pot Sink	60	x		=	
Triple Pot Sink	90	x		=	
Prescrapper (Open Type)	180	x		=	
Preflush (Hand Operated)	45	x		=	
Preflush (Closed Type)	240	x		=	
Recirculating preflush	40	x		=	
Bar Sink	30	x		=	

Total Column (3) Possible Maximum Demand	=	1978
Demand Factor	=	x 0.25
Probable Maximum Demand	=	494.5
Hourly Dishwasher Requirement	=	+
Hourly Laundry Requirement	=	+ 100.0
Adjusted Probable Maximum Demand	=	594.5

TABLE 6: HOT WATER DEMAND FOR VARIOUS TYPES OF BUILDINGS

(Gallons per Hour per Fixture Calculated at a Final Temperature of 140F)

Fixture	Apartment House	Club	Gymnasium	Hotel	Industrial Plant	Office Building	School
1. Basins, Private Lavatory	2	2	2	2	2	2	2
2. Basins, Public Lavatory	4	6	8	8	12	6	15
3. Bathtubs	20	20	30	20	-	-	-
4. Foot Basins	3	3	12	3	12	-	3
5. Kitchen Sink	10	20	-	30	20	20	20
6. Laundry Tubs	20	28	-	28	-	-	-
7. Pantry Sink	5	10	-	10	-	10	10
8. Showers	30	150	225	75	225	30	225
9. Service Sink	20	20	-	30	20	20	20
10. Circular Wash Sinks	-	-	-	20	30	20	30
11. Semicircular Wash Sinks	-	-	-	10	15	10	15
12. Demand Factor	0.30	0.30	0.40	0.25	0.40	0.30	0.40

Adapted with permission from ASHRAE 1984 Systems Handbook

TABLE 7:

GENERAL PURPOSE HOT WATER (140F) REQUIREMENTS FOR VARIOUS KITCHEN USES (a,b)

Equipment	GPH
Vegetable Sink	45
Single Pot Sink	30
Double Pot Sink	60
Triple Pot Sink	90
Prescrapper (Open Type)	180
Preflush (Hand Operated)	45
Preflush (Closed Type)	240
Recirculating Preflush	40
Bar Sink	30

a) Supply water pressure at equipment is assumed to be 20 psi
b) Dishwasher operation at 100% of mechanical capacity

Adapted with permission from ASHRAE 1984 Systems Handbook

FIG 4b: MS-26 FIRST HOUR RATING AT DIFFERENT GROSS BOILER OUTPUTS

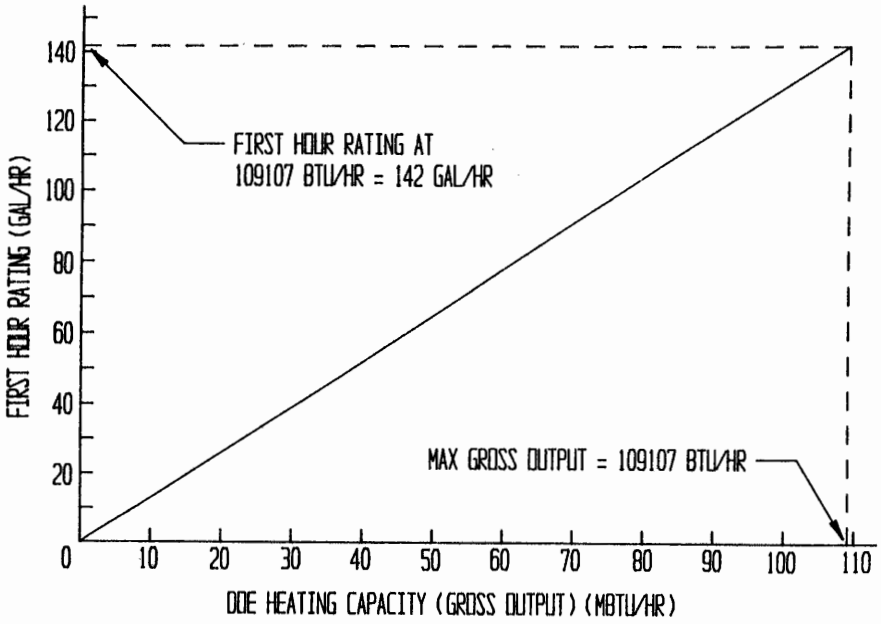


FIG 4c: MS-40 FIRST HOUR RATING AT 8.0 AND 11.4 GPM THROUGH COIL AT DIFFERENT GROSS OUTPUTS

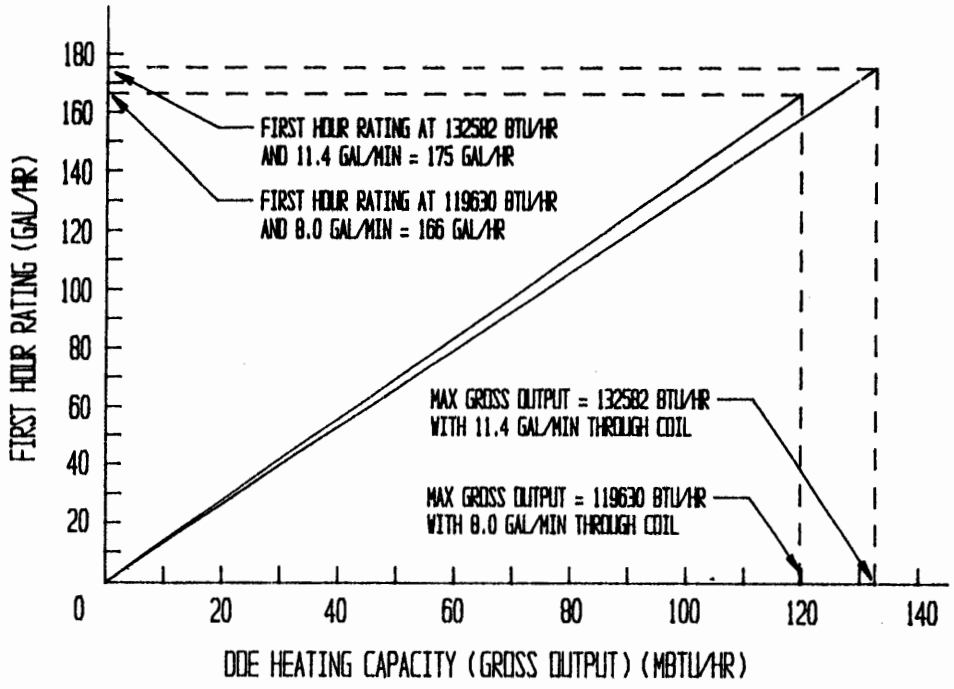


FIG. 4d MSH-40H FIRST HOUR RATING
AT DIFFERENT OUTPUTS

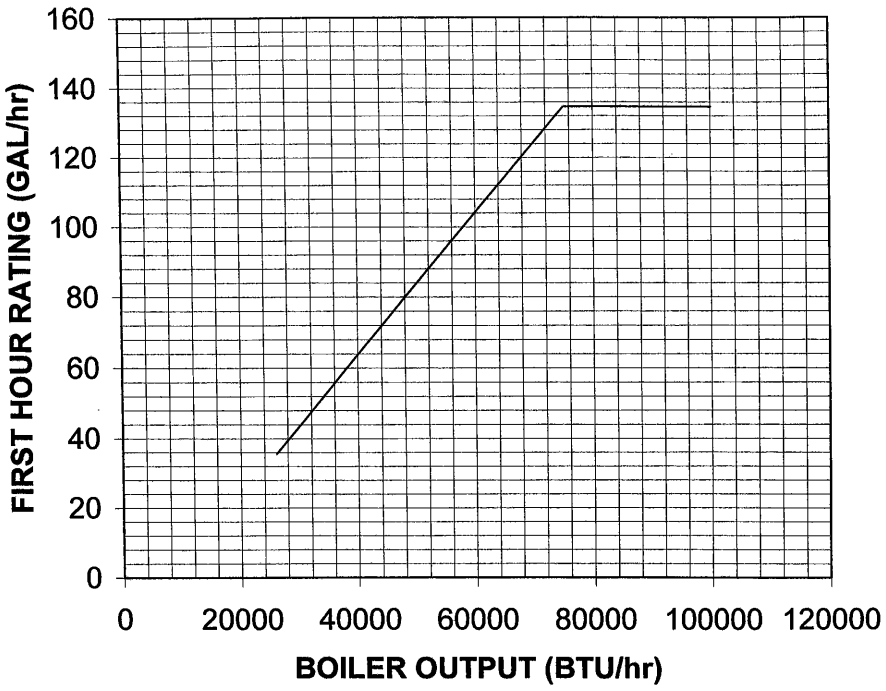


FIG. 4e: MS-53 FIRST HOUR RATING
AT DIFFERENT OUTPUTS

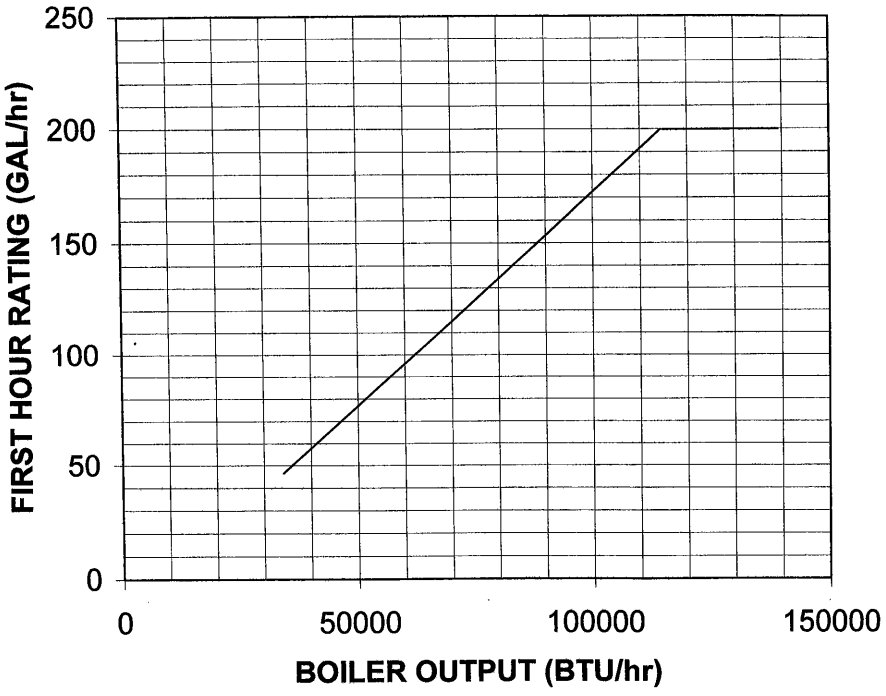


FIG. 4f: MS-79 FIRST HOUR RATINGS AT DIFFERENT GROSS BOILER OUTPUTS

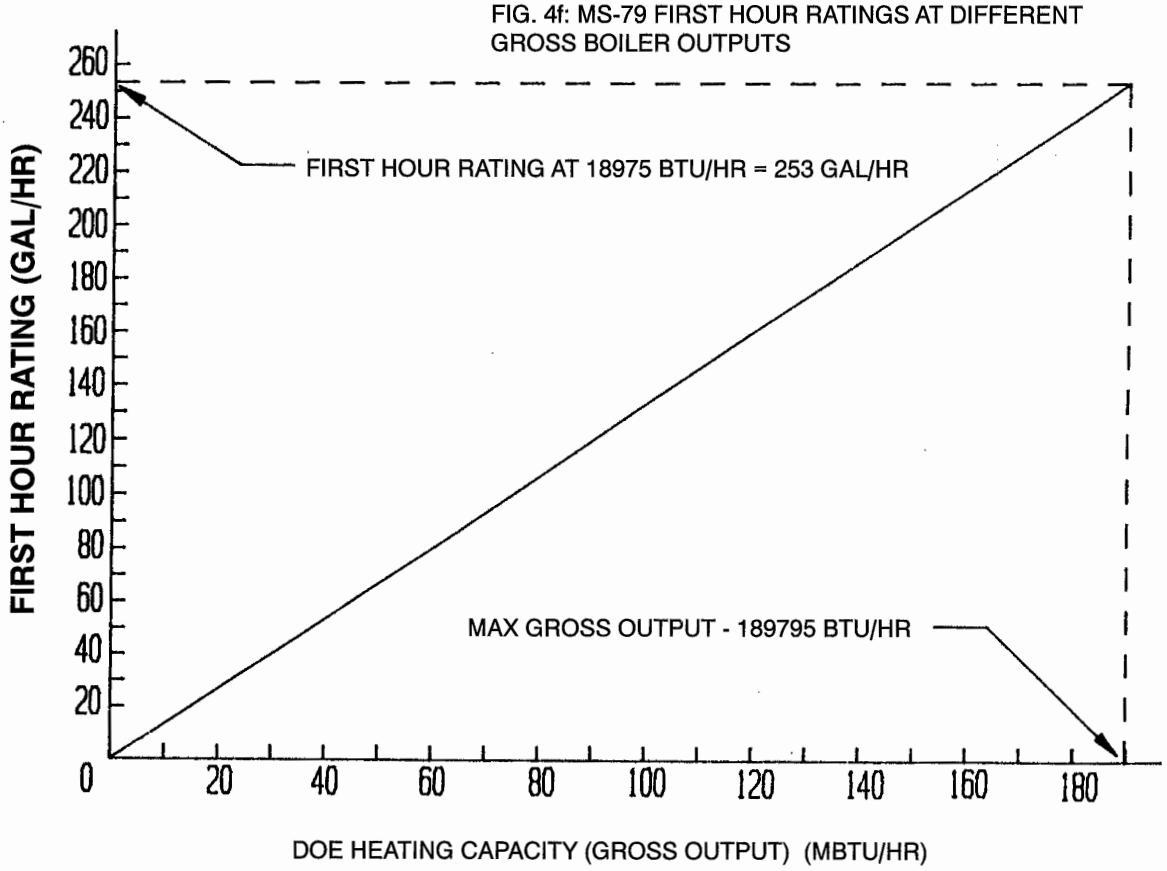


FIG. 4g: MS-119 FIRST HOUR RATINGS AT DIFFERENT GROSS BOILER OUTPUTS

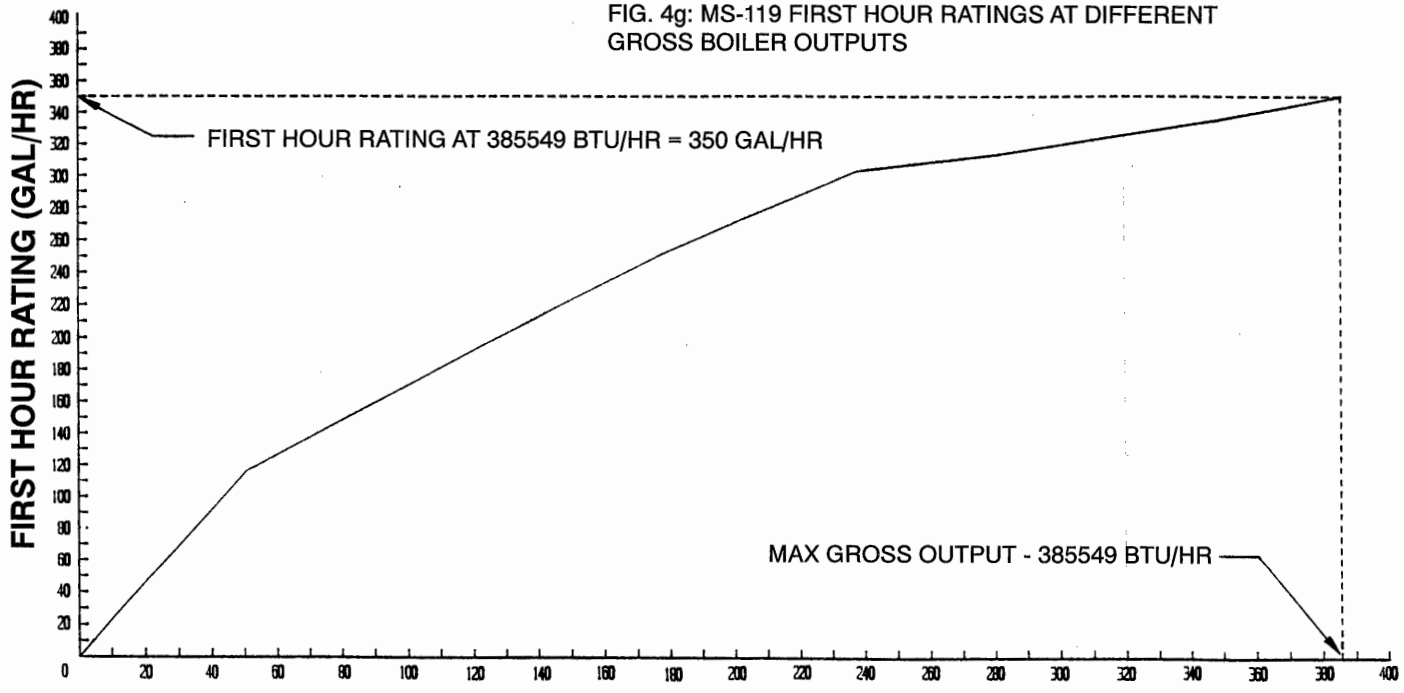


TABLE 8: 140F WATER AVAILABLE AT HIGH FLOW RATES STARTING WITH A FULLY RECOVERED TANK

Model	Draw Rate (GPM) 3.0	5.0	7.5	9.0	12.0	15.0	Boiler Output (BTU/hr)	Flow Rate Through Coil (GPM)
MS-26								
Time (min.)	6.4	3.3	1.8	1.5	-	-	110,000	8.0
Gallons	19.2	16.5	13.5	13.5	-	-		
MS-40								
Time (min.)	15.1	7.2	3.3	2.6	-	-	133,000	11.4
Gallons	45.3	36.2	24.8	23.4	-	-		
MS-53								
Time (min.)	∞	8.8	5.4	4.2			146,500	8.0
Gallons		44.1	41.1	37.5				
MS-79								
Time (min.)	∞	9.1	5.8	4.8	3.4	2.5	190,000	10.6
Gallons		45.5	43.3	42.9	40.5	38.2		
MS-119								
Time (min.)	∞	∞	11.0	8.8	6.1	4.5	386,000	15.4
Gallons			82.2	79.2	73.1	67.6		

"Time (min.)" — The time water may be drawn from a fully recovered tank before the outlet temperature falls 15 degrees.
"Gallons" — The total volume of water drawn from the tank during this time.

∞ — Draw may be made at this flow rate indefinitely with the outlet temperature falling less than 15 degrees from the outlet temperature at the beginning of the draw.

— — Untested at this flow rate.

All values shown are approximate.

Zone Design

IMPORTANT

All First Hour Ratings shown in this manual are based on the boiler water flow rates shown in Table 2. Read this section for information on sizing, piping and circulators for the Mega-Stor zone.

In designing the Mega-Stor zone piping system the following points should be considered:

1) Circulator or Zone Valve Zoning? - Circulator zones are usually a better choice. Zone valves have a relatively high pressure drop at the flow rate required through the MS coil (see Table 1).

   If zone valves are selected, use a zone valve with a minimal delay in opening, such as a motorized type.

2) Priority Zoning - Priority zoning is used to divert all boiler output to the Mega-Stor when its zone calls for heat regardless of any simultaneous calls for heat from space heating zones.

   Priority zoning can be done using a 3-way zone valve, or by using a relay to de-energize the heating zones when the Mega-Stor calls for heat.

See the Piping and Wiring Sections for more information on these zone systems.

3) Use Worksheet 3 to size piping and select a circulator for the Mega-stor zone. To do this:
   a) Use column (a) to enter the total number of each type of fitting. For straight pipe enter the total number of feet.
      When counting fittings, count all fittings in the Mega-stor zone as well as all fittings in the piping common to all zones (zone manifolds, etc.).
   b) Refer to Table 1 to find the required flow rate through the Mega-stor coil.
   c) Columns b, c, d, e, and f each show pressure drops for fittings at a given flow rate. Select the appropriate column for the required flow rate. Multiply the number of each type of fitting by the pressure drop in the column selected. Enter the result in column (g).
   d) Total column (g). This is the total pressure drop for the Mega-Stor zone.
   e) Use Table 9 or a circulator manufacturer's literature to select a circulator which will develop the required flow rate at the pressure drop calculated.

TABLE 9: SELECTING A CIRCULATOR

FLOW	Available Head (Ft. W.C.)				
15.4 GPM					
11.4 GPM					
10.9 GPM					
10.6 GPM					
8.0 GPM					
Circulator					
Taco 007	8.2	7.0	6.8	6.5	-
Taco 008	9.8	6.4	5.8	5.0	-
Taco 0011	22.8	20.3	19.8	19.1	14.6
Grundfos UPS 15-42F	11.0	8.5	8.0	7.5	-
Grundfos UP 26-64F	19.0	17.0	16.5	16.0	12.5
Grundfos UP 26-96F	22.0	19.5	19.0	18.5	14.0

Select a circulator which has an Available Head greater than the pressure drop calculated using Worksheet 3.

WORKSHEET 3: Pressure Drop Calculations Through Mega-Stor Zone

Flow	Head Loss (ft. w.c.)

15.4 GPM (ft w.c.)
11.4 GPM (ft w.c.)
10.6 GPM (ft w.c.)
8.0 GPM (ft w.c.)

Fitting Description	(a) Quantity	(b)	(c)	(e)	(f)	(g) Total
MS-26 Coil		2.5	-	-	-	
MS-40 Coil		3.0	-	6.1	-	
MS-53, MSH-40H Coil		4.5	-	-	-	
MS-79 Coil		-	8.4	-	-	
MS-119 Coil					11.6	
1 ft 1" St. Pipe	_____ft	0.05	0.09	0.11	0.20	
1 ft 1-1/4" St. Pipe	_____ft	0.06	0.03	0.03	0.05	
1 ft 1-1/2" St. Pipe	_____ft	0.01	0.01	0.02	0.04	
1" 90 EL	_____	0.16	0.27	0.32	0.58	
1-1/4" 90 El	_____	0.06	0.10	0.11	0.20	
1-1/2" 90 El	_____	0.04	0.06	0.07	0.13	
1" Run of Tee	_____	0.05	0.08	0.10	0.18	
1-1/4" Run of Tee	_____	0.02	0.03	0.04	0.07	
1-1/2" Run of Tee	_____	0.01	0.02	0.02	0.04	
1" Branch in Tee	_____	0.26	0.46	0.53	0.97	
1-1/4" Branch in Tee	_____	0.08	0.15	0.17	0.31	
1-1/2" Branch in Tee	_____	0.05	0.08	0.10	0.18	
1" Std. Ball Valve	_____	0.12	0.21	0.24	0.44	
1-1/4" Std. Ball Valve	_____	0.06	0.10	0.12	0.22	
1-1/2" Std. Ball Valve	_____	0.02	0.04	0.05	0.09	
Taco "Flo-Chek":						
#220 (1")	_____	2.18	3.82	4.45	8.12	
#221 (1-1/4")	_____	0.84	1.50	1.68	3.07	
#222 (1-1/2")	_____	0.44	0.76	0.88	1.61	
Taco Air Scoop						
#431 (1")	_____	0.15	0.26	0.30	0.55	
#432 (1-1/4")	_____	0.05	0.09	0.10	0.18	
Honeywell Zone Valves						
V8043F1101 (1" Cv=8)		2.31	4.06	4.69	8.56	
Flair Zone Valves:						
UB112738 (3-way Cv=7.1)		2.93	5.14	5.95	10.86	
Allowance for Bushings	_____					
and sudden transitions *	1	0.53	0.94	1.08	1.97	
Boiler **	_____					

Total Head Loss Through Manifold Piping and Mega-Stor Zone _____

* Includes (2) 1-1/2 x 3/4 and (2) 1-1/2 x 1 transitions.

** Pressure drop through boiler can be ignored for most cast iron or steel boilers. If in doubt, consult the boiler manufacturer.

Above pressure drops may be used for black pipe or copper tubing.

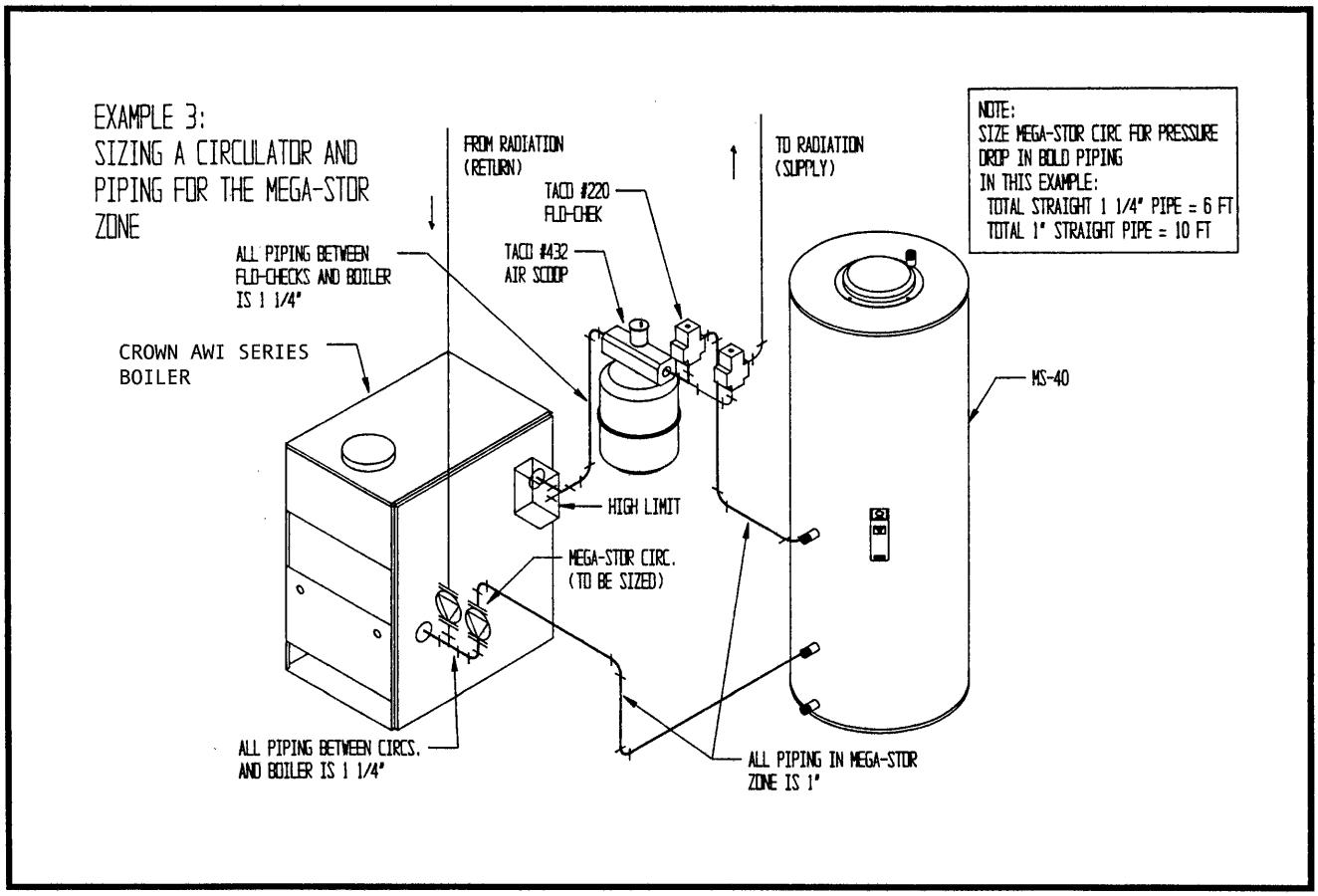
Example 3: Size a circulator for the Mega-Stor zone shown below. An MS-40 is to be used with an 8 GPM flow rate through the coil.

1) Using Worksheet 3, record the total number of fittings in Mega-Stor zone and piping common to all zones (piping shown in bold) in column (a).

2) Since 8 GPM is required, use the pressure drops shown in column (b). Multiply each entry in column (a) by the corresponding pressure drop in column (b). Enter the result in column (g).

3) The total of column (g) is 7.94 ft. of head. This is the total pressure drop for the Mega-Stor zone.

4) Select a pump which will develop 7.94 ft of Head at 8 GPM. From Table 9, we see that either a Taco 007 or a Grundfos UPS 15-42F can be used.



Worksheet 3: Completed Worksheet
Pressure Drop Calculations Through Mega-Stor Zone

Flow	Head Loss (ft. w.c.)
11.4 GPM (ft w.c.)	
10.6 GPM (ft w.c.)	
8.0 GPM (ft w.c.)	

Fitting Description	(a) Quantity	(b)	(c)	(e)	(f)	(g) Total
MS-26 Coil		2.5	-	-	-	
MS-40 Coil		3.0	-	6.1	-	3.0
MS-53, MSH-40H Gil		4.5	-	-	-	
MS-79 Coil		-	8.4	-	-	
MS-119 Coil						
1 ft 1" St. Pipe	10 ft	0.05	0.09	0.11		0.50
1 ft 1-1/4" St. Pipe	6 ft	0.06	0.03	0.03		0.36
1 ft 1-1/2" St. Pipe	ft	0.01	0.01	0.02		
1" 90 EL	6	0.16	0.27	0.32		0.96
1-1/4" 90 El	3	0.06	0.10	0.11		0.18
1-1/2" 90 El		0.04	0.06	0.07		
1" Run of Tee		0.05	0.08	0.10		
1-1/4" Run of Tee	1	0.02	0.03	0.04		0.02
1-1/2" Run of Tee		0.01	0.02	0.02		
1" Branch in Tee		0.26	0.46	0.53		
1-1/4" Branch in Tee	2	0.08	0.15	0.17		0.16
1-1/2" Branch in Tee		0.05	0.08	0.10		
1" Std. Ball Valve		0.12	0.21	0.24		
1-1/4" Std. Ball Valve		0.06	0.10	0.12		
1-1/2" Std. Ball Valve		0.02	0.04	0.05		
Taco "Flo-Chek":						
#220 (1")	1	2.18	3.82	4.45		2.18
#221 (1-1/4")		0.84	1.50	1.68		
#222 (1-1/2")		0.44	0.76	0.88		
Taco Air Scoop						
#431 (1")		0.15	0.26	0.30		
#432 (1-1/4")	1	0.05	0.09	0.10		0.05
Honeywell Zone Valves						
V8043F1101 (1" Cv=8)		2.31	4.06	4.69		
Flair Zone Valves:						
UB112738 (3-way Cv=7.1)		2.93	5.14	5.95		
Allowance for Bushings and sudden transitions *	1	0.53	0.94	1.08		0.53
Boiler **						0

Total Head Loss Through Manifold Piping and Mega-Stor Zone 7.94

* Includes (2) 1-1/2 x 3/4 and (2) 1-1/2 x 1 transitions.

** Pressure drop through boiler can be ignored for most cast iron or steel boilers. If in doubt, consult the boiler manufacturer.

Above pressure drops may be used for black pipe or copper tubing.

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IV. BEFORE STARTING INSTALLATION

1) Be sure that the planned installation is in accordance with all local codes.

2) Be certain the domestic water supply to the tank has physical and chemical characteristics that fall within the limits shown in Table 10. Where questions exist as to the composition of the water on the job, a qualified water treatment expert should be consulted.

IMPORTANT
Water with characteristics outside the limits shown in Table 10 may severely shorten the life of the tank due to corrosion. Damage to tanks in such cases is not covered under warranty

3) Read and understand all installation requirements in this manual.

TABLE 10: WATER CHEMISTRY REQUIREMENTS

Water used in the Mega-Stor must have characteristics falling within the following limits:

Characteristic	Min	Max
PH	6.0	8.0
Chloride (PPM)	0.0	80.0

V. LOCATING THE MEGA-STOR

1) Table 3 shows the weights of all Mega-Stors filled with water. Make sure that the location chosen for the Mega-Stor is capable of supporting it.

WARNING
Failure to properly support an MS tank could result in property damage or personal injury.

2) Locate the Mega-Stor in a location where a leak in the tank, the adjacent piping, or an open T&P valve will not damage the surrounding structure. If the area around the desired tank location is highly susceptible to water damage, install the Mega-Stor in a pan with a drain.

3) The Mega-Stor may be located some distance from the boiler provided the zone system is designed to provide the flow called for in Table 1 through the coil. Also, the further the Mega-Stor is from the boiler, the longer the response of the boiler will be to a call from the Mega-Stor zone. If long runs exist between the boiler and Mega-Stor it is advisable to insulate the piping.

VI. PIPING

1) BOILER SIDE PIPING

Figures 7-11 show typical boiler side piping for several common situations. Regardless of which system is used it is imperative that the flow rates called for in Table 1 are developed through the coil. This requires properly sized piping and a properly sized pump. To determine the pipe/ pump sizes required see page 20.

The systems shown in Figures 7-11 are described below:

STANDARD CIRCULATOR ZONE

This system is just like the circ zone system on a straight heat job except that one of the zones goes to the MS tank instead of radiation. As on any circulator zone system control valves should be installed in each zone to prevent unwanted circulation through zones which are not calling for heat. Figure 7 illustrates typical circ zone piping.

ZONE VALVE SYSTEM

As with the circ zone system, this system is just like a standard heating zone system except that one of the zones is connected to the tank coil. The circulator must be large enough to move boiler water through the coil at the flow rate in Table 1, regardless of the flow rate required through the heating zones.

Figure 8 illustrates typical zone valve system.

3-WAY ZONE VALVE SYSTEM

This system offers a fairly simple method of prioritizing the tank (Diverting all boiler output to the tank when the tank thermostat calls for heat). In this system a 3-way zone valve is used which has a common port, a "normally open" port, and a "normally closed" port. The zone valve motor is wired so as to be energized by the Mega-Stor thermostat (see Part IV for wiring information). The common side of the zone valve is connected to the boiler. The heating zone is connected to the normally open side of the zone valve and the Mega-Stor coil is connected to the normally closed side of the zone valve. As long as the Mega-Stor is not calling for heat, boiler water can flow from the space heating zone, through the normally open side of the 3-way valve, to the boiler. As soon as the Mega-Stor calls for heat, the zone valve is energized, and boiler water can only flow through the Mega-Stor zone.

Figure 9 illustrates typical piping using a 3-way zone valve.

RADIANT PANEL OR OTHER "LOW TEMPERATURE SYSTEM"

The First Hour Ratings published in this manual are based on a high limit setting of 200F. If, for what ever reason, the boiler water going to the heating system is held to levels much under 200F, special piping is needed to provide water to both the tank and the system at the proper temperatures. Two ways of doing this are with a heat exchanger or a 4-way valve.

In either system, the Mega-Stor must be connected to the boiler before any means used to control the temperature of the water going to the system. The temperature of the water going through the Mega-Stor coil is thus limited only by the boiler high limit setting which should be set at 200F.

Figure 10 illustrates the use of a heat exchanger to control the temperature of the water going to the "low temperature" system. This heat exchanger may be shell and tube, plate type, or a second Mega-Stor. The low temperature system water is completely isolated from the water passing through the boiler and Mega-Stor. For this reason the low temperature system must be equipped with its own expansion tank, fill, and air removal apparatus. The temperature in this system may be controlled through the use of an aquastat in the low temperature side.

Figure 11 illustrates the use of a 4-way valve to control maximum heating zone temperature while allowing 200F boiler water to enter the tank zone. The four way valve may be manually set to provide the maximum allowable temperature to the heating zone or it may be provided with a motor to control the valve in response to some parameter (outdoor temperature for example).

MEGA-STOR MANIFOLD PIPING (BOILER SIDE)

Multiple tank installations must be done in the "reverse-return" manner illustrated in Figure 12. The reason for this is to create the same pressure drop (and therefore the same flow) through the coil of each tank. The boiler manifold piping must be sized so that each coil has the flow rate called for in Table 1. For example, if two MS-26's are to be manifolded together, the circulator and zone piping common to both tanks must be capable of moving 16 GPM (2 x 8GPM)

Because the pressure drop through Mega-Stor coils varies from size to size, it is hard to predict the flow rate that will be developed through each coil when two Mega-Stors of different sizes are placed in the same manifold. For this reason it is best not to mix Mega-Stors of two different sizes in the same zone if their recovery is critical.

FIG. 7: BOILER-SIDE PIPING USING CIRCULATOR ZONES
(SEE FIG. 13 - 16 FOR DOMESTIC WATER PIPING)

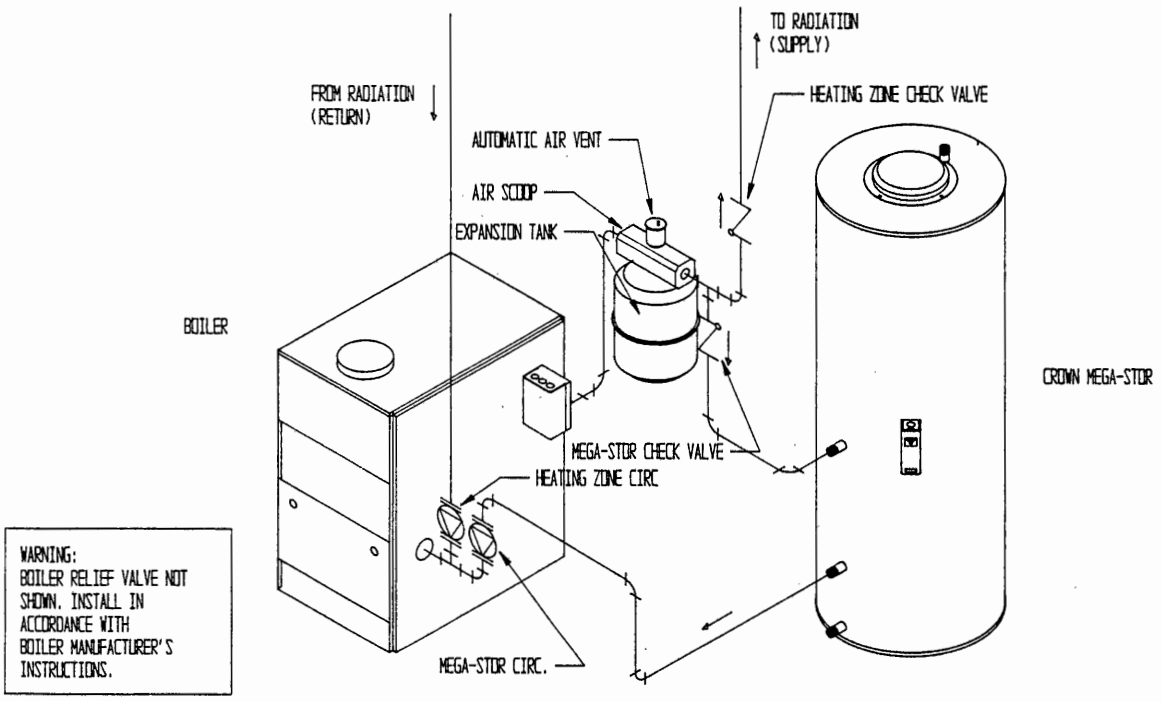


FIG. 8: BOILER-SIDE PIPING USING ZONE VALVES (2-WAY)
(SEE FIG. 13 - 16 FOR DOMESTIC WATER PIPING)

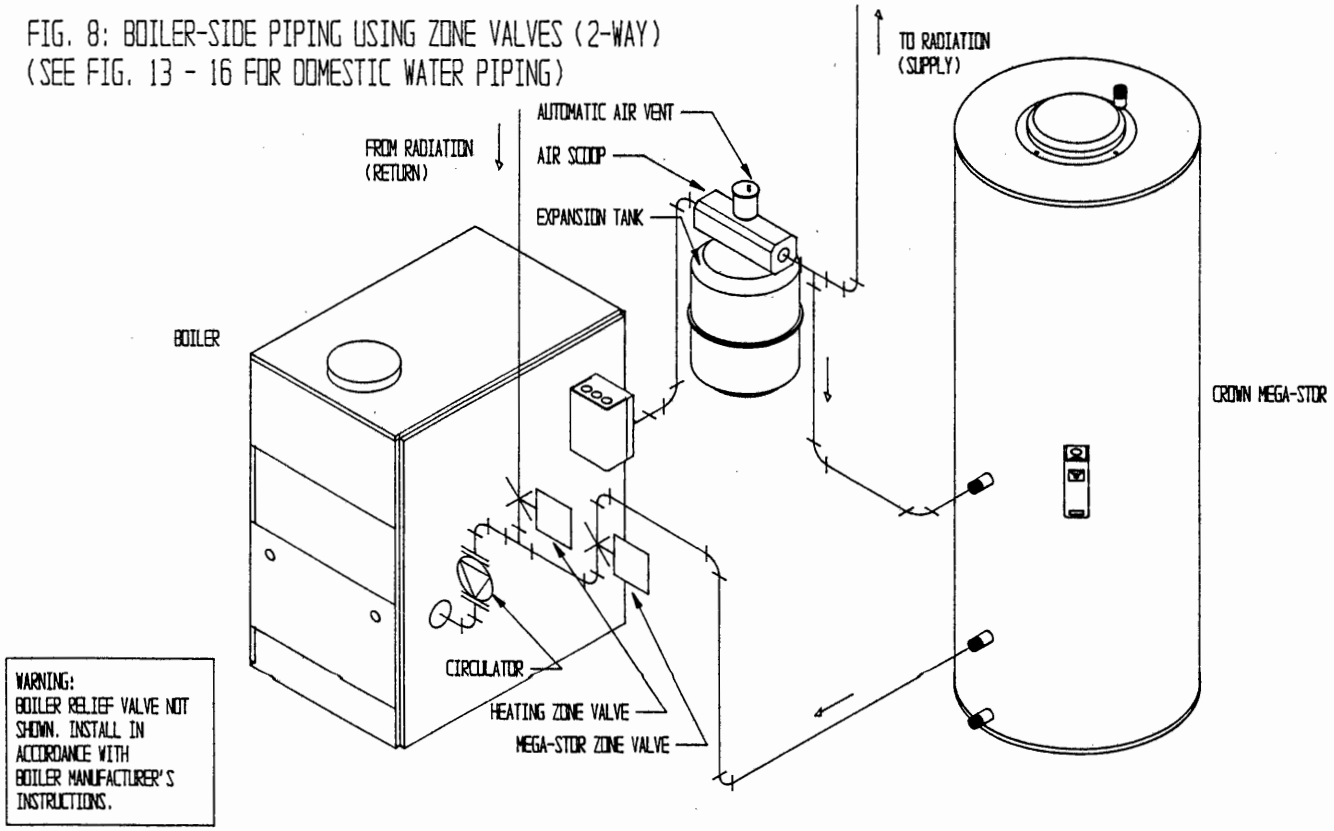


FIG. 9: BOILER-SIDE PIPING USING A THREE WAY ZONE VALVE
(SEE FIG. 13 - 16 FOR DOMESTIC WATER PIPING)

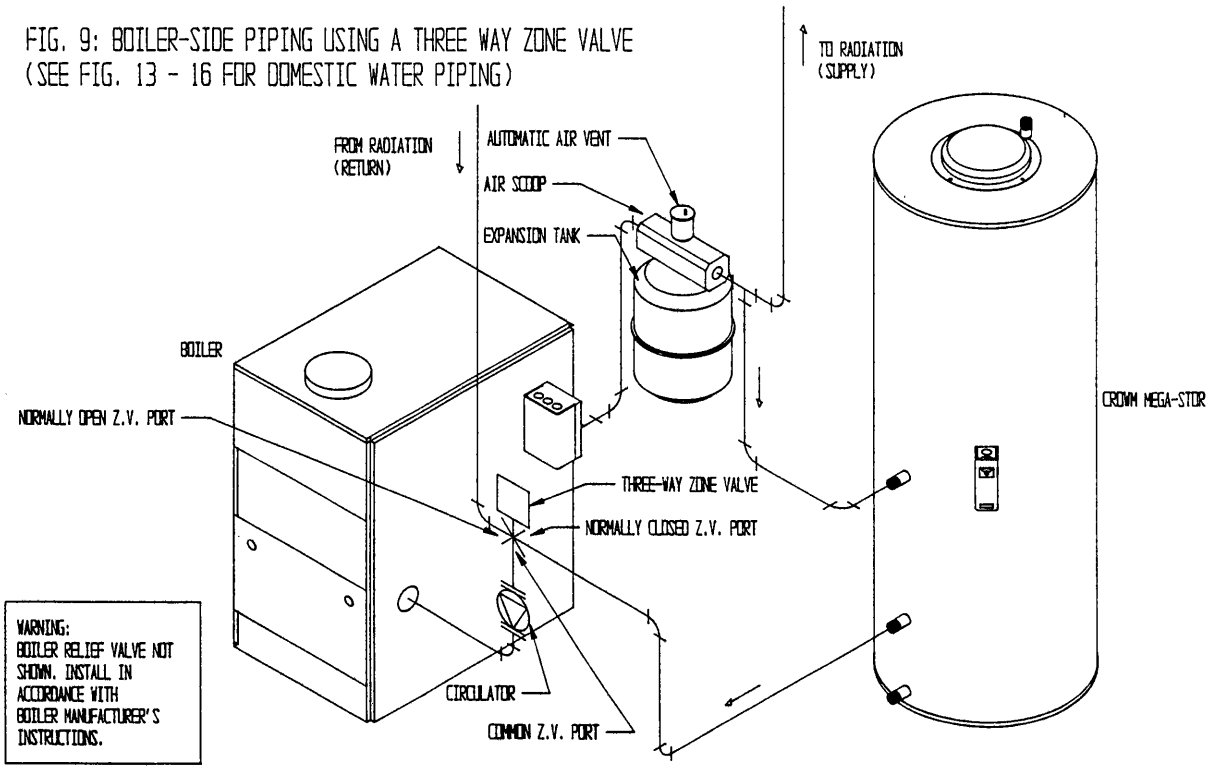


FIG. 10: BOILER SIDE PIPING
IN A RADIANT PANEL HEATING
SYSTEM USING A HEAT EXCHANGER
(SEE FIG. 13-16 FOR DOMESTIC
WATER PIPING)

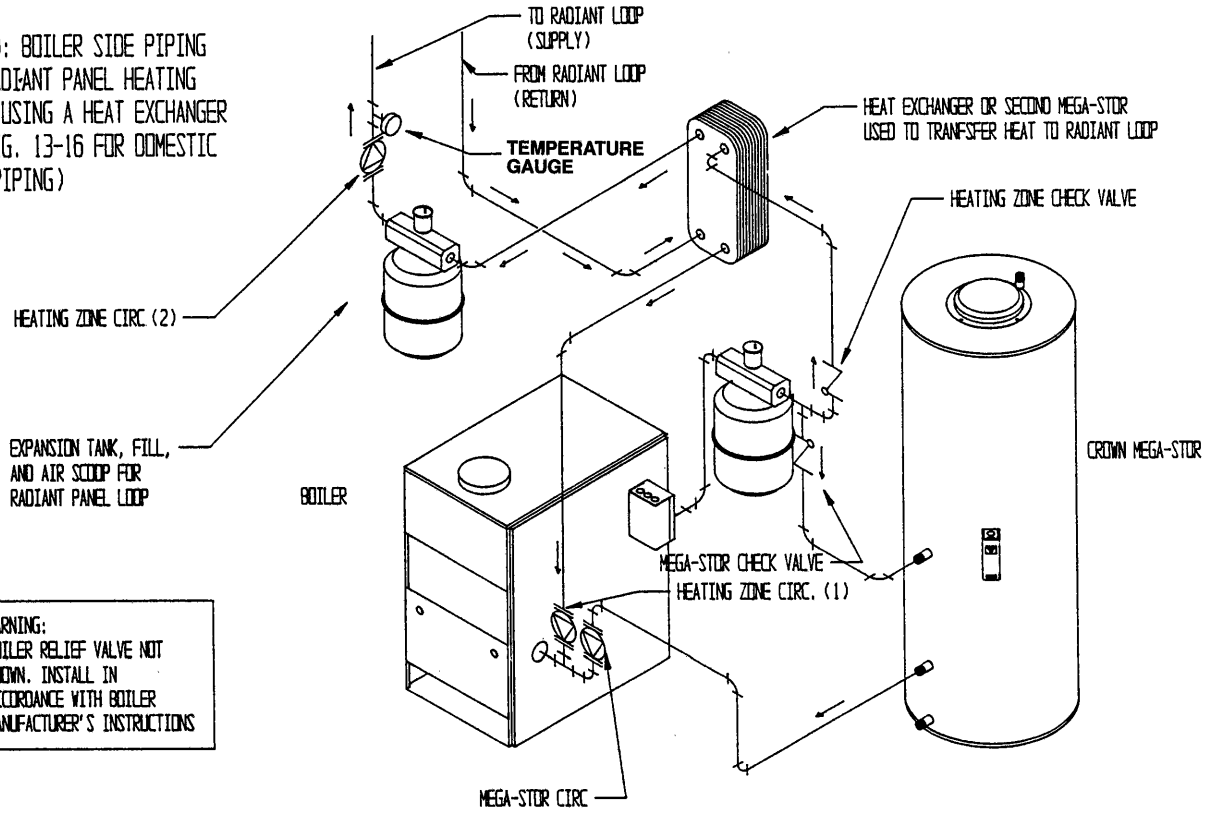
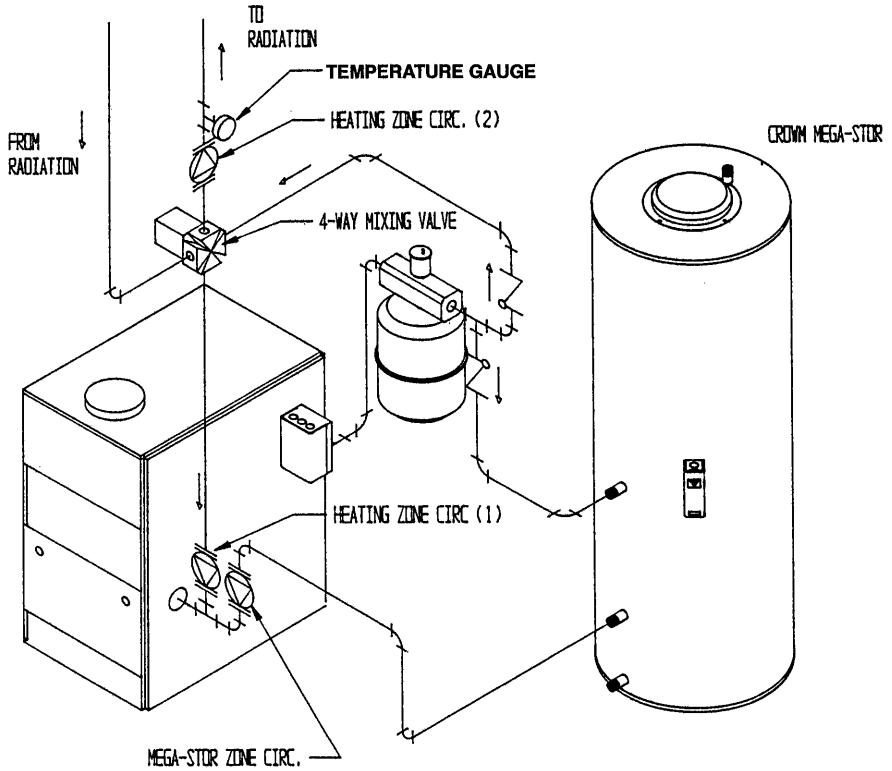


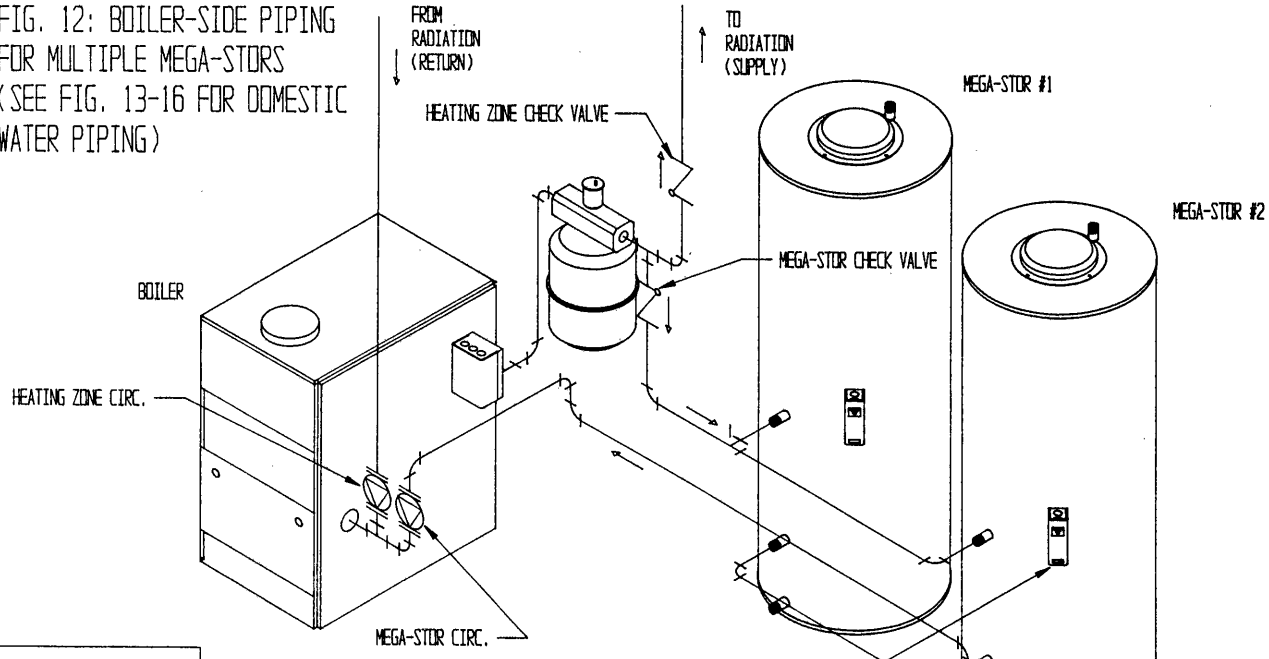
FIG. 11: BOILER-SIDE PIPING IN A RADIANT PANEL HEATING SYSTEM USING A 4-WAY MIXING VALVE (SEE FIG 13-16 FOR DOMESTIC WATER PIPING)



NOTE:
SEE MIXING VALVE MANUFACTURER'S SPECIFICATIONS FOR PROPER VALVE PORT ORIENTATION

WARNING:
BOILER RELIEF VALVE NOT SHOWN. INSTALL IN ACCORDANCE WITH BOILER MANUFACTURER'S INSTRUCTIONS

FIG. 12: BOILER-SIDE PIPING FOR MULTIPLE MEGA-STORS (SEE FIG. 13-16 FOR DOMESTIC WATER PIPING)



WARNING:
BOILER RELIEF VALVE NOT SHOWN. INSTALL IN ACCORDANCE WITH BOILER MANUFACTURER'S INSTRUCTIONS.

REVERSE-RETURN PIPING (SHOWN) BALANCES PRESSURE DROP THROUGH EACH MEGA-STOR COIL

2) DOMESTIC SIDE PIPING:

BASIC DOMESTIC PIPING

Figure 13A shows typical domestic water piping for a Mega-Stor. All components except the control are provided by the installer. The function of the components shown are as follows:

a) Control (required) This control is provided by Crown and must be installed in the location indicated. It is imperative that the bulb of the control is "bottomed out" in the control well.

b) Shut-off valves (recommended) - Use to isolate the tank for servicing.

c) Backflow Preventer (required by some codes) - Use to prevent water from backing out of the Mega-Stor in the event that inlet water pressure drops.

d) Expansion Tank (required when a backflow preventer is used) -This expansion tank absorbs the increased volume caused by heating water. If a backflow preventer is installed, this expansion tank is required because the increased water volume will otherwise have no place to go and the T&P valve will open.

Use an expansion tank designed for use on domestic water systems such as Watts DET series expansion tank. Refer to the expansion tank manufacturer's literature for the proper size expansion tank to use.

IMPORTANT

If an expansion tank is used, do not put any valves between the expansion tank and Mega-Stor inlet

e) Unions (optional) - Use to disconnect the Mega-Stor in the unlikely event that this is necessary.

f) Drain (Required) - Used to drain the tank for inspection or servicing.

g) Temperature/Pressure Relief Valve (required) - Opens to relieve excess pressure or temperature which has developed in the Mega-Stor. This valve must be sized in accordance with Table 11.

Pipe this valve as shown in Figure 13B or 13C. Run the discharge to a location where hot water discharge will not cause injury or damage. Leave a 6" gap between the T&P valve pipe termination and the drain or closest obstruction. Do not run T&P valve discharge pipe to the outdoors or other potentially freezing location.

h) Vacuum Breaker (Recommended) - This valve protects the tank in the event that the pressure in the tank falls below atmospheric. Use a Watts N-36 or equivalent.

i) Heat Trap (Optional) - The heat trap retards the migration of heat from the Mega-Stor up the hot water supply pipe.

MEGA-STOR PIPING WITH A "TEMPERATURE LIMITING VALVE"

Usually, the maximum temperature of the outlet water will stay near the setting of the Mega-Stor control. In some cases, however, hot water usage patterns can cause the outlet water temperature to rise significantly above the control setting.

The temperature of water going to the fixtures may be more carefully controlled through the use of a thermostatic mixing valve. This device blends a controlled amount of cold water with the hot water leaving the Mega-Stor so that water at a more constant temperature exits the mixing valve. Typical thermostatic mixing valve piping is illustrated in Figure 14.

WARNING

A thermostatic mixing valve does not eliminate the risk of scalding.

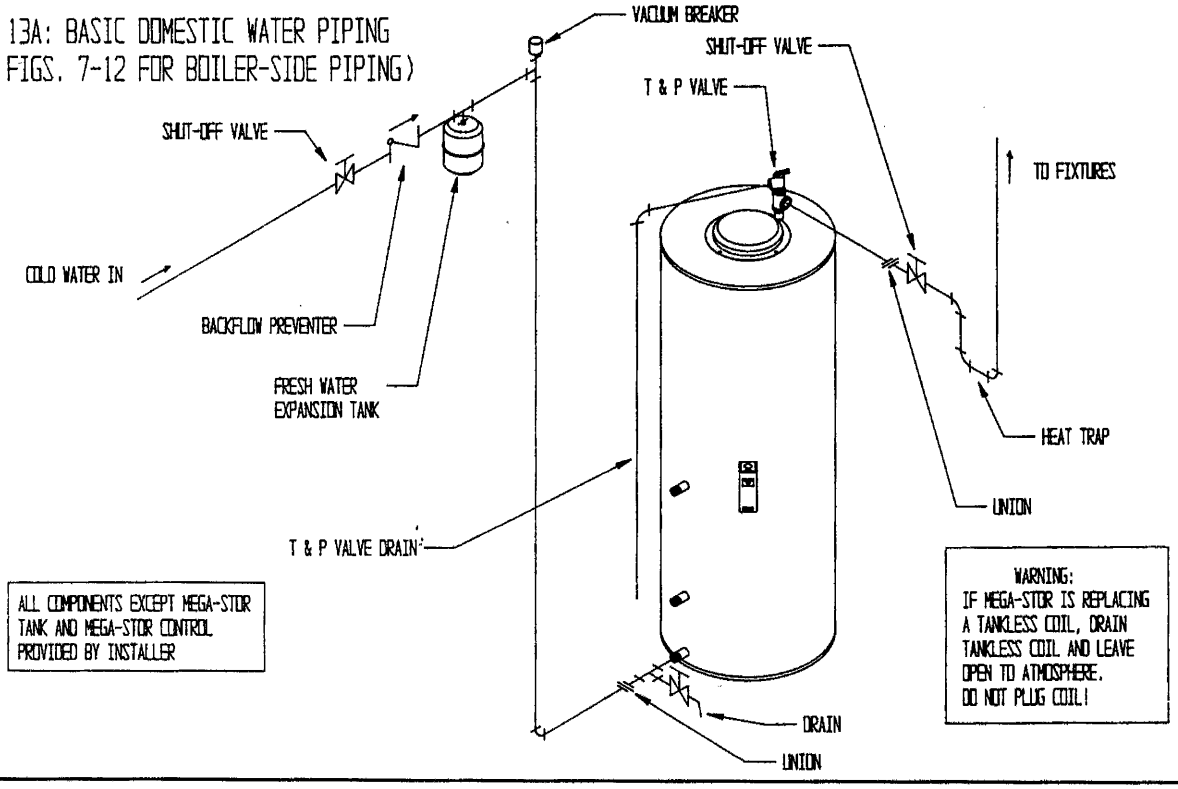
* Set the Mega-Stor thermostat as low as practical.
* Feel water before bathing or showering
* If anti-scald or anti-chill protection is required, use devices specifically designed for such service. Install these devices in accordance with their manufacturer's instructions.

DOMESTIC WATER PIPING FOR DISTANT FIXTURES

In some cases the furthest fixture may be quite distant from the Mega-Stor. In such an installation the configuration shown in Figure 13 or 14 would result in an unacceptable delay before hot water reaches these distant fixtures. Even if all the fixtures are relatively close to the Mega-Stor, the building owner may want hot water at all fixtures as soon as they are opened.

Figure 15 illustrates a solution to this problem. In it, a pipe is run from the furthest fixture on each branch back to the return of the Mega-Stor. A small bronze circulator is mounted in this line and is wired so as to run continuously. A check valve in this line permits flow towards the Mega-Stor inlet only.

FIG. 13A: BASIC DOMESTIC WATER PIPING
(SEE FIGS. 7-12 FOR BOILER-SIDE PIPING)



When no fixtures are drawing water, the bronze circulator moves hot water from the Mega-Stor to end of the branch just below the last fixture, then back to the inlet of the Mega-Stor via the return pipe. When a fixture is opened, hot water is already out in the branch very close to the fixture and hot water appears at it almost immediately. The check valve prevents cold water in the Mega-Stor's inlet pipe from passing around the tank and heading directly to the fixture.

Because hot water is always circulated in the hot water branch the entire branch should be insulated to prevent excessive heat loss.

MANIFOLD DOMESTIC WATER PIPING

Figure 16 illustrates the recommended method of piping the domestic water side of several tanks together. All Mega-Stors are piped in a "reverse- return" manner just like the boiler piping. This balances the pressure drop through each tank, resulting in an even flow rate through each tank.

Each tank must have its own T&P valve. It is recommended that each tank be equipped with its own isolation valves, unions, and drains so that one tank may be removed from the system. If local codes require a backflow preventer, check with the appropriate authority to find out whether one backflow preventer may be used for tanks or each tank must be equipped with its own backflow preventer. If each tank must have its own backflow preventer, each tank must also have its own expansion tank. If a common backflow preventer is permitted, an expansion tank must be sized to accommodate the expansion volume of all tanks.

TABLE 11: MINIMUM T&P VALVE SIZES

* If the Mega-Stor is connected to a boiler which has a Gross Output LESS than the "Max. T&P Valve Capacity" shown below, install a T&P valve having a capacity greater than or equal to the boiler's Gross Output.
* If the Mega-Stor is connected to a boiler which has a Gross Output GREATER than the "Max. T&P Valve Capacity" shown below, install a T&P valve having a capacity greater than or equal to the "Max T&P Valve Capacity."

Model	Max. T&P Valve Capacity (BTU/hr)
MS-26	172,800
MS-40	181,800
MS-53	199,800
MS-79	215,100
MS-119	445,635
MSH-40H	103,344

*Maximum T&P valve pressure setting - 150 psi
*Maximum T&P valve temperature setting - 200°F

FIG.13B: CORRECT TEMPERATURE & PRESSURE VALVE PIPING FOR **MS-26, MS-40, MS-53**

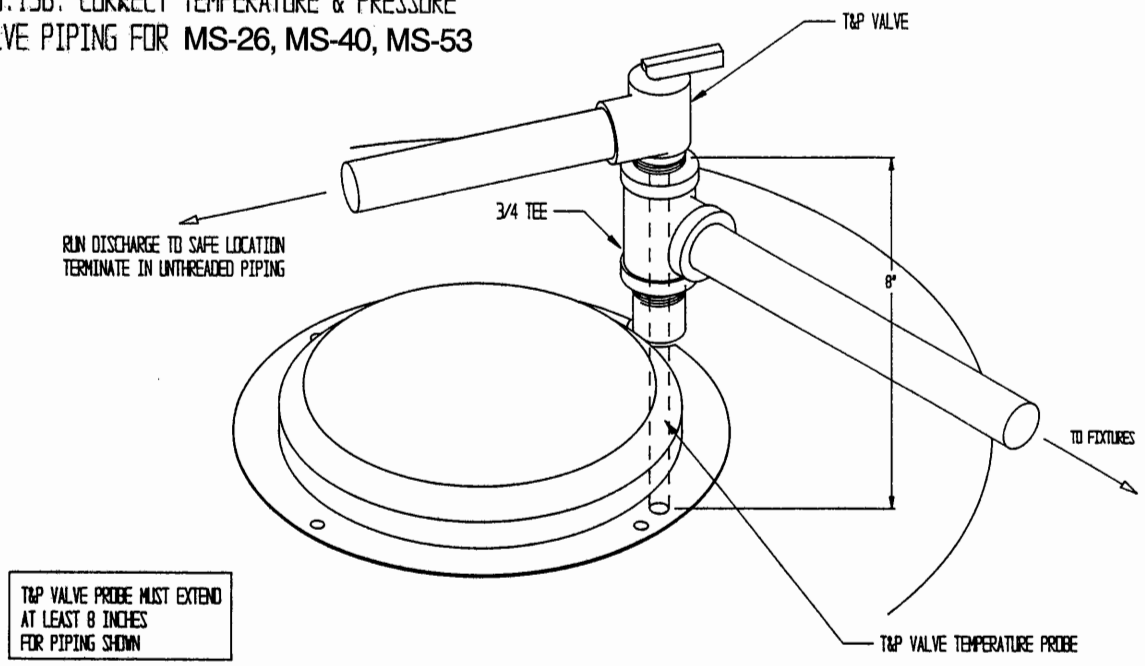


FIG. 13C: CORRECT TEMPERATURE & PRESSURE VALVE PIPING FOR MS-79, MS-119

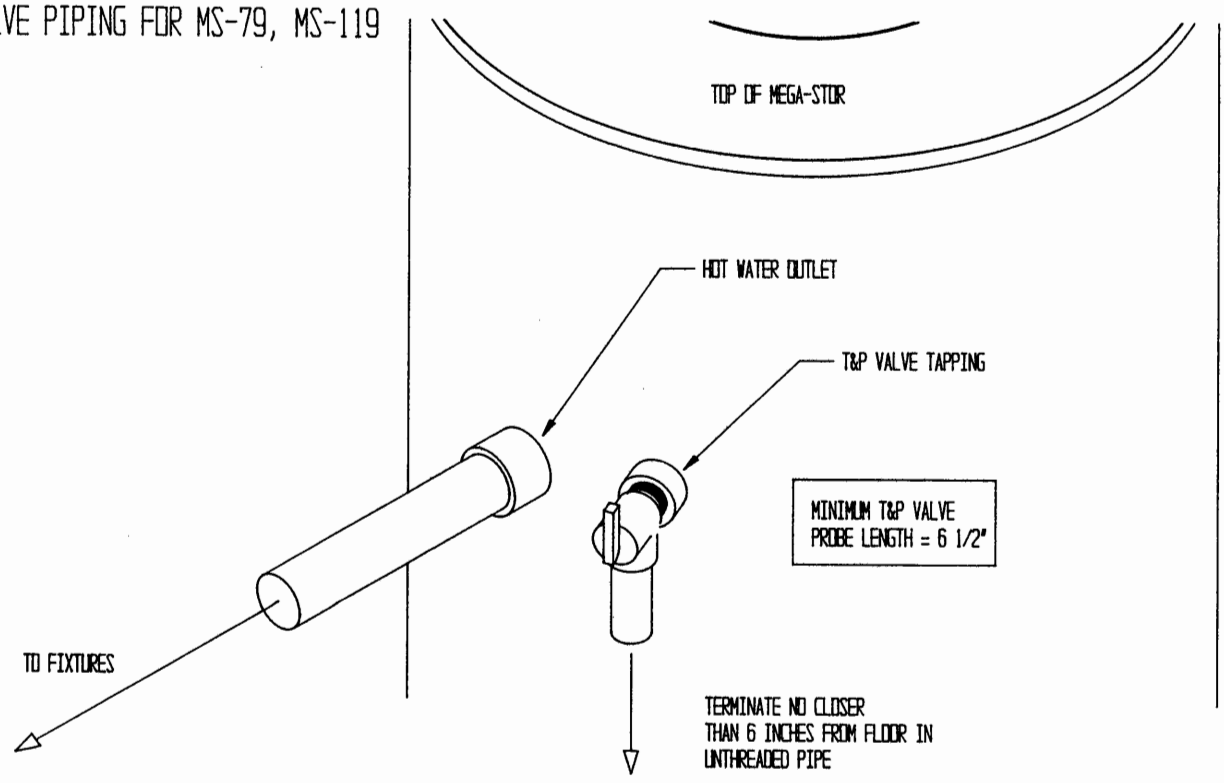
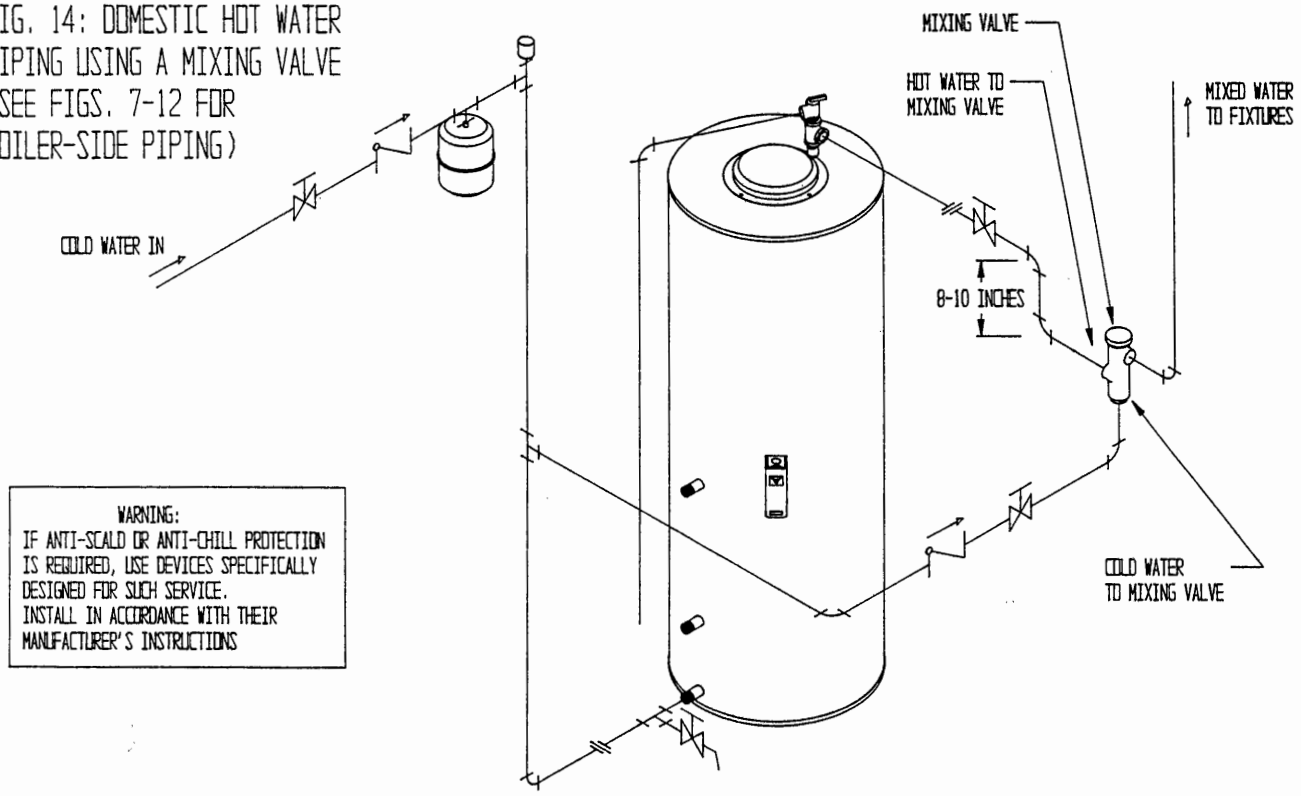


FIG. 14: DOMESTIC HOT WATER PIPING USING A MIXING VALVE (SEE FIGS. 7-12 FOR BOILER-SIDE PIPING)



WARNING:
IF ANTI-SCALD OR ANTI-CHILL PROTECTION IS REQUIRED, USE DEVICES SPECIFICALLY DESIGNED FOR SUCH SERVICE. INSTALL IN ACCORDANCE WITH THEIR MANUFACTURER'S INSTRUCTIONS

FIG. 15: DOMESTIC WATER PIPING FOR DISTANT FIXTURES USING A RECIRCULATION LINE (SEE FIGS. 7-12 FOR BOILER-SIDE PIPING)

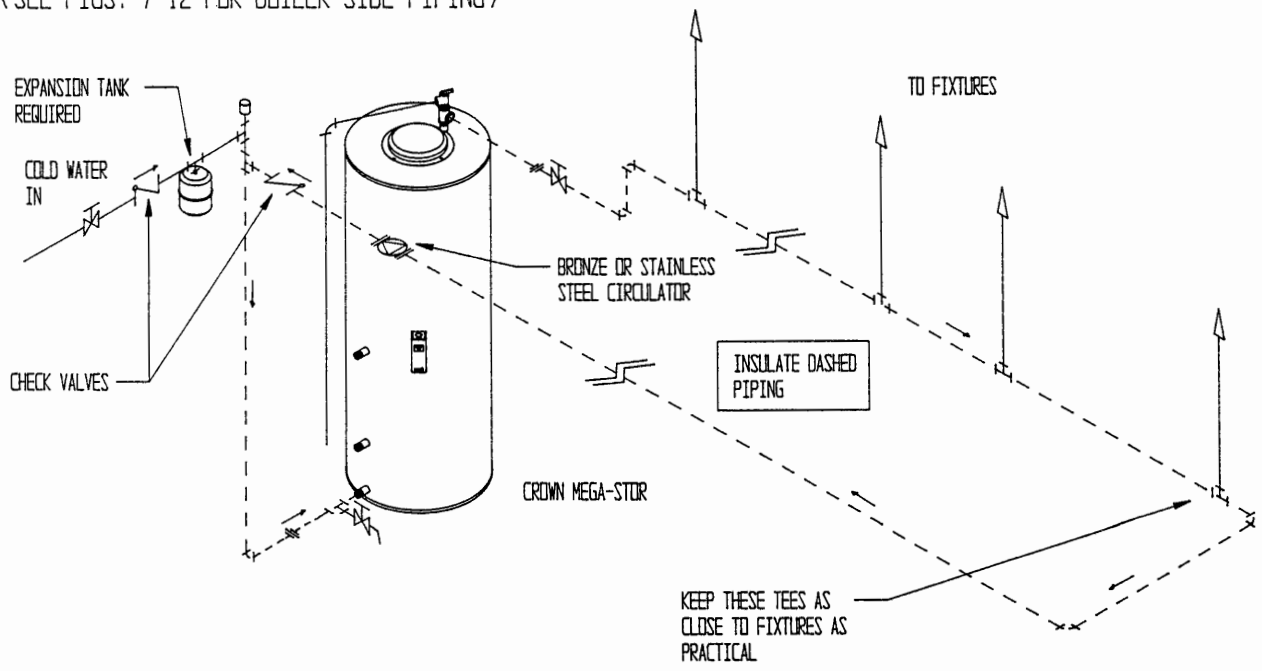
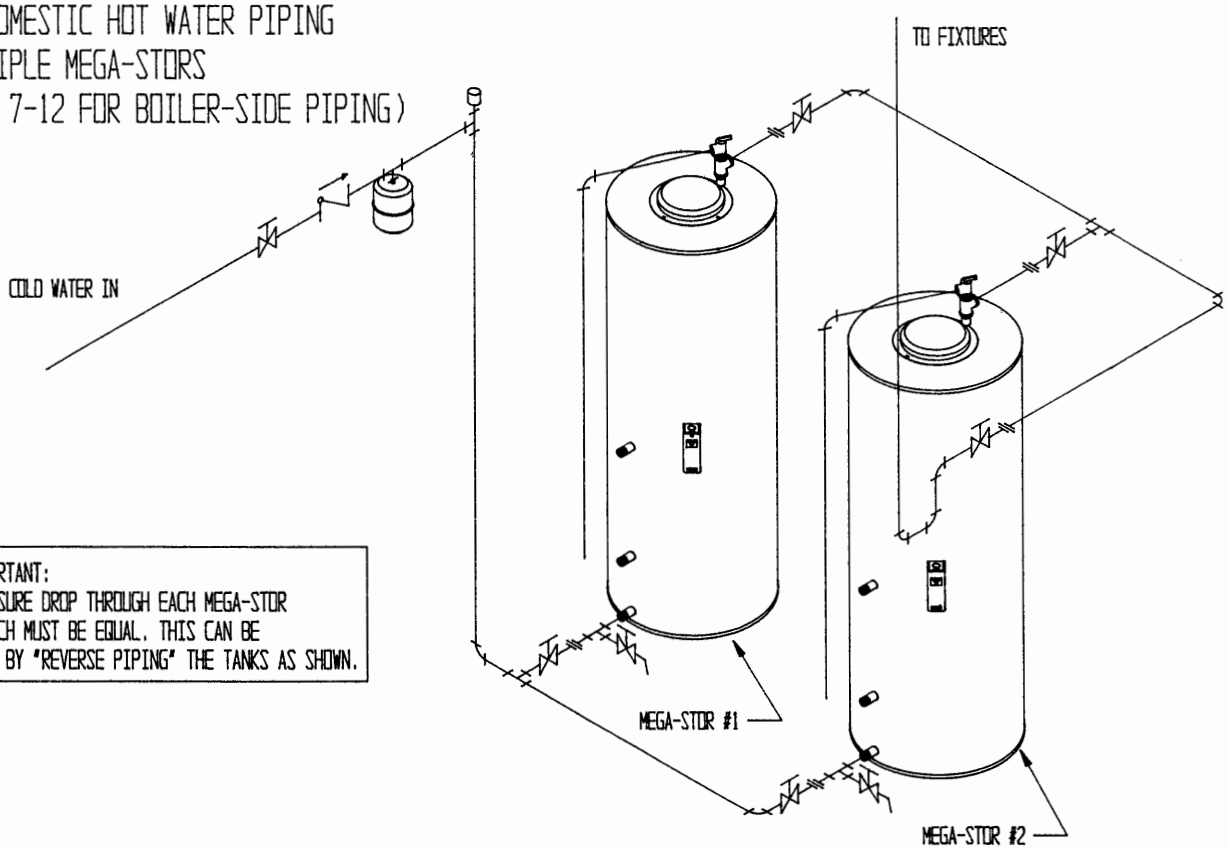


FIG. 16: DOMESTIC HOT WATER PIPING
USING MULTIPLE MEGA-STORS
(SEE FIGS. 7-12 FOR BOILER-SIDE PIPING)



IMPORTANT:
PRESSURE DROP THROUGH EACH MEGA-STOR BRANCH MUST BE EQUAL. THIS CAN BE DONE BY "REVERSE PIPING" THE TANKS AS SHOWN.

VII. WIRING

The following general notes apply to all wiring:

1) Wiring must be done in accordance with all codes. In the absence of any codes the system must be wired in accordance with the National Electric Code (ANSI/ NFPA 70-1990).

2) The entire system (that is the boiler controls, Mega-Stor, and heating zone controls) must be on its own circuit. The current rating of this circuit will depend on the total number and size of loads in the system, however it should in no case be less than 15 AMPS.

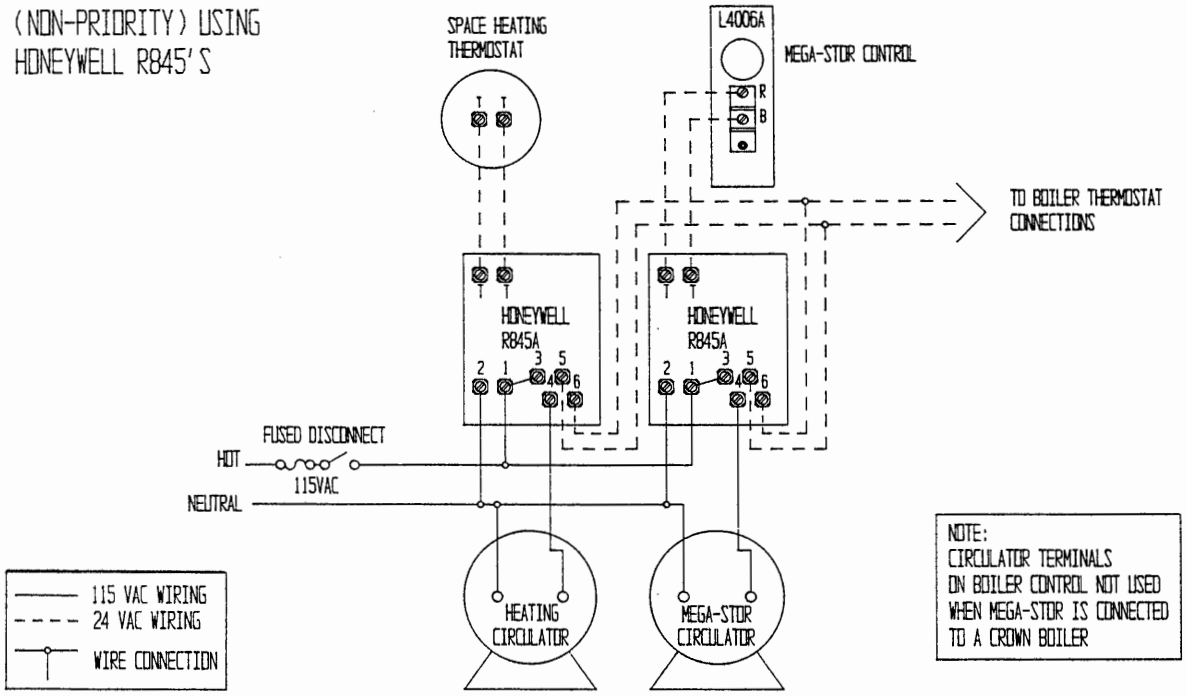
3) The Mega-Stor is equipped with Honeywell L4006A series aquastat. This aquastat has a set of contacts which make upon a call for domestic water and break when this temperature is satisfied.

CIRC ZONE WIRING (NON PRIORITY)

Figure 17 is a connections diagram for a non-priority circulator zone system using Honeywell R845A's. The R845A is equipped with two sets of contacts (3,4 and 5,6) which become made when the T and T terminals are made. Terminals 1 and 2 on the R845A are supplied with 110 VAC to power its internal transformer. In this application one R845A is provided for each zone including that of the Mega-Stor. If the boiler has a factory equipped circulator, this is disconnected from terminals C1 and C2 on the boiler.

When any thermostat (including the thermostat on the Mega-Stor) calls for heat, the relay in the R845A for that zone becomes energized. Terminals 3 and 4 become "made", energizing the circulator. Terminals 5 and 6 are also made which start the boiler.

FIG. 17: CIRC. ZONE WIRING (NON-PRIORITY) USING HONEYWELL R845'S



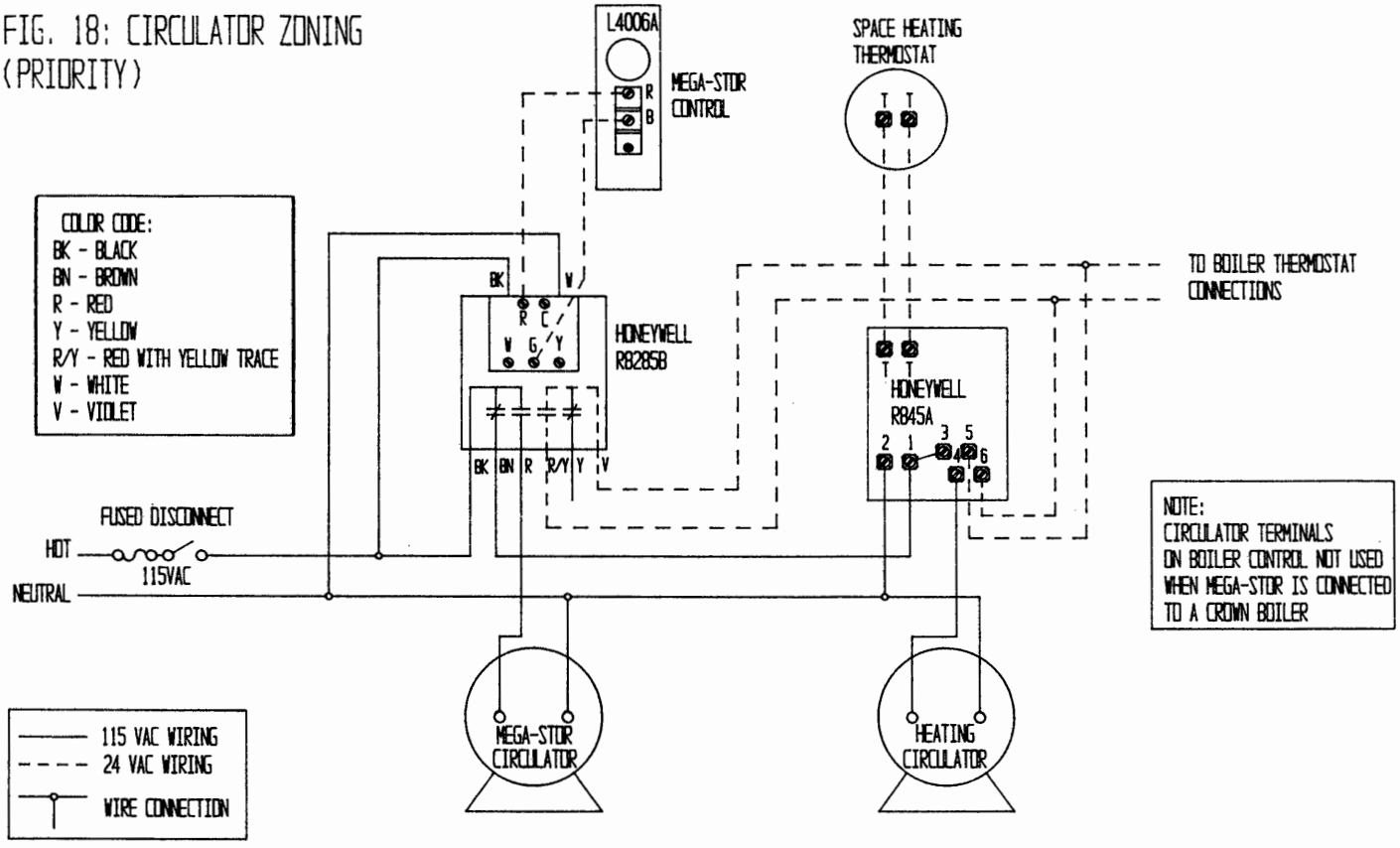
CIRCULATOR ZONE WIRING (PRIORITY) - Figure 18 is a connections diagram for priority circulator zoning. This system is similar to non-priority circulator zoning except that a Honeywell R8285B relay is used in place of the R845A on the Mega-Stor zone. This relay is equipped with its own 24 volt transformer and D.P.D.T. contacts. The Mega-Stor control is connected to terminals R and G so that when the Mega-Stor control calls for heat the relay is energized.

One set of contacts on the R8285B is used to switch line voltage. On this set of contacts the common is connected to an unswitched "hot". The normally closed contact is connected to terminal #1 on each of the space heating zone's R845A's. The normally open contact is connected to the Mega-Stor zone circulator.

The normally closed contact on the other set of R8285B contacts is not used. The common and normally open contacts are connected in parallel with terminals #5 and #6 on the space heating zone R845A's.

As long as the Mega-Stor zone does not call for heat, the R845As for the heating zones have 110 VAC across their 1 and 2 terminals and the heating zones will function as described in the non-priority circulator zone section. As soon as the Mega-Stor calls for heat, however, the normally closed terminals in the R8285B open, de-energizing the heating zones and energizing the Mega-Stor circulator. The other set of contacts in the R8285B (connected across the boiler thermostat connections) become "made" which brings on the boiler.

FIG. 18: CIRCULATOR ZONING (PRIORITY)

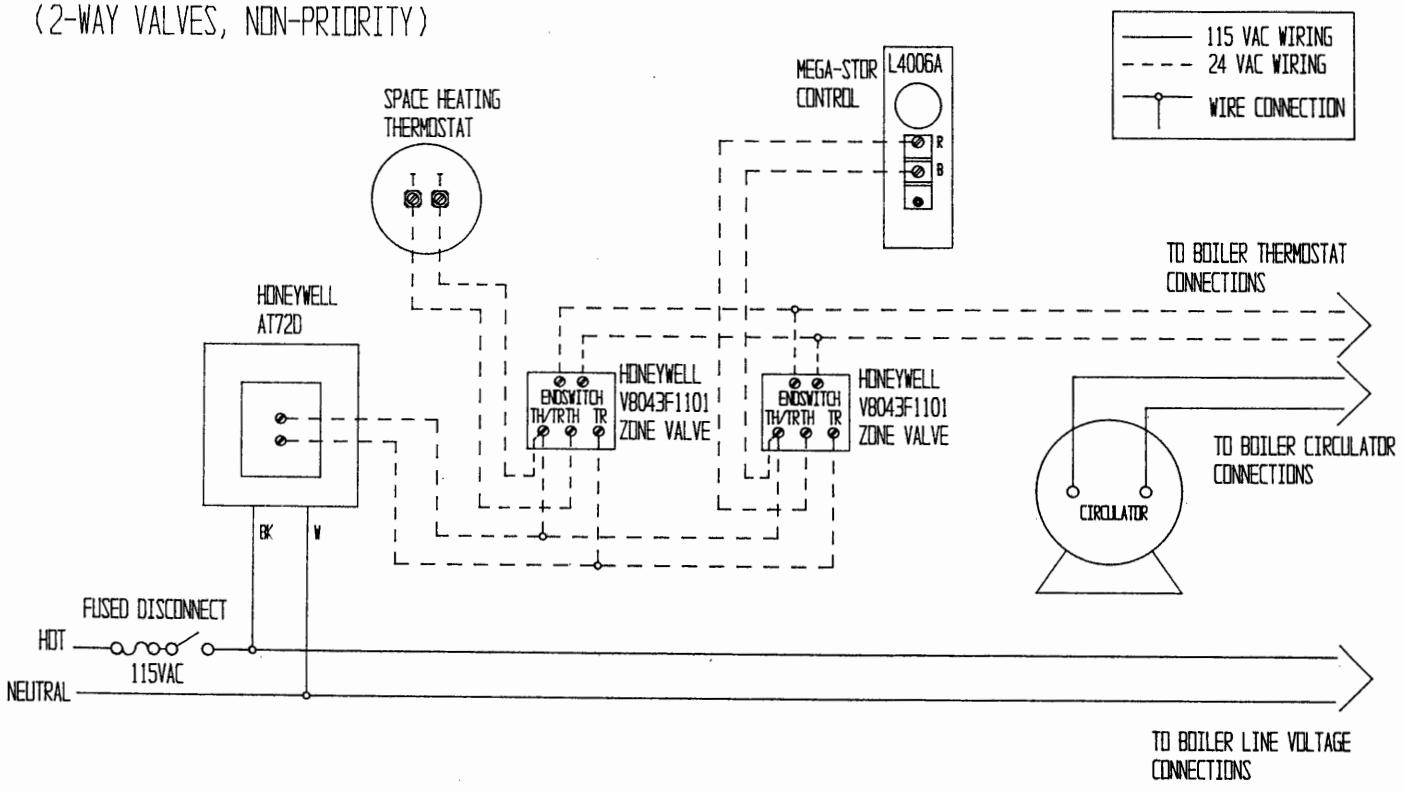


ZONE VALVES (NON PRIORITY)

Figure 19 is a connections diagram for a zone system using Honeywell V8043F motorized zone valves. The motor on these valves is connected between TH and TR. TH/TR is provided for the electrician's convenience as a binding post and is connected to nothing inside the valve. The "endswitch" terminals are connected to a set of switch contacts inside the valve which become made when the valve is open.

A call for heat from any thermostat or the Mega-Stor aquastat results in the application of 24 volts across the motor in that zone's zone valve. This drives open the zone valve. When the valve has opened, the endswitch in that zone valve makes and brings on the boiler.

FIG. 19: ZONE VALVE WIRING
(2-WAY VALVES, NON-PRIORITY)



ZONE VALVES (2-WAY PRIORITY)

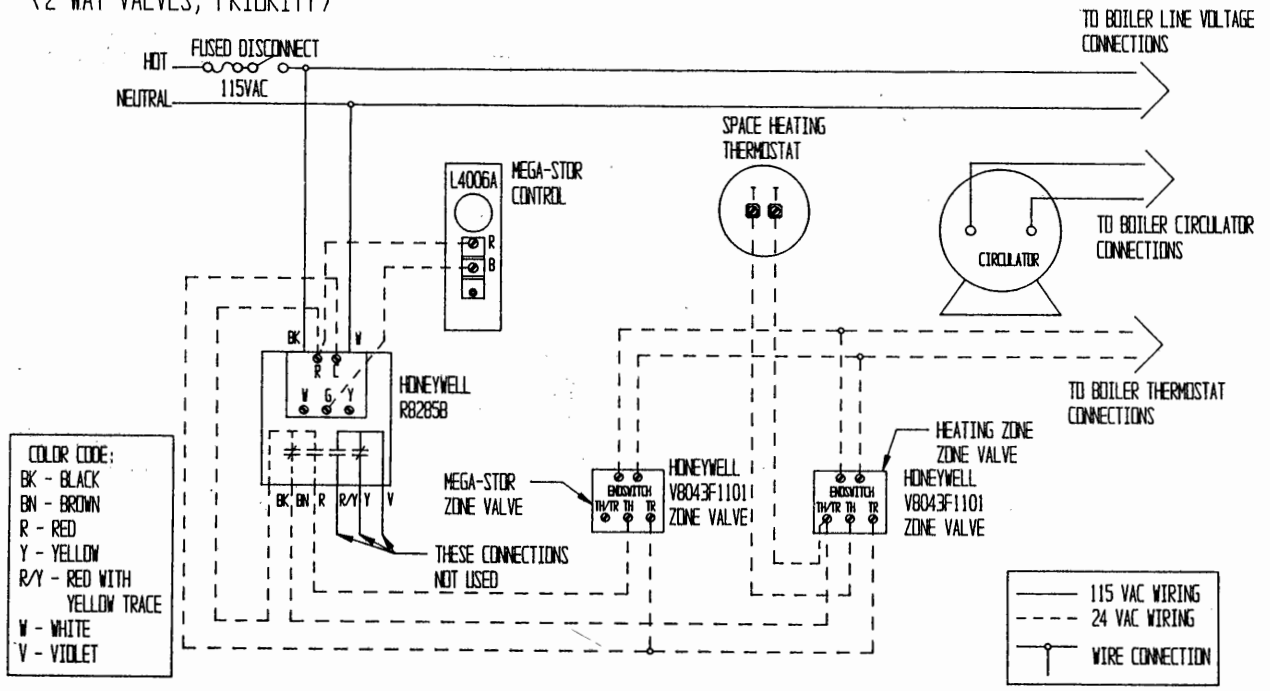
Figure 20 is a connections diagram for a priority zone system using Honeywell V8043F motorized valves. An R828B relay is used which is equipped with its own transformer and a set of S.P.D.T. contacts.

The Mega-Stor control is connected to terminals R and G on the R8285B so that when the Mega-Stor control calls for heat, the relay coil is energized. One side of the transformer is connected to the common contact. The normally closed contact is connected to all space heating thermostats. The normally open contact is connected directly to the Mega-Stor zone valve motor.

As long as the Mega-Stor is not calling for heat, power is supplied to all space heating thermostats and a call from any space heating thermostat will energize that zone's zone valve and bring on the boiler. As soon as the Mega-stor calls for heat, however, the normally closed contacts, which supply all power to the space heating thermostats, open. This de-energizes the heating zones and closes any open space heating zone valves. At the same time, the normally open contacts in the R8285B become made which energizes the Mega-Stor zone valve. The Mega-Stor zone valve opens and its endswitch brings on the boiler.

If four or fewer zones (including the Mega-Stor zone) are present, the transformer in the R8285B may be used instead of an external transformer. Use terminals R and C with C being the "common" side of the 24 volt wiring.

FIG. 20: ZONE VALVE WIRING
(2-WAY VALVES, PRIORITY)



ONE VALVES (3-WAY PRIORITY)

Figure 21 is a connections diagram for a Flair UWO series 3-way zone valve. This valve is equipped with 4 connections, 2 of which are for a 24 volt motor and 2 of which are endswitch connections which become "made" when the valve is open.

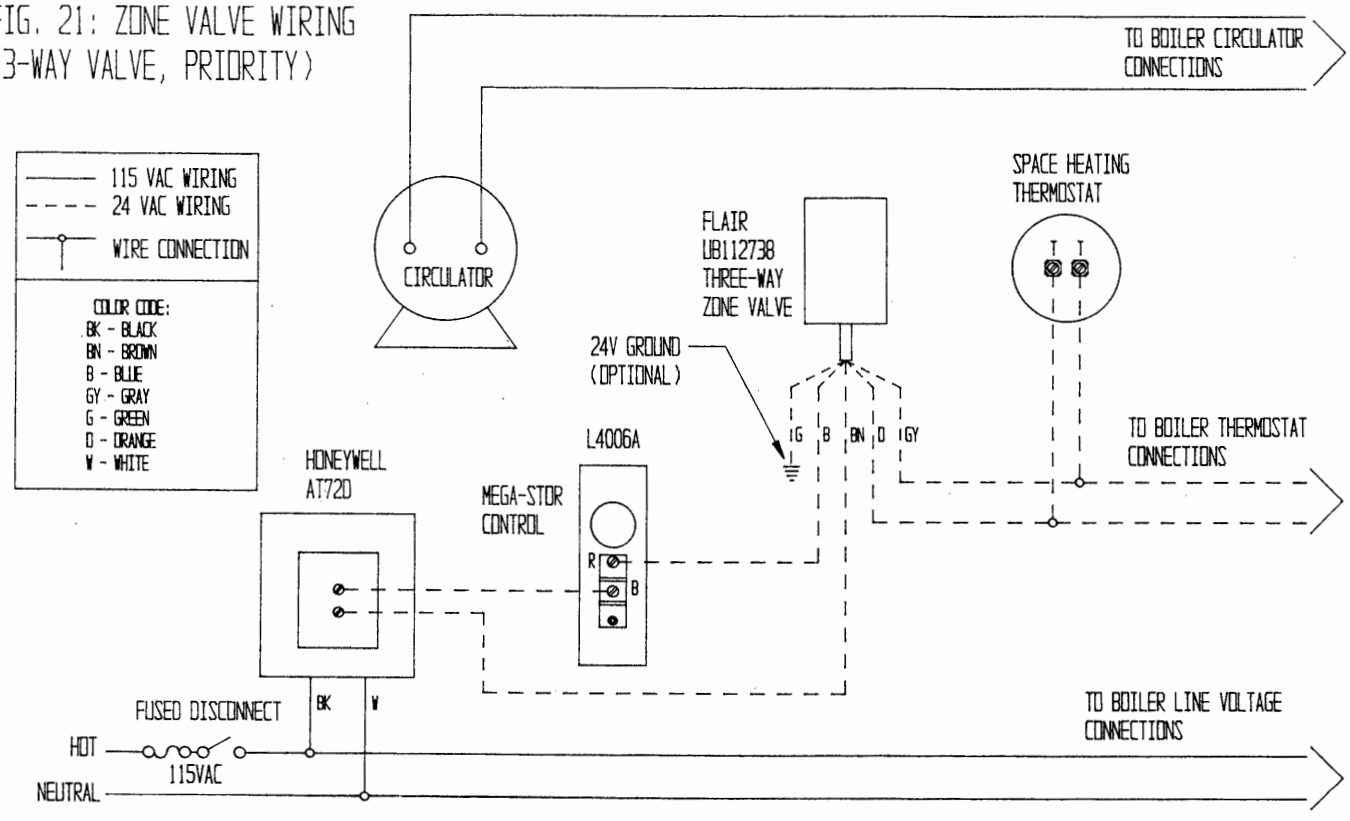
As long as the Mega-Stor is not calling for heat, a call from the space heating thermostat will start the boiler and water will circulate to the space heating zone through the normally open port of the zone valve (see the piping section for more information on this). If the Mega-Stor thermostat calls for heat, however, the zone valve motor is energized and boiler water is redirected through the Mega-Stor coil regardless of the status of the space heating thermostat.

MANIFOLD WIRING

Wiring for manifolded Mega-Stors is identical to wiring for a single Mega-Stor except for the presence of more than one tank aquastat. Depending on the way the tank is piped, two choices are possible:

* If unions and isolation valves are present so that any tank could be pulled from the manifold without shutting down the entire tank zone, install all the aquastats provided and wire then in parallel. In this way any tank can be completely removed from the manifold while allowing operation of the other Mega-Stors.
* If unions and isolation valves are not present on each tank, only one aquastat need be installed. If the Mega-Stors have been piped as shown in this manual, it does not matter which Mega-Stor this aquastat is installed in.

FIG. 21: ZONE VALVE WIRING
(3-WAY VALVE, PRIORITY)



VIII. Start-up and Check-out

1) Make sure that the system is free of leaks and that air is purged from the system.

> **Warning**
> Never attempt to fill a hot empty boiler.

> **Important**
> Fix any leaks found before proceeding further. Leakage from the boiler piping can result in severe damage to the boiler.

2) Many soldering fluxes contain Zinc Chloride which can cause severe corrosion damage to stainless steel. After completing all domestic water connections, flush the Mega-Stor thoroughly before leaving the installation. This is particularly important if the Mega-Stor will be unused for an extended period of time after installation. Flush the Mega-Stor by drawing at least three times its volume from the tank.

3) Make sure that all electrical connections are correctly made and that no exposed high voltage wiring is present.

4) Temporarily disable the burner. This can be done on gas boilers by turning the gas valve to the "pilot" or "off" position and on oil boilers by disconnecting the jumper on the T and T terminals of the oil burner primary control. On the Crown CT series boiler, simply unplug the burner.

5) Make sure that each zone valve or circulator operates when, and only when, its thermostat calls for heat. Let each zone operate long enough to purge any remaining air from the system.

6) Set the Mega-Stor thermostat to the desired position. Because hot water presents a scald hazard, it is best to set the thermostat at 120F or lower and raise it only if necessary to provide adequate hot water.

7) Re-enable the burner and allow the Mega-Stor zone to operate. Make sure that the Mega-Stor aquastat shuts down the zone when it is satisfied.

IX. Maintenance

The Mega-Stor is an extremely simple device and as such requires very little maintenance. There are, however, several items which should be checked out on an annual or as needed basis to ensure a reliable supply of hot water:

* **On an annual basis, remove the black cover over the handhole and make sure that the handhole cover is leak-tight.**

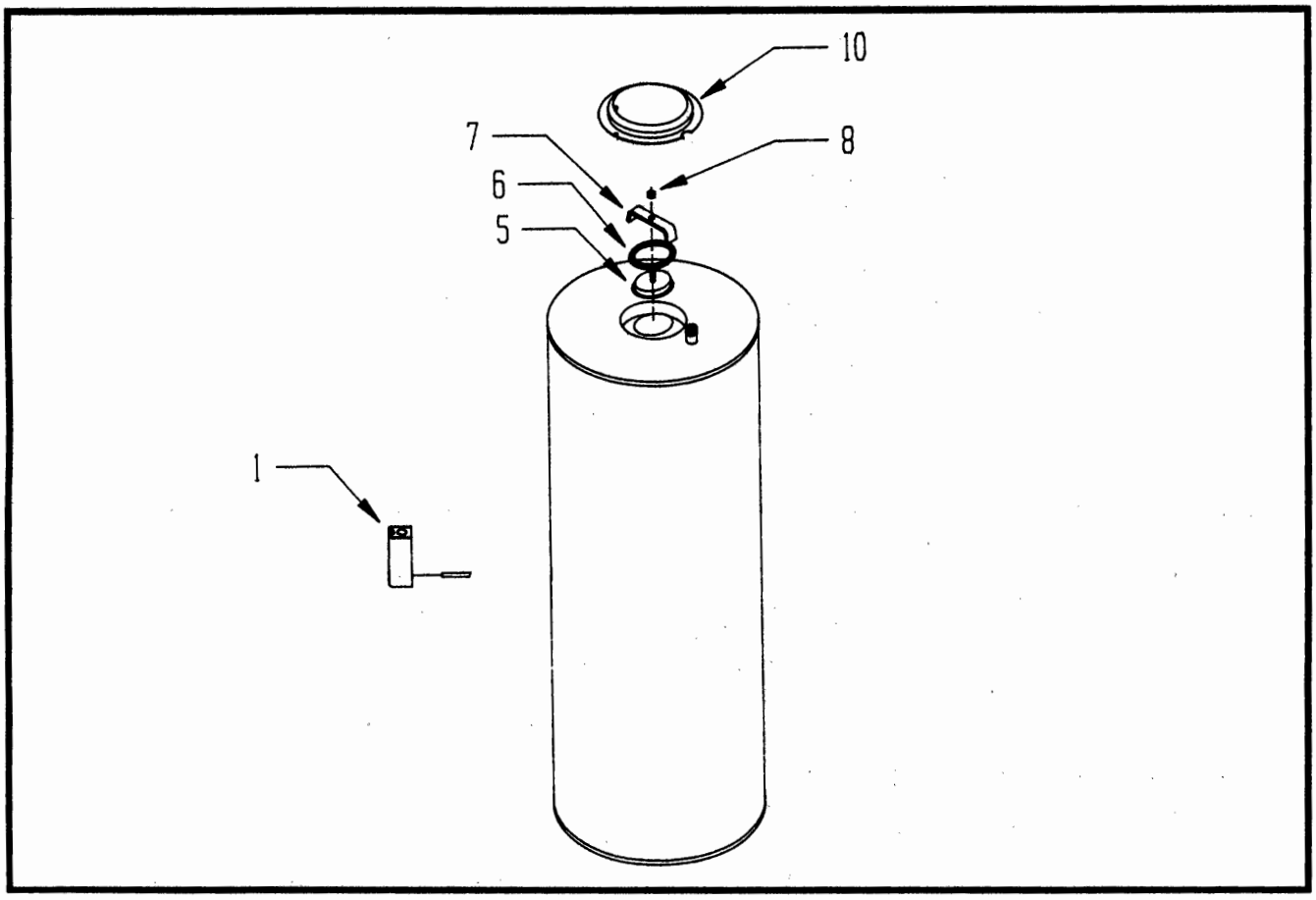
* **Make sure that the rest of the boiler and domestic water piping is free of leaks.**

* **If there is an oil lubricated circulator in the system, make sure that it is lubricated as called for by the circulator manufacturer.**

* **The Mega-Stor depends upon the boiler for a source of heat and is therefore only as reliable as the boiler. Make sure that the boiler is maintained in accordance with the boiler manufacturer's instructions.**

* **If a water treatment system is required to keep the water chemistry within the parameters shown in Table 10, make sure that this system is properly maintained.**

X. PARTS



Key #	Part #	DESCRIPTION	QTY./TANK
1	L4006A2114	THERMOSTAT	1
5	20-021	HANDHOLE COVER	1
6	20-022	"O" RING GASKET	1
7	20-023	HANDHOLE COVER BRACKET	1
8	90-025	M10 NUT	1
10	20-024*	HANDHOLE JACKET COVER	1

Notes:
All part numbers are per item.
*This part not used on MS-79 or MS-119.

Appendix A: Whirlpool Sizing

IMPORTANT

This procedure is not intended to size whirlpool tubs in commercial applications. Whirlpool tubs present special sizing problems because of the large rate (as much as 20 GPM) at which they fill. The following procedure is intended to be used after a Mega-Stor/boiler combination has been selected for hot water uses other than the whirlpool. It is predicated upon a Mega-Stor storage temperature of 140F.

Before using this procedure, it is important to determine whether the tub in question is a whirlpool tub or a "hot tub". A hot tub has its own water heating source and is not refilled each time it is used. In this way it is like a miniature swimming pool. DO NOT ATTEMPT TO USE THIS PROCEDURE FOR A HOT TUB. A whirlpool tub is refilled each time it is used and in this way resembles an over-grown bath tub.

1) If not already done, use one of the procedures in Part III to size a Mega-stor/boiler combination for all fixtures EXCEPT the whirlpool tub.

2) Find the nominal volume of the whirlpool tub. This should be listed on the tub manufacturer's literature.

3) If the whirlpool tub has a volume greater than the Mega- Stor(s) selected in (1), increase the size of the Mega-Stor selected to one with a volume greater than or equal to the volume of the tub. The size of the boiler does *not* have to be increased from that selected in (1).

   Regardless of the volume of the whirlpool, do not attempt to use an MS-26. An MS-40 is the minimum size Mega-Stor which should be considered for use with any whirlpool tub.

4) Determine the recovery time for the Mega-Stor. This is done as follows:

   Recovery Time = 44982 x V ÷ Q

   Where:

   V is the volume of the Mega-Stor in Gallons.

   Q is the DOE Heating Capacity of the boiler to be used in BTU/hr.

   Recovery time is in minutes.

5) If adequate hot water is to be assured for filling the whirlpool tub, no significant amount of hot water may be used for other purposes while the whirlpool is filling, or for a period equal to the recovery time before the whirlpool is filled. Also, hot water may not be available until the recovery time has passed after the tub is filled. If this is not acceptable, the whirlpool should be supplied with its own source of hot water.

Example:

A 50 gallon whirlpool tub is to be installed in a residence. Using one of the procedures in Part III, an MS-40 has been selected with a boiler having a 120,000 BTU/hr DOE heating capacity to handle space heating and all domestic hot water loads except for the whirl pool tub.

Solution:

Since the whirlpool tub has a volume (50 Gal) greater than that of the MS-40 (39.6 Gal), select an MS-53 (52.8 Gal) instead of the MS-40. The boiler size stays at 120,000 BTU/hr.

The recovery time is:

44982 x 52.8 ÷ 120,000 = 19.8 minutes

This means that hot water may not be available for purposes other than filling the whirlpool, during the fill, 19.8 minutes before the fill, or 19.8 minutes after the fill.

NOTES

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