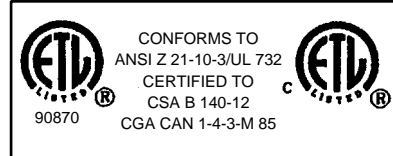


Phase III[®] HM Series Oil and Gas Fired Water Heaters



- Input from 165,000 to 390,000 Btu/hr -

* I N S T A L L A T I O N A N D M A I N T E N A N C E * M A N U A L

WARNING

Before proceeding with installation and operation, read entire manual carefully. Failure to do so can cause injury or property damage.

When receiving Phase III, any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

NOTICE

Warranty Registration Card must be filled out by the customer and mailed within thirty (30) days of installation in order to gain warranty coverage.

Leave all documentation received with appliance with owner for future reference.

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The following terms are used throughout this manual to bring attention to the presence of potential hazards or to important information concerning the product.

DANGER

Indicates the presence of a hazardous situation which, if ignored, will result in death, serious injury or substantial property damage.

WARNING

Indicates a potentially hazardous situation which, if ignored, can result in death, serious injury or substantial property damage.

CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in minor injury or property damage.

NOTICE

Indicates special instructions on installation, operation or maintenance, which are important to equipment but not related to personal injury hazards.

DANGER

Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system which has been under water.

DANGER

- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WARNING

Should overheating occur or the gas supply fails to shut off, turn OFF the manual gas control valve external to the appliance.

DANGER

Do not use gasoline, crankcase oil or any oil containing gasoline to fuel the burner.

CAUTION

To prevent damage to inner tank, installer must:

- Fill inner tank prior to outer tank during start-up.
- Relieve primary system pressure below 15 psig prior to draining inner tank.

WARNING

Bacteria can develop in the domestic water system if certain minimum water temperatures are not maintained.

DANGER

Water temperature over 125°F can cause severe burns instantly or death from scalds.

- Children, disabled and elderly are at highest risk of being scalded.
 - Never leave them unattended in or near shower, bathtub or sink.
 - Never allow small children to use a hot water faucet or draw their own bath.
- If any one using hot water in the building fits this description or codes require specific water temperatures at hot water faucets, we recommend:
 - a) to install a thermostatic mixing valve at this appliance or at each water faucet.
 - b) to set the thermostat knob for the lowest temperature which satisfies your hot water need.

This will also provide the lowest operating cost.

WARNING

Adjusting the water temperature

Setting the knob to a lower temperature will not have an immediate effect. The stored hot water will first have to be used.

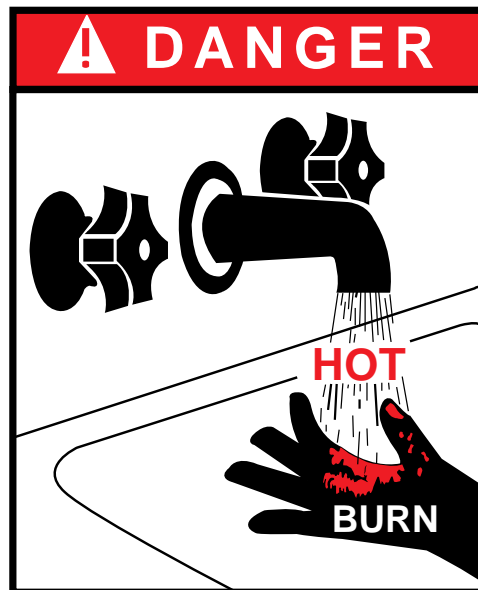
Further adjustments may be necessary as you use your Phase III® heater and water heating system.

CAUTION

Protection must be taken against excessive temperature and pressure!

TO PROTECT AGAINST EXCESSIVE TEMPERATURE AND PRESSURE

- Check if the Temperature and Pressure (T&P) relief valve is in the location provided. (Domestic Water)
- Check if the 30 psi relief valve supplied is in the location provided. (Primary water)
- To avoid injury, install the relief devices to comply with local code requirements.



1- KNOW MORE ABOUT YOUR WATER HEATER

The HM Series water heaters are our latest standard in high efficiency products where large quantities of hot water are required.

The construction, based on the “Tank-in- Tank” technology, consists of an annular stainless steel heat exchanger with a center flueway immersed in a primary fluid for indirect firing.

The primary water - also cooling off the base of the combustion chamber - prevents direct contact of flame and combustion gases with the corrugated hot water tank. This unique design ensures a possible 180°F continuous hot water production while minimizing the lime deposit on the heat exchanger and ensuring longevity of the unit.

Lime deposits and overheating of combustion chamber are leading sources of poor performance and ultimately the failure of conventional water heaters.

With a power burner (natural gas, propane or oil) providing a heat input ranging from 165 MBH to 382 MBH and a built-in recirculating pump, the HM Series water heater can provide a high recovery in domestic water delivery.

In addition to the high recovery rate, the HM Series water heater is equipped with 2 safety limits, a low water cut-off device in the primary water and 2 pressure relief valves making the HM Series water heaters one of the most safest and reliable in today’s market.

Typical applications include residential, light commercial and industrial installations. Although used primarily as a complete hot water system, multiple HM water heaters can be manifolded together on both primary fluid side and domestic side to improve the performance.

Also, when larger quantities of hot water are required, the HM water heater can be combined with the Phase III® indirect water heater.

A- Construction characteristics (Fig. 2, page 5)

Stainless Steel Heat Exchanger:

The heat exchanger (H) is the heart of the HM Water Heater and serves two primary functions:

1. To resist the corrosive nature of the supplied water;
2. To resist the fluctuations of pressure and temperature.

The heat exchanger is manufactured in durable 304 stainless steel and is completely welded with argon protection using the Tungsten Inert Gas welding process. Before assembly, the heads are cleaned and treated to improve the corrosion resistance. The cylinder is corrugated over its entire length, using an exclusive process. This allows the inner tank to descale itself through expansion and contraction during normal operation.

Flueway Tubes:

Located through the middle of the heat exchanger, between the combustion chamber and the flue collector, are eight 2 1/2” flueway tubes (B). Inside the flueway tubes are high temperature steel turbulators (M). The shape and length of the turbulators are specifically designed to retain heat longer and to decrease chimney loss.

Protection of the Combustion Gas Circuit:

The combustion gas circuit (combustion chamber (F) and flueway tubes (B)) are protected by cold galvanization. The coating is formed with an epoxy plating rich in Zinc (93%). This protection against corrosion insures a long life for the HM Water Heaters.

Combustion Chamber:

The combustion chamber (F) is entirely water cooled in order to reduce the heat loss in the lower part of the water heater.

Insulation:

The insulation (J) which, totally covers the tank, is a thick layer of polyurethane foam (1 1/2") - this is the equivalent of 2 1/2" to 3" of fiberglass.

Control Panel: (Fig. 1)

The HM series is equipped with a complete control panel.

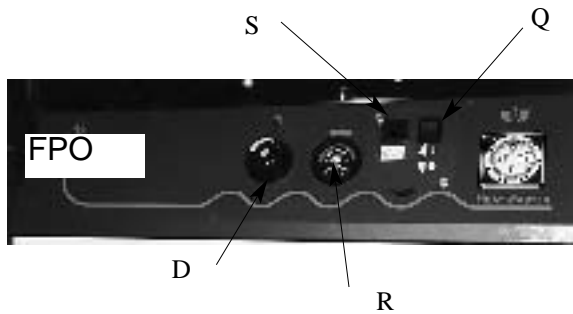


Fig.1: Control Panel

Legend

- Q On/Off Switch
- D Adjustable Thermostat
- R Temperature/Pressure Gauge
- S 115V Outlet - 6 AMP max.

Jacket:

The jacket (O) is completely made of steel and is degreased and phosphatized before it is painted with an epoxy-polyester paint and baked in an oven at 430° F. This guarantees a high quality, durable finish. (paint/powder form is electrostatically applied)

B- Operation

The sensor of the primary heating thermostat (D), adjustable between 90°F and 180°F, is located at the bottom of the outer tank. When the primary water is used for space heating, this thermostat (D) switches ON the burner. At this time the total output of the burner is used to recover the tank temperature.

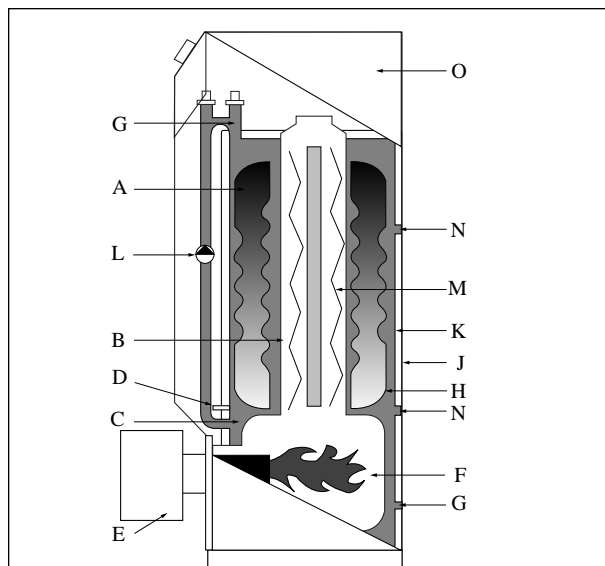
A safety limit thermostat set at 194° F with an automatic reset located on the top of the unit. A second safety limit set at 205° F with a manual reset is located at the top of the unit and is designed to shut down the unit in case of failure of the other thermostatic controls. A low water cut-off device (LWCO) does not allow the firing of the unit if there is less than 7 psig in the outer primary tank.

Anatomy of your Water Heater

Legend

- B. Flueway fitted with stainless steel turbulators
- C. Primary water
- D. Primary Circuit thermostat (up to 180°F) sensing bulb
- E. Burner
- F. Water cooled immersed combustion chamber
- G. Primary circuit drain connection
- H. Corrugated stainless steel heat exchanger
- J. 1 1/2" of rigid (CFC-Free) polyurethane insulation
- K. Steel body containing primary water
- L. Circulator
- M. Baffles (turbulators)
- N. Primary connection
- O. Baked enamel steel jacket
- L.W.C.O.: Low water cut-off device (not shown)

Fig. 2: Cross section of Water Heater



1- CODE COMPLIANCE

The Water Heater installation must conform to the requirements of local codes and the authority having jurisdiction. In the absence of these requirements:

Gas fired heaters should be installed in accordance with National Fuel Gas Code, ANSI Z223.1.

Oil fired heaters should be installed in accordance with NFPA 31 Installation of Oil Burner Equipment.

NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

For installations in Canada - CGA/B149 Installation Code for Gas Burning Equipment.

For installations in Canada - CSA/B139 Installation Code for Oil Burning Equipment.

All electrical wiring, including grounding of the heater and burner, must be in accordance with local codes; or in the absence of local codes with the National Electrical Code, ANSI/NFPA 70.

The HM-100 ASME Model is constructed in accordance with ASME Section VIII - latest edition. Check with local codes for applicability.

2- CHIMNEY

- Confirm that the chimney is of sufficient size to handle the flue gases of all connected equipment.
- Check that it is clear and free of obstructions. Particular attention should be given to replacement of oil fired systems.
- Soot may have degraded the chimney liner and/or accumulated in the chimney requiring a liner replacement or cleaning.

DANGER

If inspection reveals the existing chimney is unsafe or inadequate for the application, it should be rebuilt to conform to local or

national codes, lined or relined, or provided with a new chimney or vent sized for the application.

WARNING

Long horizontal breechings, excessive number of tees and elbows or other obstructions restricting combustion gas flow can result in possibility of condensation, flue gas leakage and carbon monoxide emissions, causing severe personal injury or death.

3- COMBUSTION AND VENTILATION AIR REQUIREMENTS

WARNING

Do not install an exhaust fan in boiler room. Adequate combustion and ventilation air must be provided to assure proper combustion and prevent possibility of flue gas leakage and carbon monoxide emissions, causing severe personal injury or death.

Recommended Combustion Air Inlets:

1. When all air is to be taken from INSIDE a building with adequate infiltration, the confined space shall be provided with two permanent openings to the room. Each opening, one located within 12" above the floor the other within 12" of the ceiling, shall have a free area of one square inch per 1,000 BTU/H for the total input of all the equipment located in the space, but not less than 100 square inches.
2. When all air is taken from OUTDOORS the confined space shall be provided with two openings, one 12" above the floor the other 12" below the ceiling. Each opening shall be sized for total input of all the equipment in the space as follows:
 - a. If directly connected to the outdoors, or if connected to the outdoors through vertical ducts: 1 square inch free area per 4,000 BTU/H total input.

b. If connected to the outdoors through horizontal ducts: 1 square inch free area per 2,000 BTU/H total input.

3. Ducts, when used, shall have the same cross sectional area as the free area of the openings to which they are connected. The minimum dimension of a rectangular air duct is 3 inches.

NOTICE

When the water heater is to be installed in beauty shops, dry cleaning establishments or other places with airborne chlorides, fluorides, hydrocarbons or cleaning fluids, it is essential the combustion air is taken from outside these areas.

4- RECOMMENDED CLEARANCES

- Clearance to combustibles:
Sides 6", Top 6", Venting 8", Rear 6", Front 6" .

NOTICE

HM water heaters are certified for combustible floors. This water heater should not be installed directly on carpet. It must be installed directly on the floor or on metal or wood panel covering the entire water heater base. The panel must be strong enough to carry the weight of the heater when full of water.

- Burner clearance:
Provide 24" clearance in front of the heater for servicing the burner.
- Check local code requirements which may require greater clearances than those specified, and specific elevation from the floor.

5- LOCATING WATER HEATER

- Locate the heater as close to the chimney or stack as practical for optimum location of the barometric damper and the shortest vent connection.

- The barometric damper should be located as close as possible to the heater and must be in the same room as the heater.

- The preferred barometric damper installations are shown in Fig. 3a & 3b, for gas installations or Fig. 3c & 3d, for oil installations.

NOTICE

This water heater is not approved for outdoors installation. It should be located indoors in an area with above freezing temperatures.

- The water heater should be located so that any leakage from the tank or water connections will not cause damage to the area adjoining the water heater or to lower floors in the structure.

- When such a location is unavoidable a suitable drain pan with adequate drainage, should be placed under the water heater. The pan must not restrict combustion air flow.

6- OPERATING RESTRICTIONS

- Maximum working pressure for inner (domestic water) tank is 150 psig.
- Maximum working pressure for outer (primary water) tank is 45 psig.
- Maximum domestic hot water temperature is 180°F (use only for special high-temperature operational requirements).
- A Temperature & Pressure Relief Valve with an AGA rating of 200,000 Btu/hr is provided with HM-40, HM-45 and HM-80 water heater.
- A Temperature & Pressure Relief Valve with an AGA rating of 500,000 Btu/hr is provided with HM-60, HM-90 and HM-100 water heater.
- A 30 psig pressure relief valve, rated at 535,000 Btu/hr, is provide with the water heater.
- Electrical rating:120 V, 60 Hz, less than 12 amperes

- Single wall heat exchanger in water heater complies with National Standard Plumbing Code, provided that:
 - Outer tank water (including additives) is practically non-toxic, having toxicity rating or class of 1, as listed in Clinical Toxicology of Commercial Products,
 - Outer tank pressure is limited to maximum 30 psig by approved relief valve.
- Single wall heat exchangers are permitted under the Uniform Plumbing code - Paragraphs L3.2 and L3.3 if they satisfy all of the following requirements.
 - 1.The heat transfer medium is potable water or contains only substances which are recognized as safe by the U.S. Food and Drug Administration.
 - 2.The pressure of the heat transfer medium is maintained less than the normal minimum operating pressure of the potable water system
 - 3.The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat transfer medium.
- pH & chloride limits for water heater are:
 - Chloride, less than 80 mg/l.
 - pH, 7.

Gas Fired Installations

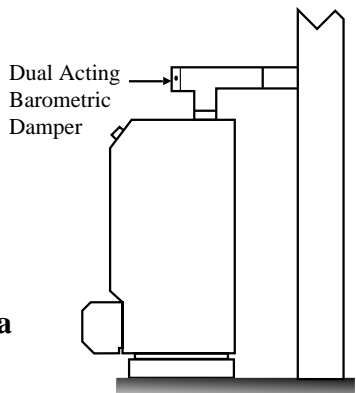


Fig. 3a

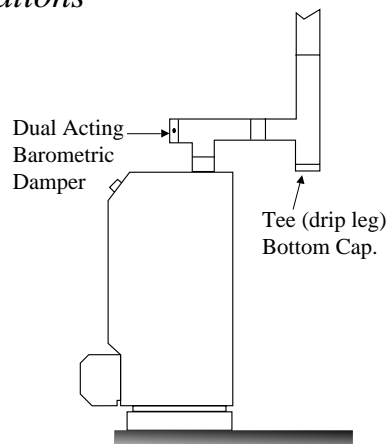


Fig. 3b

Oil Fired Installations

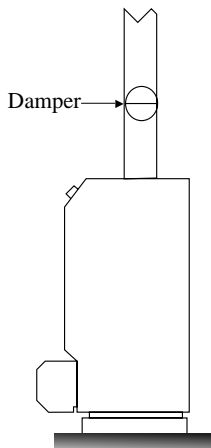


Fig. 3c

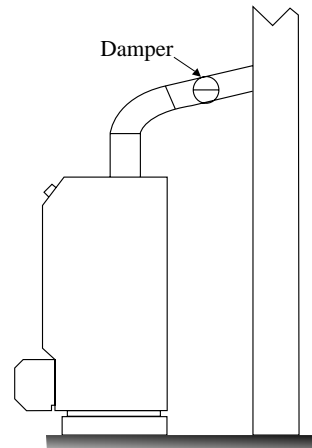


Fig. 3d

1- VENTING THE WATER HEATER

- Use vent materials approved by local codes for gas-fired or oil-fired appliances. In their absence refer to:
 - National Fuel Gas Code, ANSI Z223.1.
 - NFPA 31, Installation of Oil Burning Equipment.
 - In Canada, refer to CAN/CGA B149 Installation Code for Gas Fired Equipment.
 - In Canada, refer to CAN/CSA B139 Installation code for Oil Fired Equipment.
 - NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.
- NFPA 211 requires chimney to be lined before connected to water heater.
- Refer to ASHRAE Guide for chimneys to be lined before connected to water heater.
- The water heater should be connected to a flue having sufficiency draft at all times to assure proper operation of the unit.
- The draft control is the same size as the vent connector on the water heater.
- The preferred barometric damper installations are described under “Locating Water Heater” and Figs.3a, 3b, 3c and 3d.
- Horizontal vent connections should be without dips and have an upward slope to the chimney of 1/4” per linear foot.
- When entering into the chimney, the connector end shall be prevented from entering so far as to restrict the space between it and the opposite wall of the chimney.
- Vent connector joints should be securely fastened with screws.
- When two or more appliances are connected to a common vent or manifold, the area of the common vent or manifold should be at least equal to the area of the largest single vent plus 50% of the vent areas of the other connected appliances.

2- PIPING THE WATER HEATER

A-Thermal Expansion

If a backflow preventer, check valve, or pressure reducing valve is piped on cold water inlet, install an expansion tank on cold water supply line to prevent normal thermal expansion from repeatedly forcing open T&P relief valve.

CAUTION

T&P relief valve is not intended for constant duty, such as relief of pressure due to repeated normal system expansion. Correct this condition by installing a properly sized expansion tank in domestic water system. Refer to expansion tank manufacturer’s instructions for proper sizing.

B- Air Vent

- Air vent is factory installed on the heater.
- Unscrew vent cap on air vent one full turn. Leave cap unscrewed one turn for normal venting.

C- Temperature and Pressure Relief Valve

- T&P relief valve is factory installed on inner tank of the heater.
- T&P relief valve discharge piping must be:
 - made of material serviceable for temperatures of 250°F or greater
 - directed so that hot water flows away from all persons.
 - directed to a suitable place for disposal.
 - installed so as to allow complete draining of the T&P relief valve and discharge line.
- T&P relief valve discharge piping **must not** be:
 - excessively long. Using more than 2 elbows or 15 feet of piping can reduce discharge capacity.
 - directly connected to a drain. Terminate discharge piping within 6” from floor. Refer to local codes.

- plugged, reduced or restricted.
- subjected to freezing.

WARNING

Do not install any valve between T&P relief valve and tank connection, or on T&P relief valve discharge piping. Do not plug T&P relief valve or discharge piping. Improper placement and piping of T&P relief valve can cause severe personal injury, death or substantial property damage.

D- Pressure Relief Valve

- Pressure relief valve is factory installed on outer tank of the heater.
- Provide safe discharge through piping near floor or close to floor drain. Relief valve must be installed so that the spindle is vertical.

WARNING

To avoid scalding or water damage, relief valve discharge must be piped near floor or close to floor drain. Do not plug, valve or place any obstruction in discharge piping.

E- Water hammer

Dishwashers, clothes washers and fast-closing positive shut-off valves incorporated in the system all contribute to creating water shock. Install a water hammer arrester to prevent damage to pipes and appliances. See manufacturer's instructions for application and installation.

F- Vacuum Breaker

Installing a vacuum breaker on the domestic cold water inlet will prevent damage to the inner tank, if a negative pressure is developed in the domestic supply line. See control manufacturer's instructions for application and installation.

3. GENERAL PIPING

- All plumbing must meet or exceed all local, state and national plumbing codes.
- Use pipe dope or tape suitable for potable water on the domestic piping.

5. INNER TANK (DOMESTIC) PIPING

- For recommended domestic piping, see Fig. 4 through Fig. 9.
- Union on domestic hot water outlet should be at a higher elevation than domestic water drain valve. This will make draining the water heater easier.
- Install unions for easy removal of water heater. Use dielectric unions or couplings to protect hot and cold water fittings from corrosion when connecting dissimilar materials such as copper and galvanized iron pipe.
- When water supply pressure is higher than T&P relief valve rating, install a pressure reducing valve on cold water supply line to prevent water loss through T&P relief valve.

5. PRIMARY (OUTER TANK) PIPING

- In some applications, the primary water of the outer tank may be used to provide space heating. It is recommended that the load of the space heating remain relatively minimal as a means to maintain the high recovery rate for domestic water production.
- It is the responsibility of the installer to provide the HM Series Water Heater with the necessary components for "near appliance" piping that are required on all hydronic systems i.e. expansion tank, air elimination devices...

NOTICE

The HM Series Water Heater is provided with expansion tank(s) for the outer tank. The factory installed expansion tank(s) will **not** provide adequate expansion volume for the space heating system.

NOTICE

Local or State Plumbing Codes may require the use of a backflow preventer on the factory installed automatic fill system for the outer tank when using the HM series water heater for space heating applications.

- For recommend primary piping when using the HM Series Water Heater in conjunction with a TR Series Water Heater see Fig. 10 through Fig. 12.
- For recommend primary piping for space heating applications see Fig. 13 and Fig. 14.
- If plastic is used for primary water connections, it must not exceed a maximum oxygen diffusion rate of 0.1 mg/liter-day for water heater protection.
- Primary water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in Clinical toxicology of Commercial Products.
- If antifreeze is used in the primary (outer tank) system, local codes may require a backflow preventer on cold water supply line. Use **antifreeze specifically intended for hydronic heating systems. Inhibited propylene glycol is recommended.**

DANGER

Do not use automotive, ethylene glycol or any undiluted or petroleum-based antifreeze. This can cause severe personal injury, death or substantial property damage.

- Any water conditioning system must be installed and maintained in accordance with manufacturer's specifications.

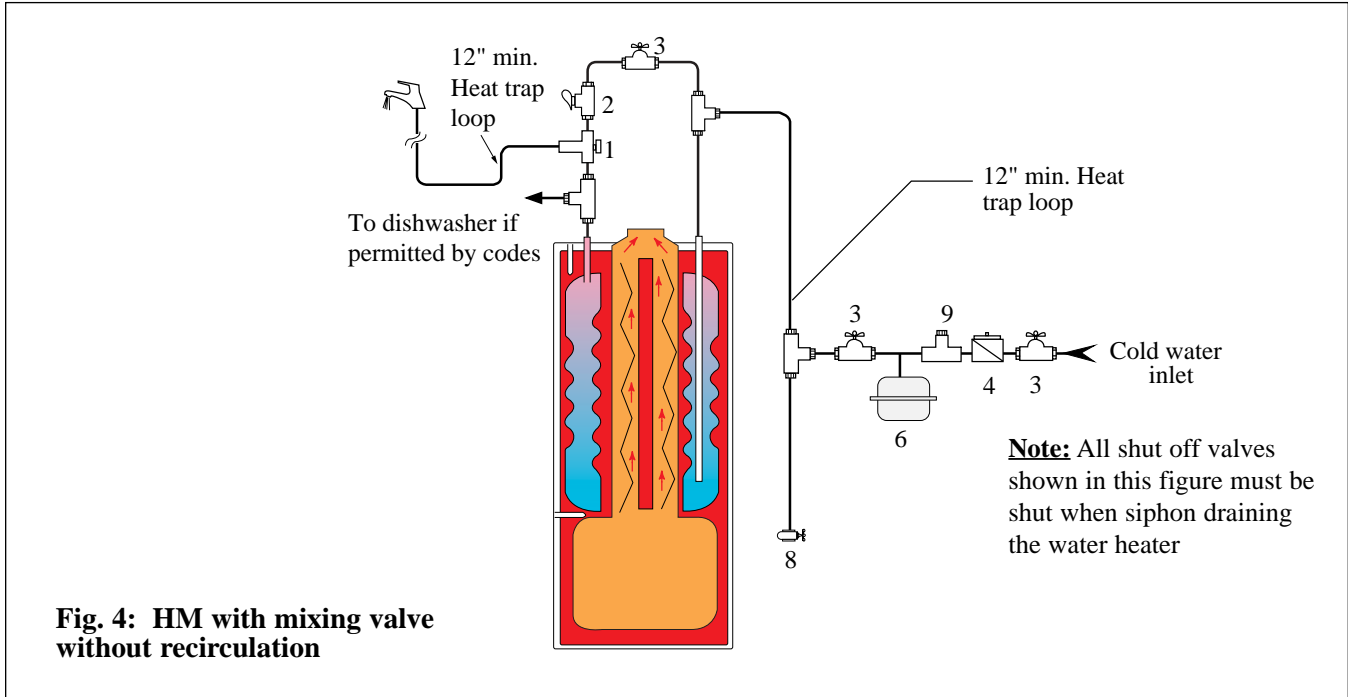
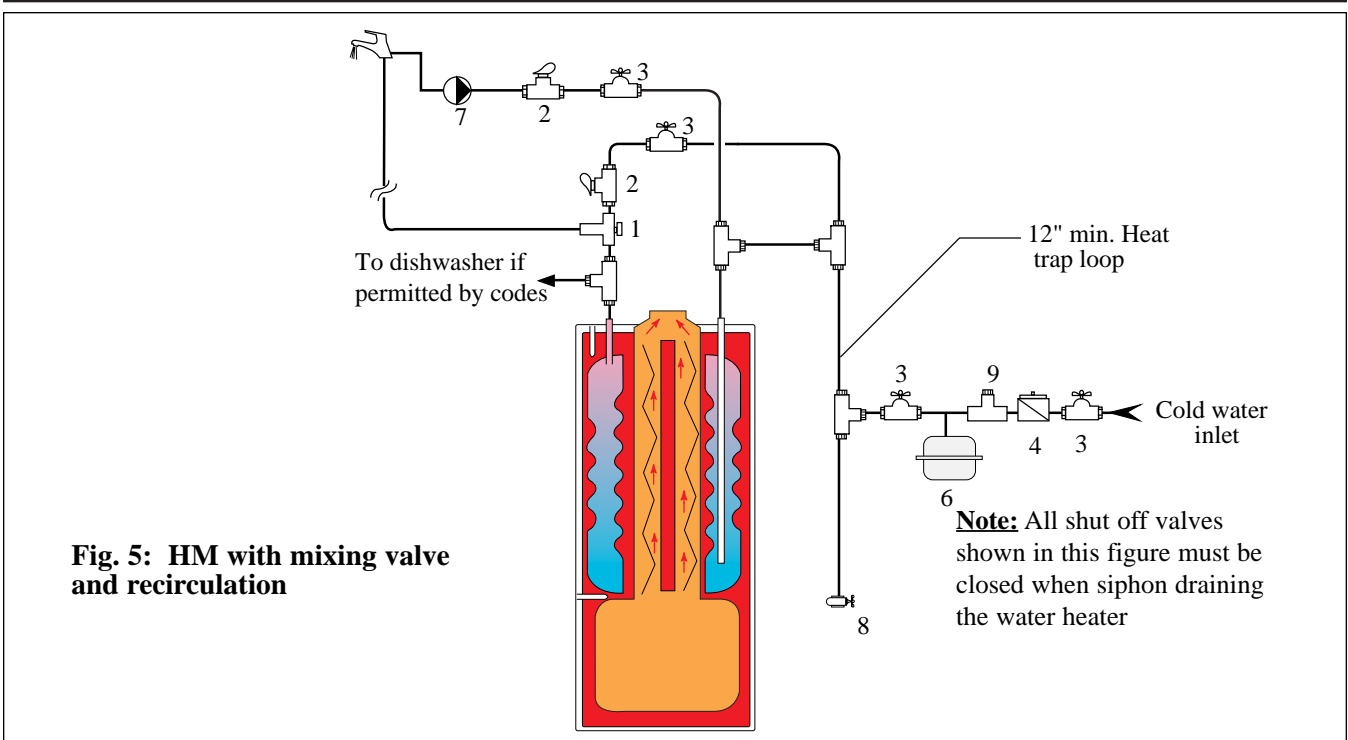
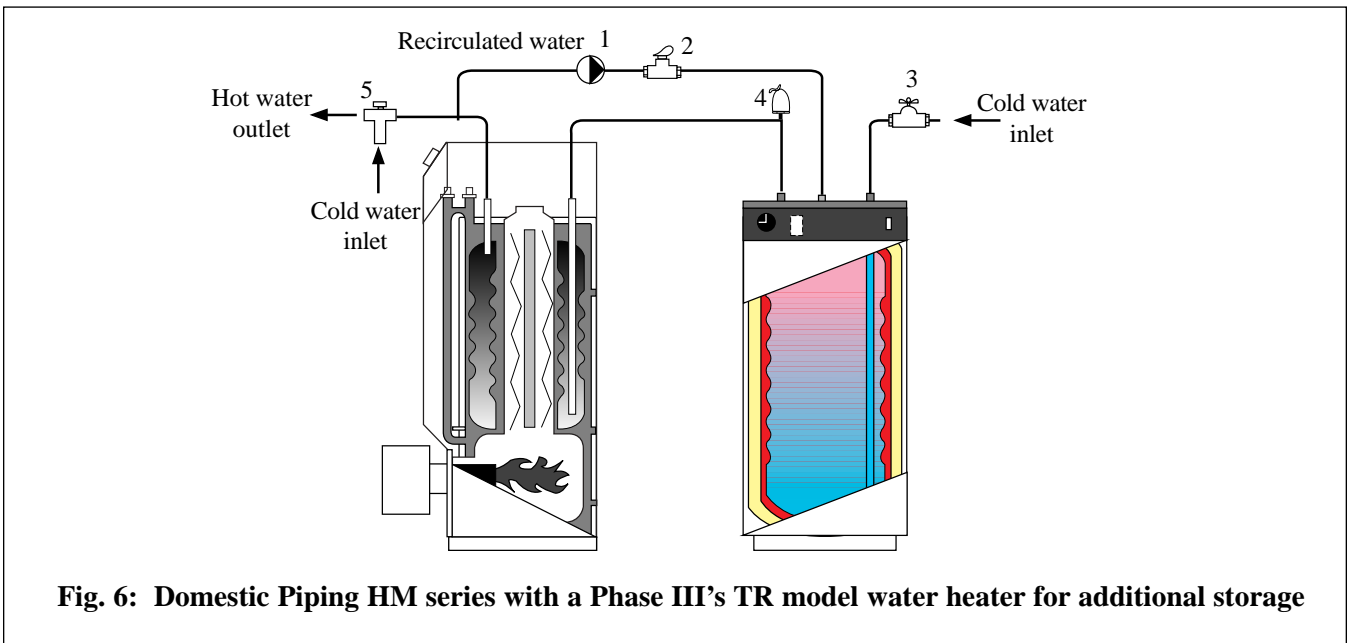


Fig. 4: HM with mixing valve without recirculation

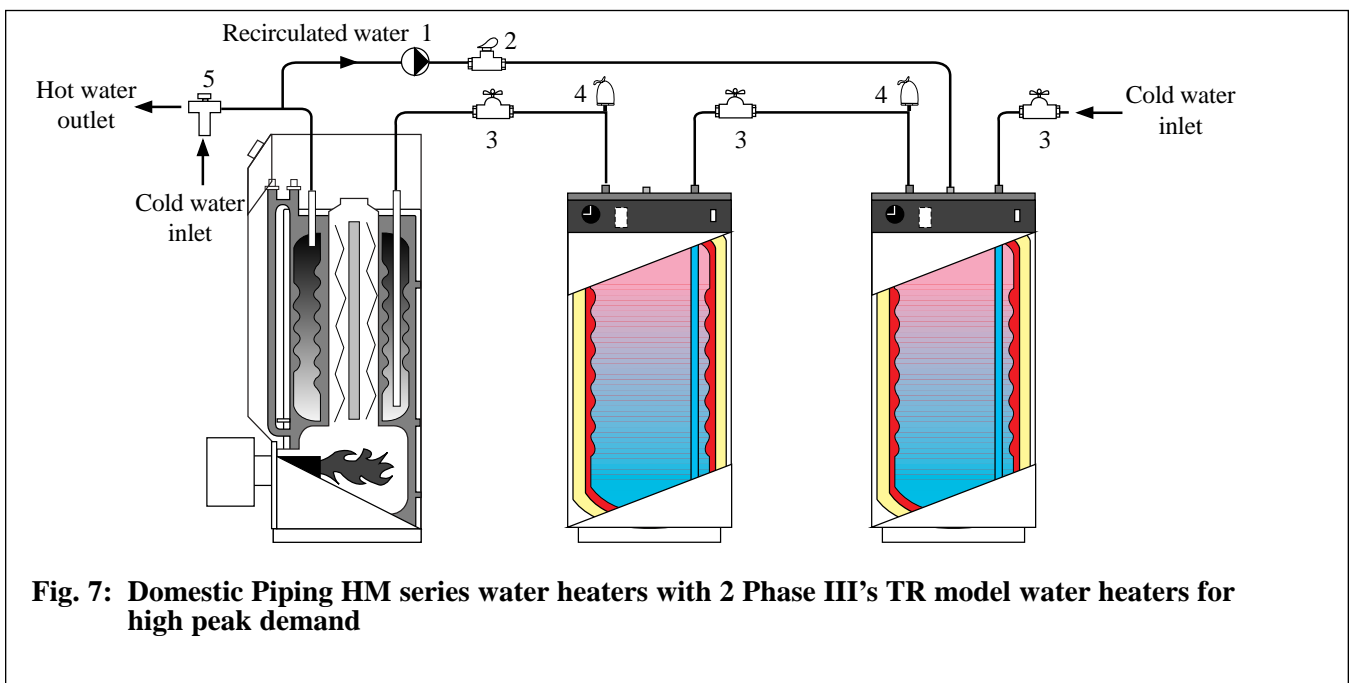
- | | |
|--|--|
| 1. Mixing valve | 6. Thermal expansion tank |
| 2. Flow check valve | 7. Circulator (controlled by aquastat) |
| 3. Shut off valve | 8. Domestic drain valve |
| 4. Backflow preventer or pressure reducing valve | 9. Vacuum breaker |
| 5. T&P relief valve | |



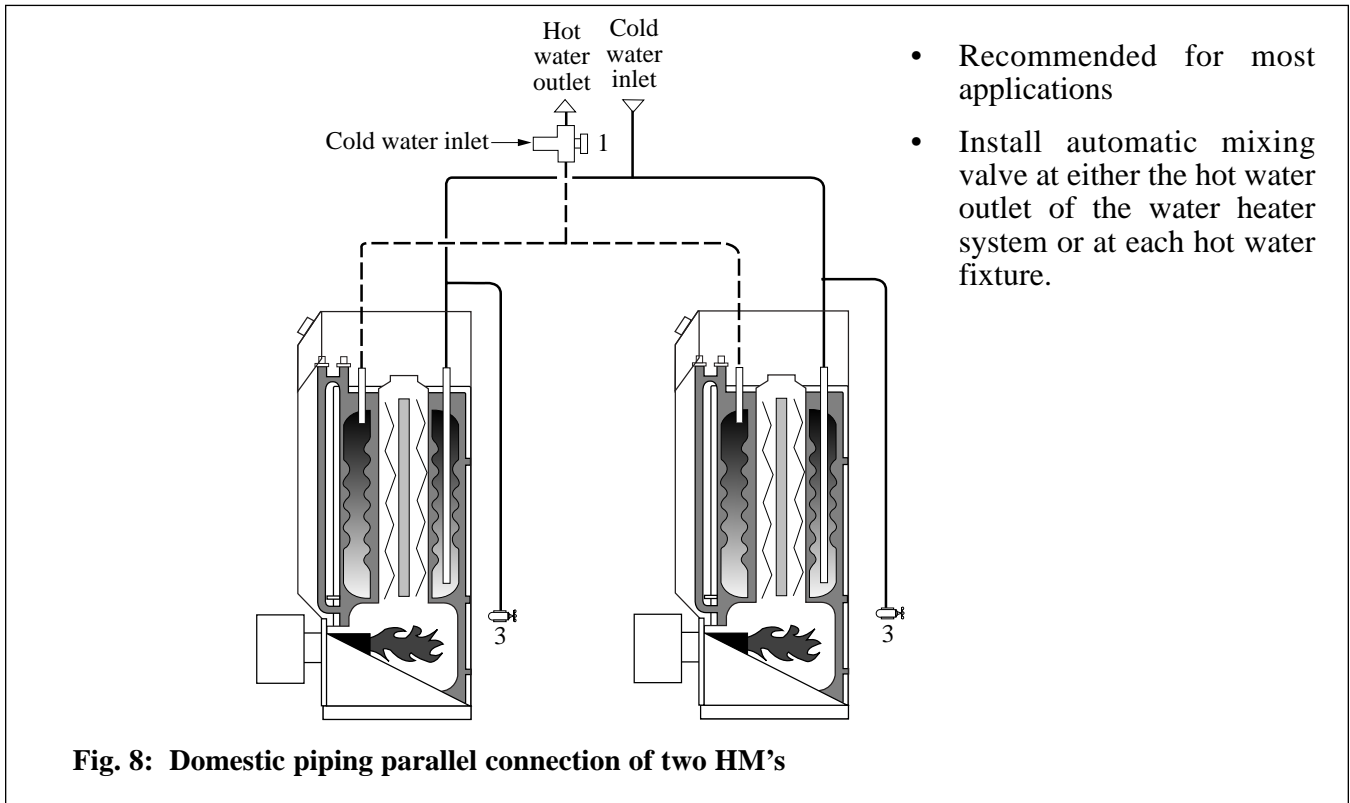
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|--|--|
| 1. Mixing valve | 5. T&P relief valve |
| 2. Flow check valve | 6. Thermal expansion tank |
| 3. Shut off valve | 7. Circulator (controlled by aquastat) |
| 4. Backflow preventer or pressure reducing valve | 8. Domestic drain valve |



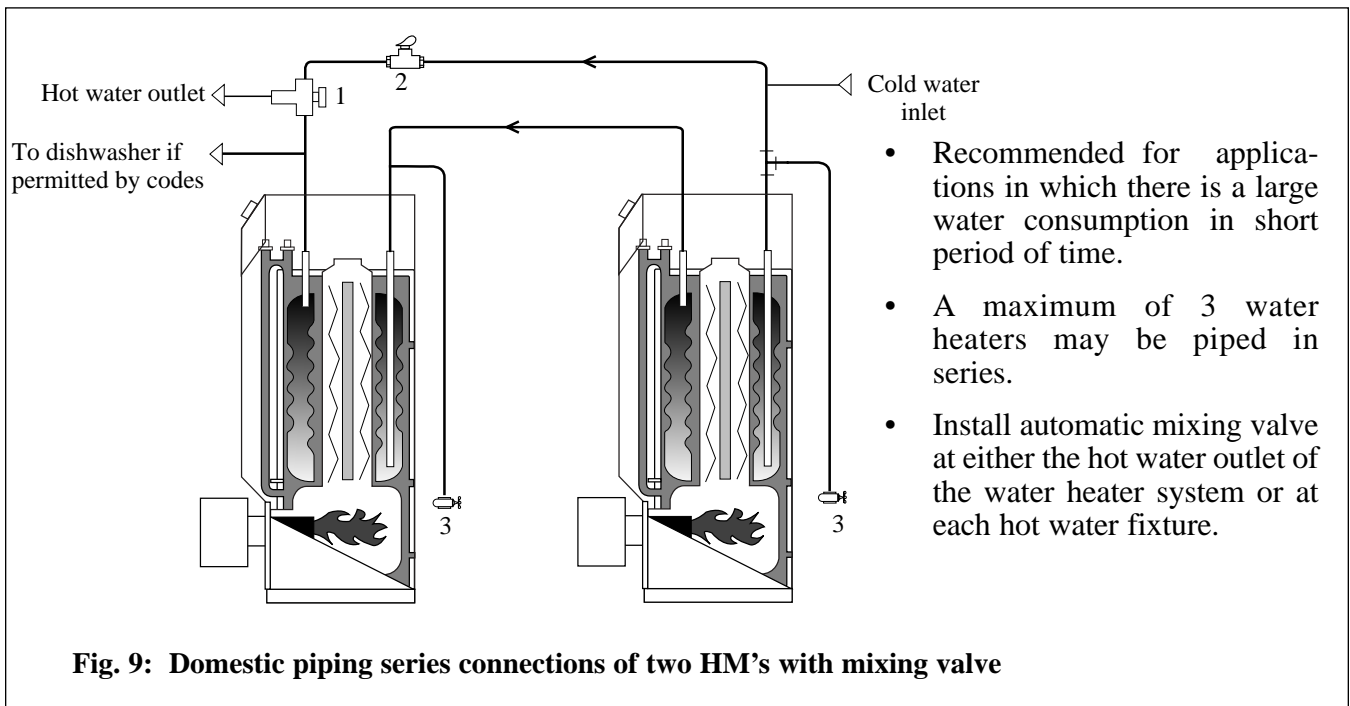
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| 1. Circulator | 4. T&P relief valve |
| 2. Flow check valve | 5. Mixing Valve |
| 3. Shut off valve | |



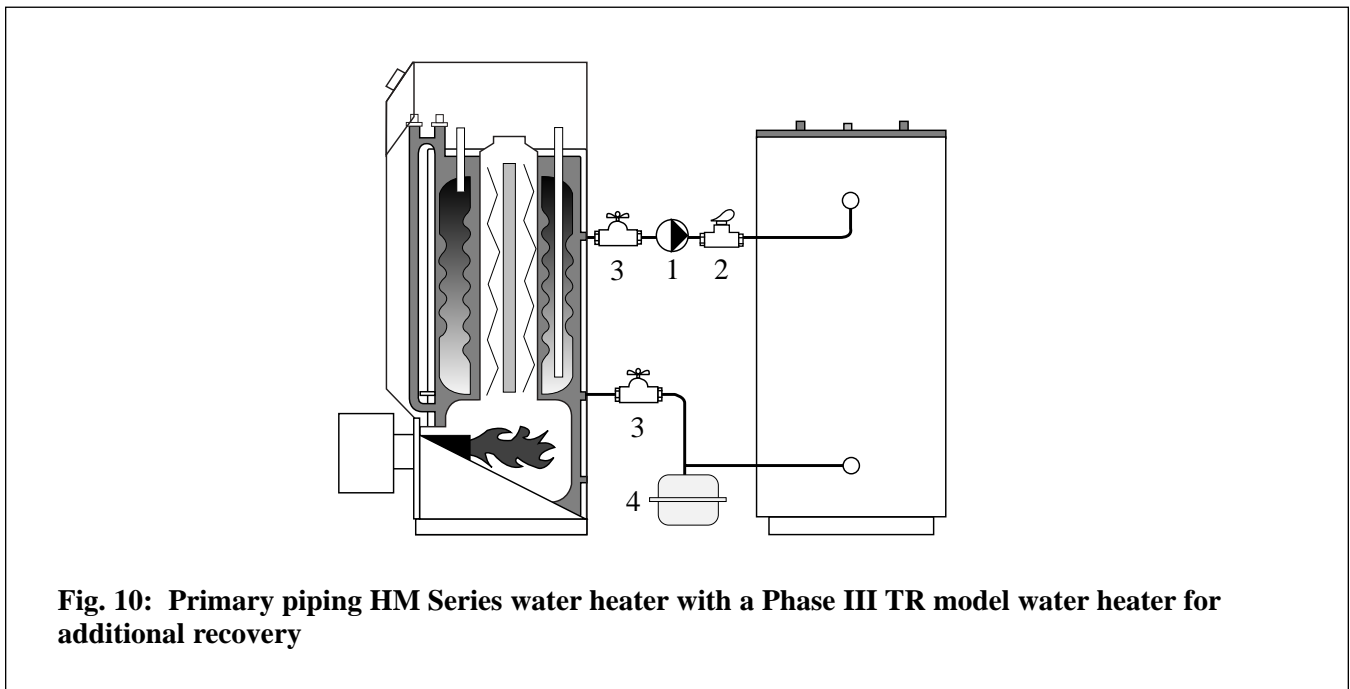
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|---------------------|---------------------|
| 1. Circulator | 4. T&P relief valve |
| 2. Flow check valve | 5. Mixing Valve |
| 3. Shut off valve | |



- | | |
|---------------------|-------------------------|
| 1. Mixing valve | 3. Domestic drain valve |
| 2. Flow check valve | |



- | | |
|---------------------|-------------------------|
| 1. Mixing valve | 3. Domestic drain valve |
| 2. Flow check valve | |



- | | |
|---------------------|---------------------|
| 1. Circulator | 3. Shut off valve |
| 2. Flow check valve | 4. T&P relief valve |

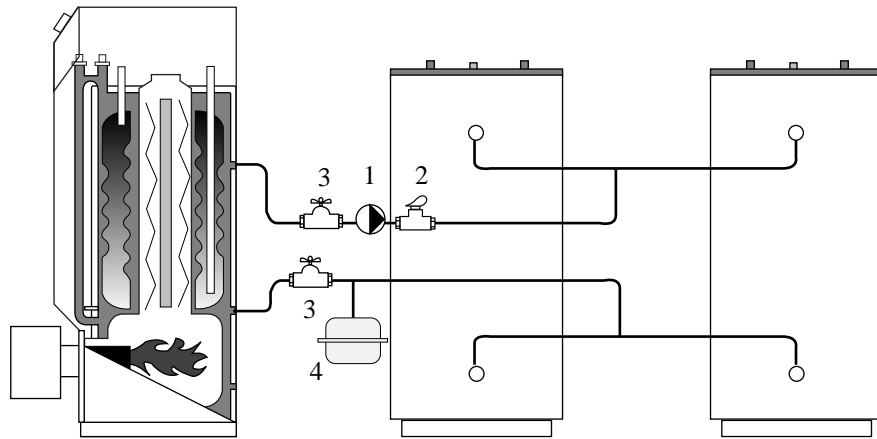


Fig. 11: Primary piping HM Series water heater with 2 Phase III TR model water heater (parallel piping)

- | | |
|---------------------|---------------------|
| 1. Circulator | 3. Shut off valve |
| 2. Flow check valve | 4. T&P relief valve |

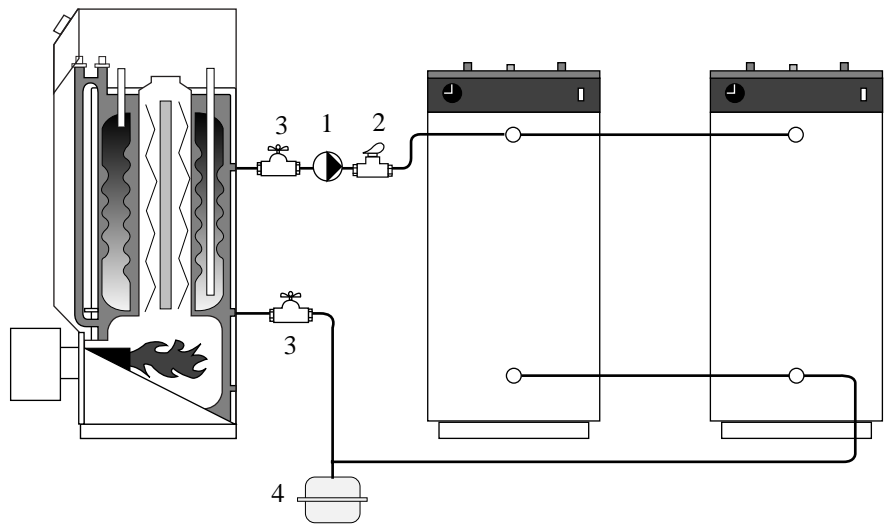
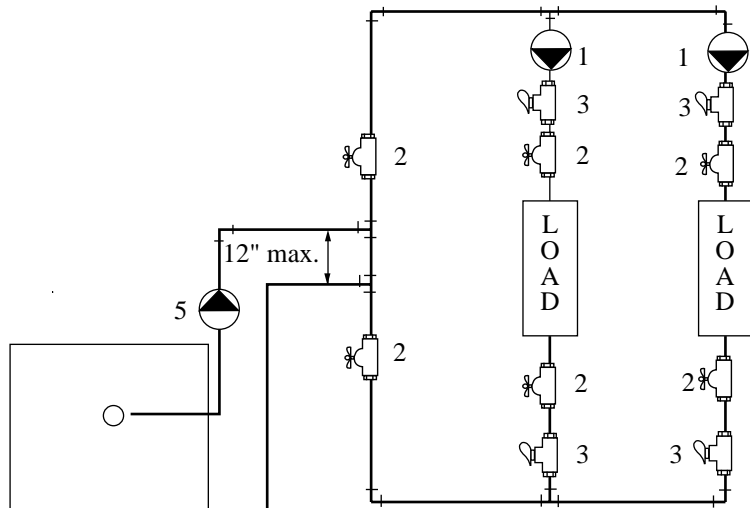


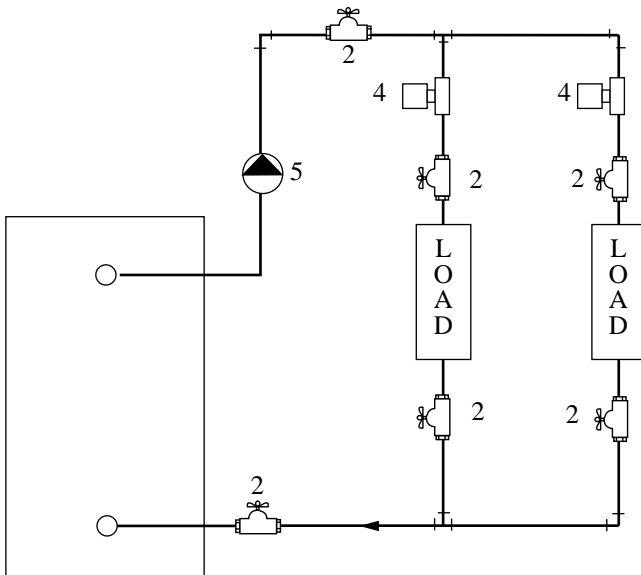
Fig. 12: Primary piping HM Series water heater with 2 Phase III TR model water heaters (series piping)

- | | |
|---------------------|-------------------|
| 1. Circulator | 3. Shut off valve |
| 2. Flow check valve | 4. Expansion tank |



- Size primary manifold for total flow of all circulators
- Size each circulator to individual circuit requirements
- Install balancing valves to adjust flow to distribute heat to all zones
- Install “near appliance” components i.e.: Expansion tank, air vents...

Fig. 13: Space Heating Piping - Zoning with Circulators



- Install balancing valves to adjust flow to distribute heat to all zones
- Install “near appliance” components i.e.: Expansion tank, air vents...

Fig. 14: Space Heating Piping - Zoning with Zone Valve

- | | |
|---------------------------|-------------------------|
| 1. Circulator - Zone | 4. Zone valve |
| 2. Manual shut-off valves | 5. Circulator - Primary |
| 3. Flow check valve | |

7- WATER HEATER WIRING

CAUTION

Electrical shock hazard. Can cause severe personal injury, death or substantial property damage. Disconnect power before installing and/ or servicing.

General Wiring

- All wiring must be a minimum of 14 gauge and installed in accordance with:
 - U.S.A. - National Electrical Code ANSI/NFPA 70- latest edition and any other national, state or local code requirements having jurisdiction.
 - Canada - C.S.A. C22.1 Canadian Electrical Code Part 1 and any other national, provincial and local code requirements having jurisdiction.
- If original wire, supplied with appliance must be replaced, Type 90°C or its equivalent must be used.

CAUTION

The 115V, 6 amp electrical outlet reciprocal located on the console panel has LINE VOLTAGE present when water heater service switch is in either the ON or OFF position.

Space Heating Application

- For field wiring using zone circulators see Fig.: 16.
- For field wiring using zone valves see Fig.: 17.
- For field wiring using zone circulators with domestic priority see Fig.: 18
- For field wiring using zone valves with domestic priority see Fig.: 19.

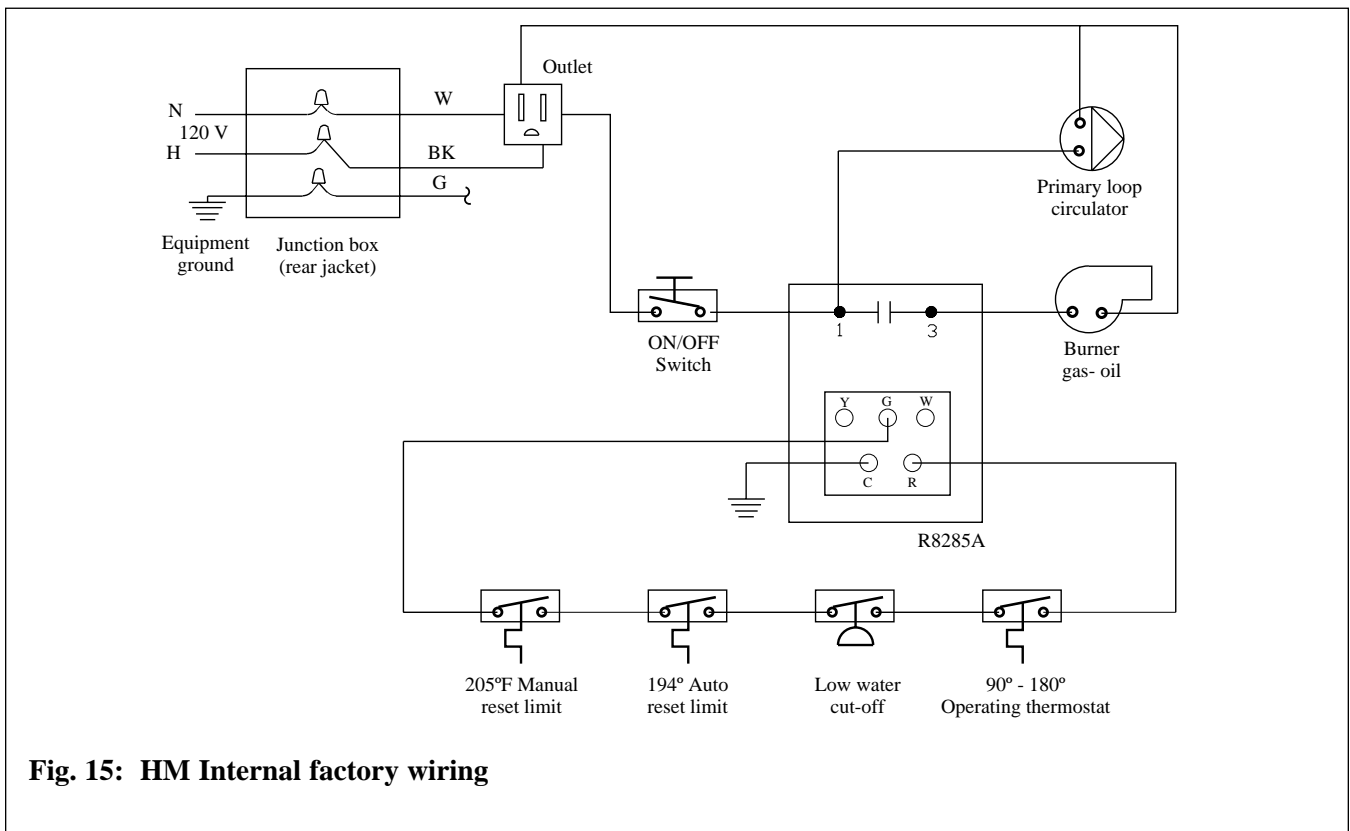


Fig. 15: HM Internal factory wiring

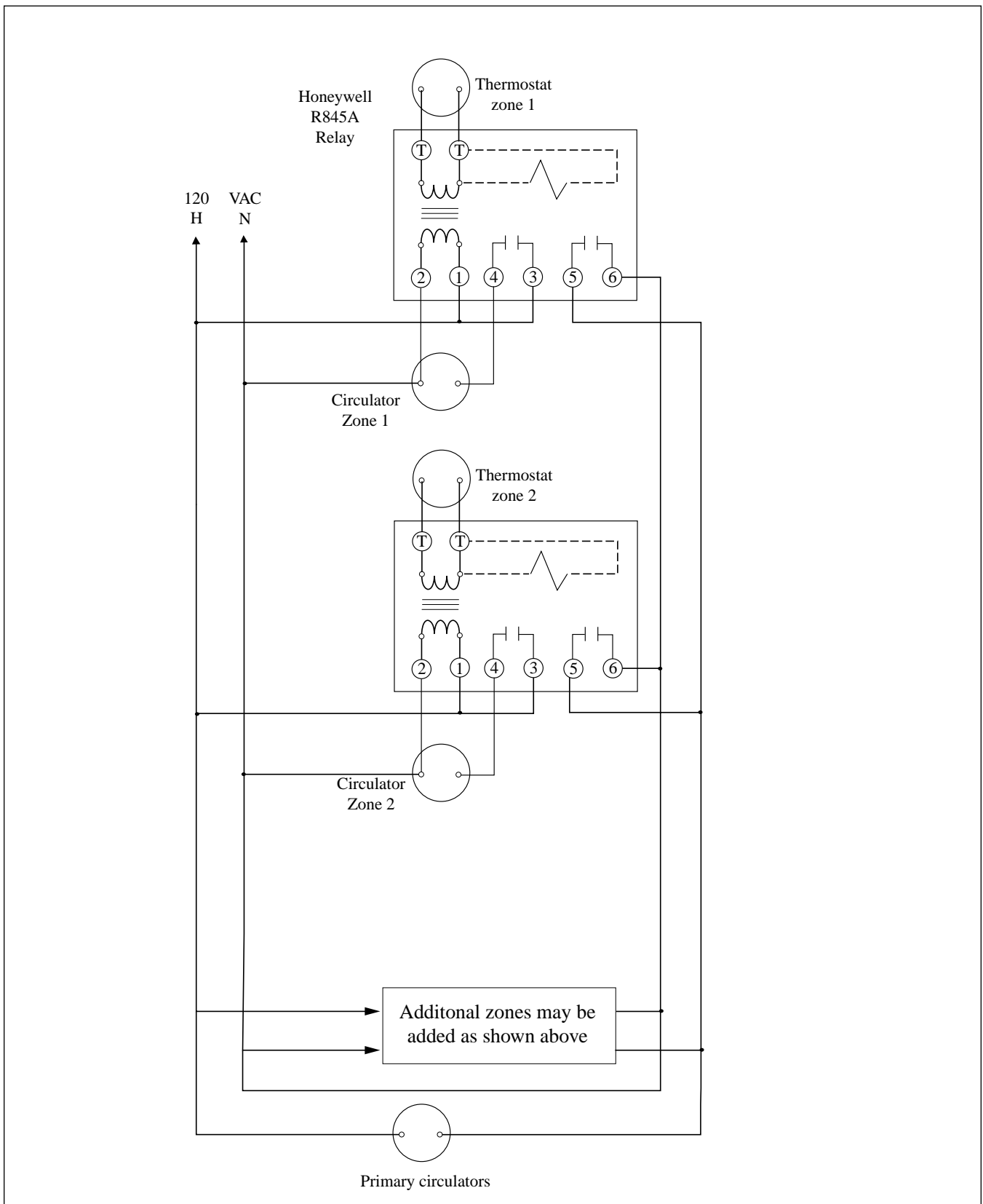
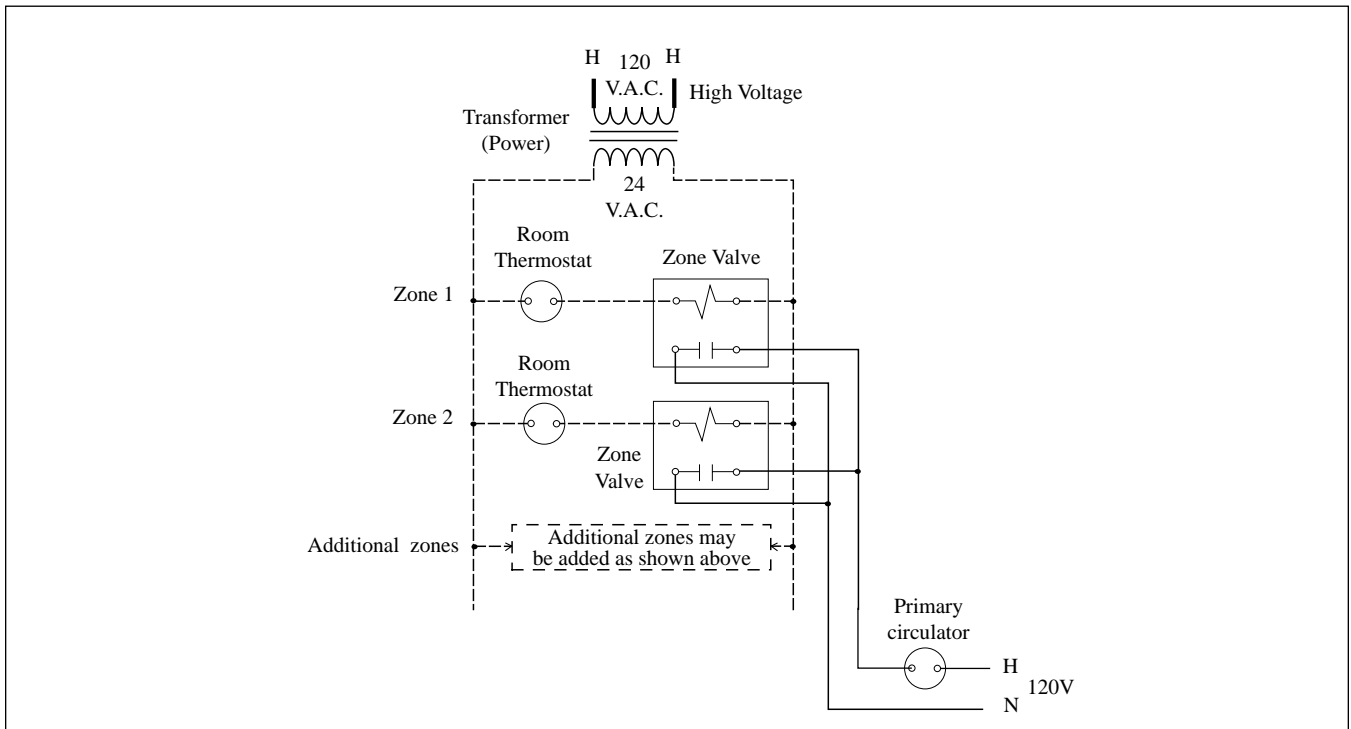


Fig. 16: Field wiring for space heating using zone circulators without domestic priority

4 Wire Zone Valve



3 Wire Zone Valve

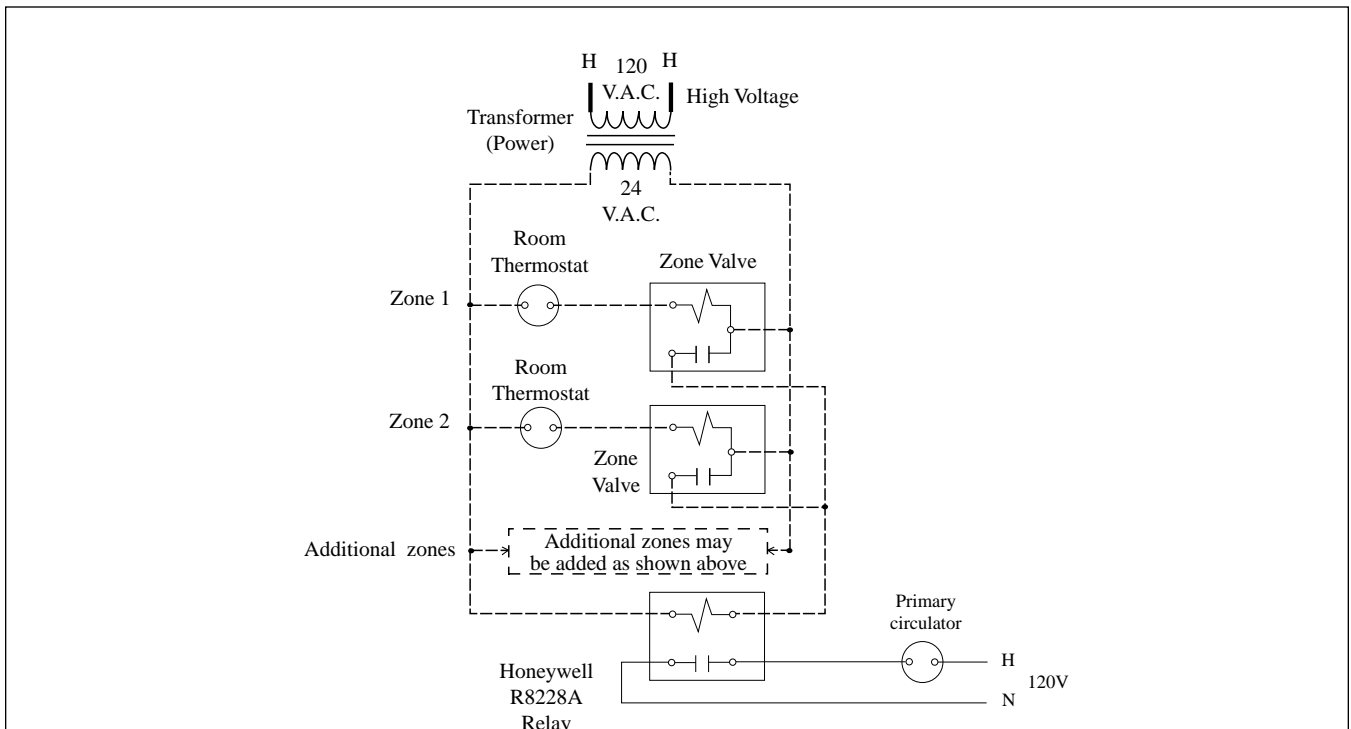


Fig. 17: Multiple zone field for space heating wiring using zone valves

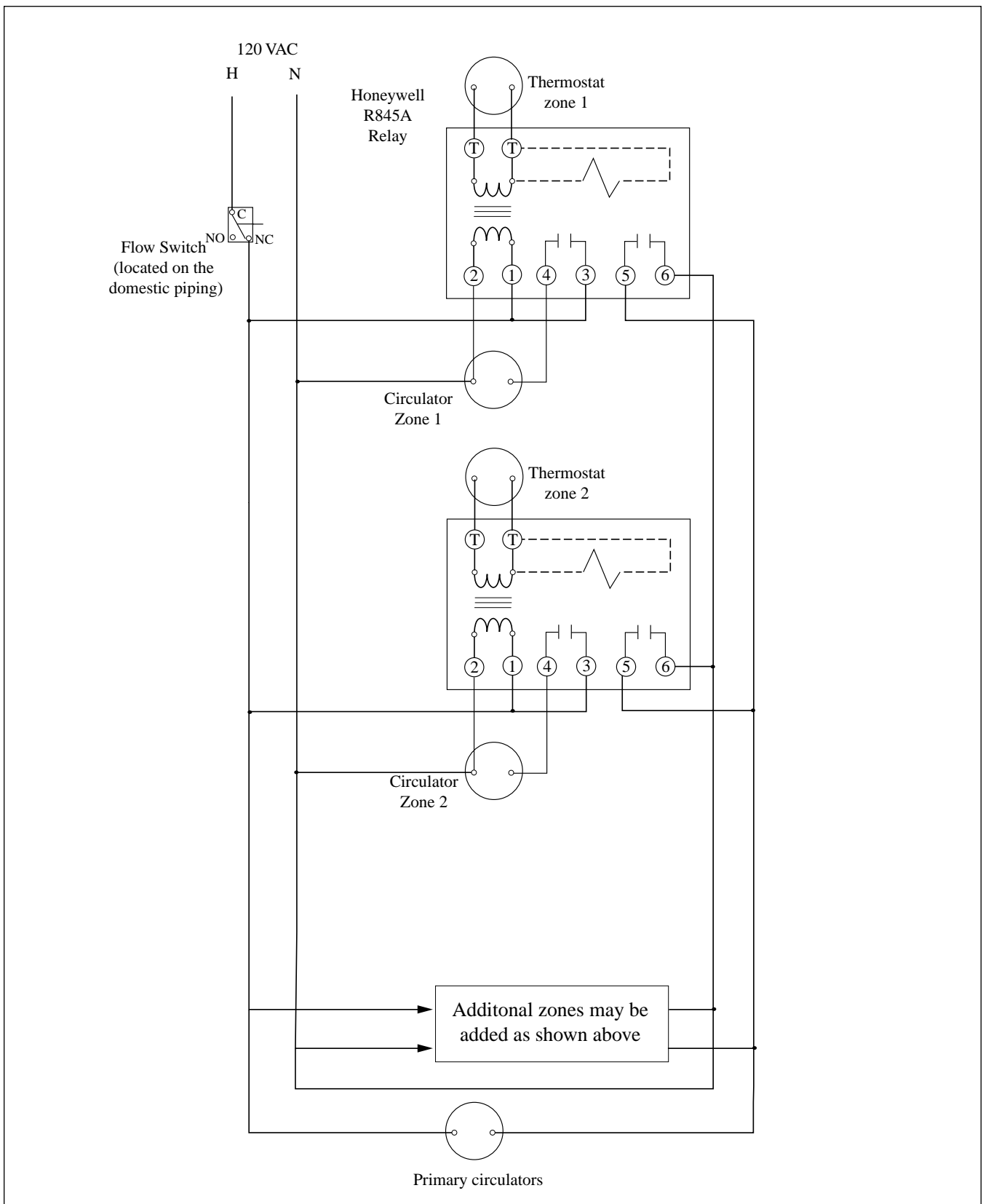
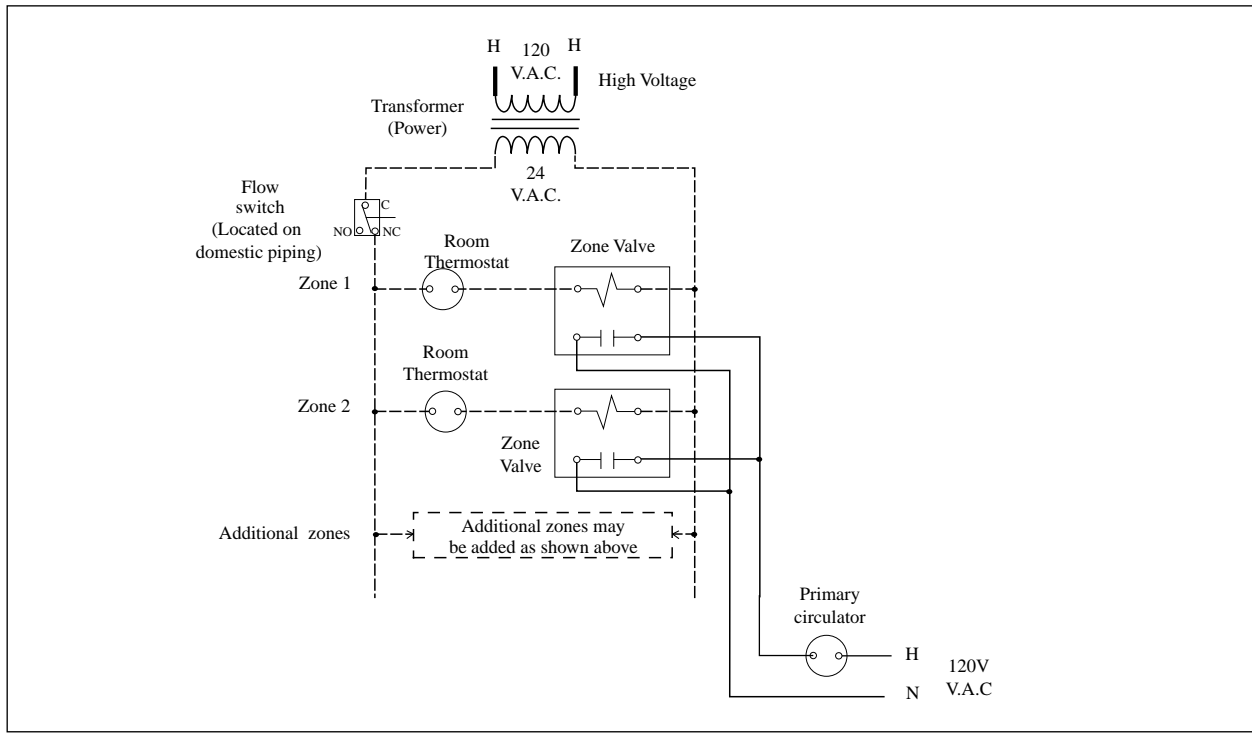


Fig. 16: Field wiring for space heating using zone circulators with domestic priority

4 Wire Zone Valve



3 Wire Zone Valve

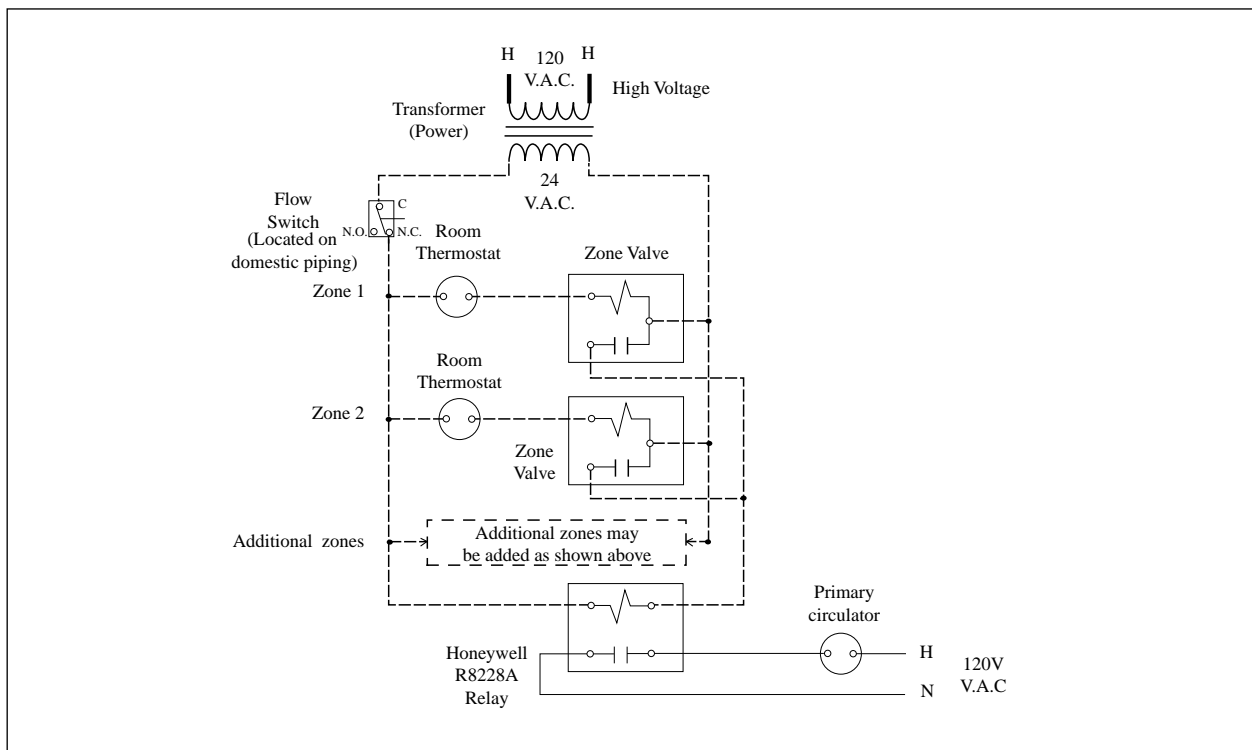


Fig. 19: Multiple zone field wiring for space heating using zone valves with domestic priority

GAS BURNER INSTALLATION

1. MOUNTING THE GAS BURNER

- To mount, set up and operate the burner, refer to the burner manufacturer's installation guide shipped with the burner.

2. WIRING THE GAS BURNER

WARNING

Electrical shock hazard. Can cause severe personal injury, death or substantial property damage. Disconnect power before installing and/or servicing.

- All burners must be wired for direct line voltage control using metal clad wire harness supplied with the water heater.
- No additional thermostats or limit controls are required for burner control.
- Refer to the burner manufacturers installation instructions for direct line voltage control wiring connections.

3. GAS SUPPLY PIPING

- Check that the gas supply meter has sufficient capacity for the full input of the unit and any other appliances on the meter.
- Refer to Figure 22 for recommended gas piping.
- Support gas piping with hangers, not by the heater or its accessories.
- Purge all air from gas supply piping.
- Before placing the water heater into operation check the gas connections for leaks.
 - Close manual main shut-off valve during any pressure testing at less than 13"W.C.
 - Disconnect heater and gas valve from gas supply piping during any pressure testing greater than 13"W.C.

WARNING

Do not check for gas leaks with an open flame - use bubble test. Failure to use bubble test or check for gas leaks can cause severe personal injury, death or substantial property damage.

- Use pipe dope compatible with natural and/or propane gas. Apply sparingly only to male threads of pipe joints so that pipe dope does not block gas flow.

WARNING

Failure to apply pipe dope as detailed above can result in severe personal injury, death or substantial property damage.

Natural Gas:

1. Refer to chart 1 for pipe length and diameter. Base on rated water heater input (divide input by 1,000 to obtain cubic feet per hour).
2. Inlet pressure at gas valve inlet: maximum 13"W.C, minimum 4"W.C.
3. Install 100% lock-up gas pressure regulator in supply line if inlet pressure exceeds 13"W.C. Adjust for 13"W.C. maximum.

Propane Gas:

1. Refer to chart 1A for pipe length and diameter.
2. Contact gas supplier to properly size pipes, tanks and 100% lock-up gas pressure regulator.
2. Adjust regulator provided by gas supplier for 14"W.C. maximum pressure.
3. Inlet pressure at gas valve inlet: maximum 14"W.C, minimum 11"W.C.

Chart 1: Gas pipe sizing natural gas

Maximum Capacity of Pipe in Cubic Feet of Natural Gas per Hour for Gas Pressures of 0.5 Psig (14" water column) or less and a Pressure Drop of 0.3 Inch Water Column (Based on a 0.60 Specific Gravity Gas)														
Nominal SCH 40 Pipe Size, Inches	Length of Pipe, Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1	520	350	285	245	215	195	180	170	160	150	130	120	110	100
1 1/4	1,050	730	590	500	440	400	370	350	320	305	275	250	225	210
1 1/2	1,600	1,100	890	760	670	610	560	530	490	460	410	380	350	320
2	3,050	2,100	1,650	1,450	1,270	1,150	1,050	990	930	870	780	710	650	610
2 1/2	4,800	3,300	2,700	2,300	2,000	1,850	1,700	1,600	1,500	1,400	1,250	1,130	1,050	980

Chart 1A: Gas pipe sizing - L.P.G

Maximum Capacity of Pipe in Thousands of Btu per Hour of Undiluted Liquefied Petroleum Gases (at 11 Inches Water Column Inlet Column) (Based on a Pressure Drop of 0.5 Inch Water Column)														
Nominal SCH 40 Pipe Size, Inches	Length of Pipe, Feet													
	10	20	30	40	50	60	70	80	90	100	125	150		
1	1,071	732	590	504	448	409	378	346	322	307	275	252		
1 1/4	2,205	1,496	1,212	1,039	913	834	771	724	677	630	567	511		
1 1/2	3,307	2,299	1,858	1,559	1,417	1,275	1,181	1,086	1,023	976	866	787		

- For additional piping schedules, see ANSI Z223.1
- Canadian installations must comply with CAN/CGA B149.1 or B149.2 Installation Code.

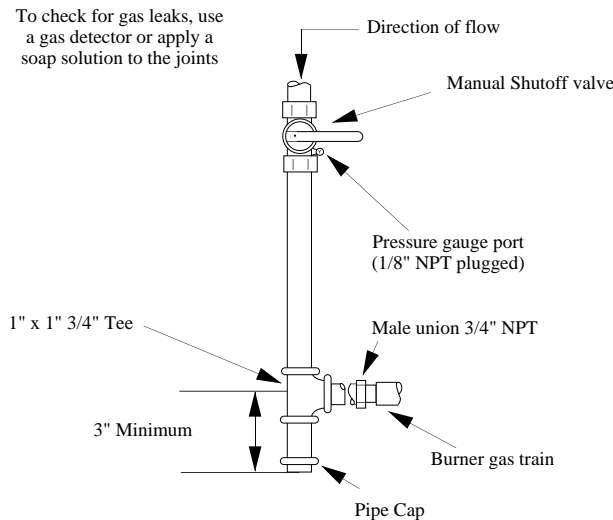


Fig. 14: Gas supply piping

4. GAS BURNER SET UP

- Follow the burner manufacturer's installation manual
- Using combustion test equipment, adjust burner for:
 - Between 9% and 10% CO₂
 - CO in flue gas not exceed 300 ppm (0.03%)
- Any other checks and adjustments recommended by the burner manufacturer must be completed before attempting to start the burner.

OIL BURNER INSTALLATION

1- MOUNTING THE OIL BURNER

- To mount, set-up and operate the burner, refer to the burner manufacturer's installation guide shipped with the burner.

2- WIRING THE OIL BURNER

WARNING

Electrical shock hazard. Can cause severe personal injury, death or substantial property damage. Disconnect power before installing and/or servicing.

- All burners must be wired for direct line voltage control using the metal clad wire harness supplied with the heater.
- No additional thermostats or limit controls are required for burner control.
- Refer to the burner manufacturer's installation instructions for direct line voltage control wiring connections.

3- FUEL UNITS/FUEL LINES

- Fuel systems must be installed in accordance with all local codes and authorities having jurisdiction, in their absence refer to:

- NFPA 31, Standard for the Installation of Oil-Burning Equipment
- In Canada, CSA B139, Installation of Oil-Burning Equipment
- Information provided with Burner and Fuel Pump

- Refer to the burner manufacturer's lift and tank installation for the fuel unit supplied with the burner.
- When installing oil lines, continuous runs of correctly sized heavy wall copper tubing are recommended. Always use flared fittings. Do not use compression fittings or Teflon tape on any oil line connections.
- Install an oil line filter in the supply line as close to the tank as practical.
- Locate fusible shut off valves between the tank and the filter and near the burner for ease of service.
- When a float valve is used with a supply tank over 9 gallon capacity, the fusible shut off valve shall be installed in the fuel line adjacent to, and up stream of the float valve.

4. OIL BURNER SET UP

- Follow the burner manufacturer's installation manual.
- Using combustion test equipment, adjust burner for:
 - CO₂ between 11% and 12%
 - 0 to trace smoke
- Any other checks and adjustments recommended by the burner manufacturer must be completed before attempting to start the heater.

CAUTION

Do not attempt to start the burner when excess oil has accumulated, when the unit is full of vapor, or when the combustion chamber is very hot.

Water Heater Start-Up

1- FILLING THE INNER TANK (Domestic Water)

CAUTION

Never use water heater unless it is completely filled with water.

CAUTION

Always fill the inner tank before filling the outer tank to prevent any damage to the inner tank.

1. Close domestic water drain valve and primary (outer) tank isolation valves located in front of water heater.
2. Open domestic water isolation valves for water heater.
3. Vent air from inner (domestic water) tank by opening nearest hot water faucet. Fill domestic water tank completely by allowing water to run until there is a constant flow of water.
4. Close hot water faucet

2- FILLING THE OUTER TANK - (Fig.: 15) (Primary Water)

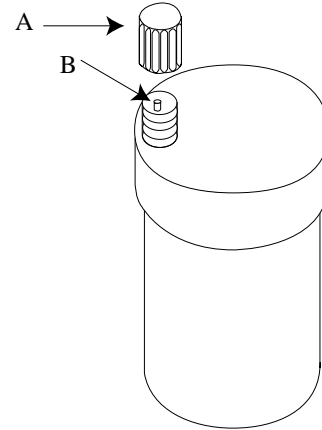
1. Close drain valve located on the bottom rear of water heater.
2. Open water heater's system isolation valves. Located in front of water heater
3. Allow air to escape from outer (system water) tank by opening cap on automatic air vent, located on top of water heater.
4. Fill to correct system pressure. Correct pressure will vary with each application. Normal cold water fill pressure is 12 psig.

NOTICE

For proper water heater operation, always leave vent cap unscrewed one full turn.

5. When tank is full, air will stop escaping, and vent will close. If air vent does not

seat properly (i.e., water leaks out), remove cap A. Briefly push in valve B and release it to clean valve seat. Screw cap A on completely, then unscrew one turn.



6. If antifreeze is used in primary water, ensure concentration never exceeds a 50/50 ratio. System water (including additives) must be practically non-toxic, having a toxicity rating or class of 1, as listed in Clinical Toxicology of Commercial Products. Inhibited propylene glycol is recommended. Follow antifreeze manufacturer's instructions.

WARNING

Do not use automotive or ethylene glycol antifreeze, or any undiluted antifreeze. This can cause severe personal injury, death or substantial property damage if ignored.

3- BURNER OPERATION

1. Check to see if the HM water heater is filled with water (10-12 psi on Pressure & Temperature gauge on console).
2. Set the thermostat on console to call for hot water.
3. Turn ON-OFF switch on the console ON.
4. Refer to burner manufacturer's installation manual "Starting the Burner". Refer to attached specification sheet when adjusting the burner to rated input.

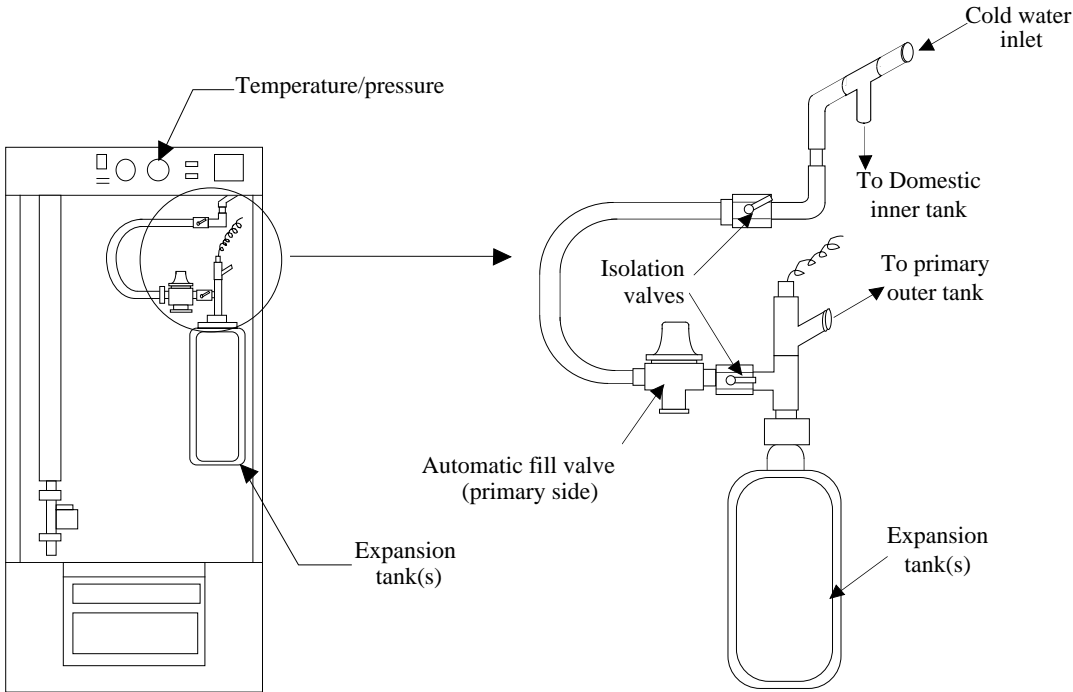


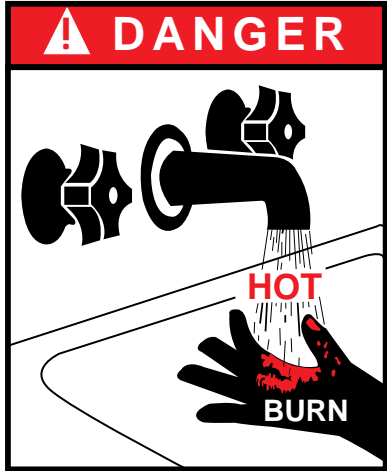
Fig. 15: Detail of automatic fill system with Temp/Pressure indicator on outer (primary) tank.

DANGER

HOT WATER CAN SCALD!

- Water temperatures over 125°F can cause severe burns instantly, or death from scalds.
- Feel water before bathing or showering.
- Consumer Product Safety Commission and some states recommend temperatures settings of 130°F or less. Setting thermostat higher than 130°F setting will increase risk of scald injury and cause severe personal injury or death.
- Water heated to a temperature suitable for clothes washing, dish washing and other sanitizing needs will scald and cause permanent injury.
- Children and elderly, infirm or physically handicapped persons are more likely to be injured by hot water. Never leave them unattended in or near a bathtub. If anyone using hot water in the building fits this description, or if state laws or local codes require certain water temperatures at hot water faucets, take special precautions.

- Install an automatic mixing valve at water heater or at each hot water faucet, bath and shower outlet. Selection and installation must comply with valve manufacturer's recommendation and instructions.
- Use the lowest practical temperature setting.
- Check water temperature after any adjustment. You must follow "Adjusting the water heater Thermostat" procedures.



Water Heater Start-Up

General Notes

- Household water usage patterns will affect water temperature at any faucet or shower. Occasionally check temperature at each point of use, then adjust thermostat accordingly. Always recheck temperature after adjusting thermostat.
- When hot water is used in repeated small quantities, a “stacking” effect can develop in the water heater. The upper layer of water in tank can be hotter than lower layer.
- Lowering the thermostat setting or installing automatic mixing valves as indicated in these instructions will reduce water temperature levels. Consult your installer or service technician.


- Check water temperature at a hot water faucet immediately after first heating cycle. Further temperature adjustment may be necessary as water heating system is used. Recheck water temperature at faucet after adjustment.


WARNING

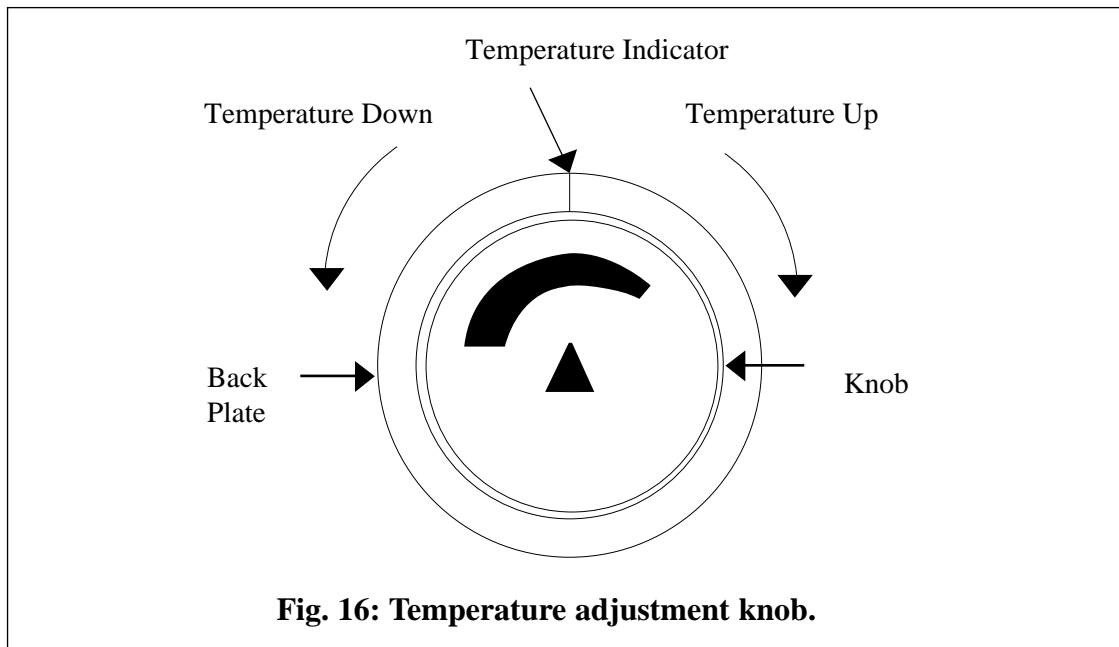
At no time should boiler limit control be set above 210°F. This can cause severe personal injury, death or substantial property damage if ignored.

Adjusting the Water Heater Thermostat

Water heater thermostat is factory set to its lowest temperature. This may or may not be suitable for your needs.

Turn thermostat knob clockwise  to increase water temperature.

Turn thermostat knob counter-clockwise  to decrease water temperature.



1- ANNUAL MAINTENANCE

A- Flueway

- Must be examined annually.
- Examine flueway by removing the vent pipe, jacket and flue collector from the top of the water heater.
 - If cleaning is necessary, remove the flue baffles and burner,
 - Sweep with a flue brush or any wire scratch brushes.
 - Remove any particle that may have fallen into the combustion chamber before replacing the burner.
- Reinstall the flue baffles and flue collector.
- Examine the vent system for any obstruction to the flow of combustion or ventilation air and for deterioration or damage which could cause leakage of flue gases or improper venting.
- Clean, repair or replace as required.
- Check the barometric damper and determine it is intact and functioning properly.

B. Pressure relief valve and T&P relief valves

Manually operate the relief & T&P at least once a year. This will release some hot water.

WARNING

Before manually operating either pressure or T&P relief valve check that the discharge is directed to a suitable place for disposal. The discharge line must be full size, without restriction and installed to permit complete drainage of both the valve and line.

T&P relief valve

- Located on the top left rear of the heater.
- Lift the lever handle and permit water to discharge for several seconds.

- If after closing the valve, the valve fails to completely reset and water continues to flow, shut OFF power to the heater and follow the draining procedure. Partially drain the inner tank and replace the T&P relief valve.
- If T&P weeps periodically, it may be due to thermal expansion (see Thermal Expansion page 8).

Pressure relief valve

- Located on the left rear top of the outer primary tank.
- Shut OFF the power to the heater.
- Lift the lever handle to permit water to discharge for several seconds.
- After closing the valve, if some water continues to flow, shut OFF the two isolation valves separating the water heater from heating system. Partially drain the outer tank and replace the pressure relief valve.

WARNING

Water from opened drain valves, unions and other connections may be extremely hot. To avoid personal injury, death or substantial property damage;

- **Tighten all drain hose connections**
- **Direct hot water away from all persons**

C. Antifreeze

- The outer (primary) tank is compatible with inhibited propylene glycol solution with a maximum a 50/50 mix.
- System water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in the Clinical Toxicology of Commercial Products.

WARNING

Do not use automotive or ethylene glycol antifreeze, or any undiluted antifreeze. This can cause severe personal injury, death or substantial property damage;

- Introduction of antifreeze can be done through the drain valve located on the rear bottom of the heater.
- Check the pH value of the concentration. If different than pH 7, the antifreeze must be replaced immediately.

CAUTION

Failing to replace the antifreeze periodically voids the warranty on the water heater.

- Other undiluted solutions are prohibited and could cause severe personal injury or substantial property damage.

D. Oil Filter

- Change the oil filter on the oil supply line annually.

E. Air Vent

- Check air operation
 - Remove vent cap. Briefly push in valve and release it to clean valve seat. Screw vent cap on completely, then unscrew one turn.

CAUTION

When shutting down a unit for an extended period of time, it is recommended to follow the maintenance procedures shown under annual maintenance before restarting the unit.

2- PERIODICAL MAINTENANCE

- Follow instructions on circulator for oiling, if it is oil lubricated.
- Check valves, pipes and fittings for leaks.

- Check functions of field installed controls (see control manufacturer's installations).
- Check thermostatic mixing valve per enclosed manufacturer's installation and maintenance instructions.

3- BURNER MAINTENANCE

- Refer to enclosed burner manufacturer's maintenance schedule.

4- COMBUSTION CHAMBER

- No maintenance is required for combustion chamber. The combustion chamber is an integral part of the water heater which can not be removed or replaced.

5- DRAINING THE WATER HEATER

A. Drain Outer Tank

CAUTION

Always drain outer tank before you drain inner (potable water) tank to prevent any damage to inner tank.

1. Disconnect power supply to the HM water heater
2. Close isolation valves to the outer tank located on front of water heater.
3. Connect a garden hose to drain valve located bottom/rear of water heater. Direct the discharge to a safe place of disposal and drain the primary tank.

WARNING

Water from opened drain valves, unions and other connections may be extremely hot. To avoid personal injury, death or substantial property damage;

- Tighten all drain hose connections
- Direct hot water away from all persons.

B. Drain Inner Tank

1. Close the shut off valve on the cold water line supply.

2. Connect a hose from the domestic tank drain valve to a floor drain
3. Open drain valve.
4. Open vent valve on domestic supply piping. If there is no vent valve, open and separate the hot water line union or a hot water heater faucet above the water. This will initiate the siphoning procedure.
5. To refill and put the HM water heater back in operation follow the instruction under "Filling the Inner Tank" page 24 .

C. When Primary (outer tank) System Contains Sufficient Anti-Freeze

1. Disconnect power supply to water heater
2. If system pressure is greater than 15 psig, relieve system pressure before proceeding.

CAUTION

System pressure must not exceed 15 psig to prevent damage to inner tank.

3. Follow the procedures for draining the inner tank. The outer tank does not require draining.
4. When draining is complete
 - close drain valve
 - remove hose

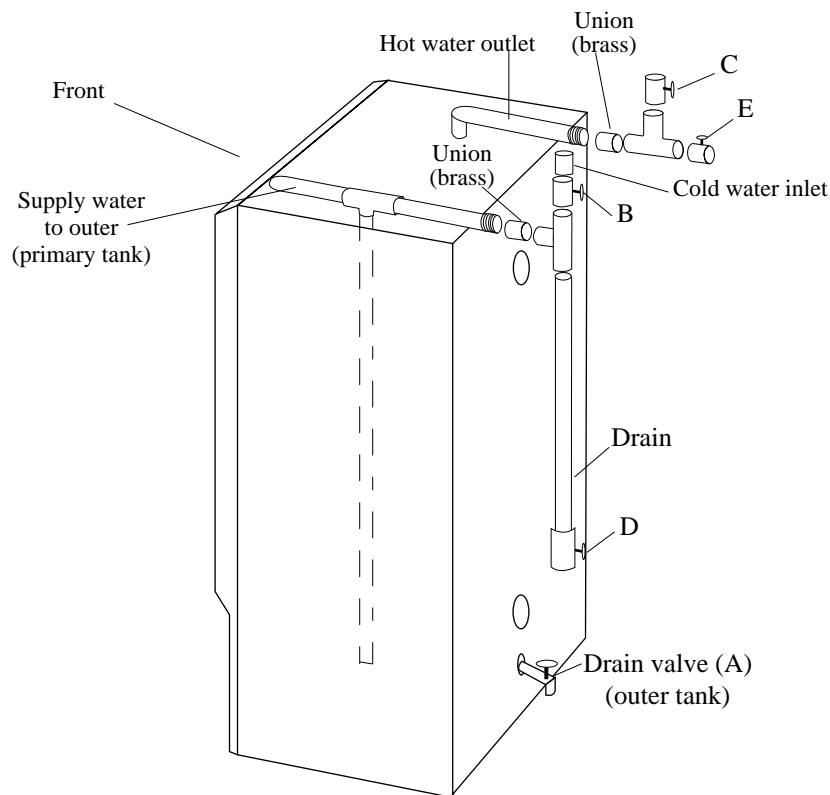


Fig. 17 : Draining the water heater

Chart 4

Part No.	Description	Quantity required	
		by Model	
		HM 40 & 45	HM 80, 90 & 100
HMJKT40/45	Complete Jacket Set	1	
HMJKTL80	Complete Jacket Set		1
HMJKT40F	Jacket, Front	1	
HMJKT80F	Jacket, Front		1
HMJKT40L	Jacket, Left side	1	
HMJKT80L	Jacket, Left side		1
HMJKT40R	Jacket, Right side	1	
HMJKT80R	Jacket, Right side		1
HMJKT40B	Jacket , Back	1	
HMJKT80B	Jacket , Back		1
HMJKTTP03	Jacket, Top cover	1	
HMJKTTP04	Jacket, Top cover		1
HMCS01	Control panel console	1	
HMCS02	Control panel console		1
HMHOO01	Draft Hood 7"	1	
HMHOO03	Draft Hood 8"		1
HMBAF01	Baffles	8	8
HMDRA01	Drain Valve	1	1
HMREL01	Honeywell Relay R8285A	1	1
HMTPV01	T & P Relief Valve 150 psi	1	
HMTPV02	T & P Relief Valve 150 psi	1	1
HMRLV01	Pressure Relief Valve 30 psi	1	1
P3AVT01	Air Vent	1	1
HMPRV01	Pressure Reducing Valve 12 psi	1	1
P3DT02	Dip Tube HM 40/45	1	
P3DT03	Dip Tube HM 100		1
HMEXP01	Expansion Tank	1	1
HMCIR01	Grundfos Circulator	1	1
HMVLV04	Shut-off Valve	1	1
HMNIP21	Stainless Steel Nipple 1"x15"	1	1
HMLWC01	Low Water Cut Off Device	1	1
HMTH02	Thermostat	1	1
HMTH01	Automatic Reset	1	1
HMCON02	Aquastat/Control	1	1
HMGAU01	T&P Gauge	1	1
	Barometric Damper		
HMBAR01	7" Single Acting - Oil	1	1
HMBAR02	7" Double Acting - Gas	1	1
HMBAR03	8" Single Acting - Oil	1	1
HMBAR04	8" Double Acting - Gas	1	1

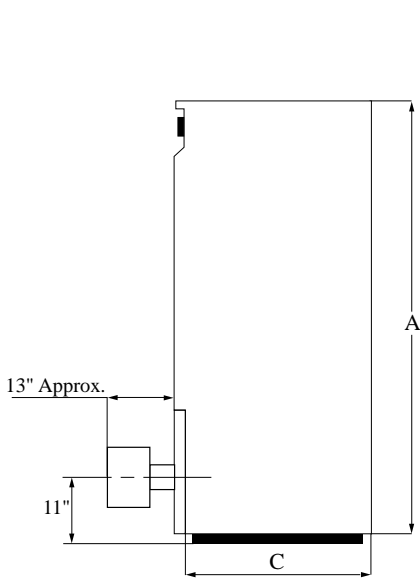


Fig. 18: Side view

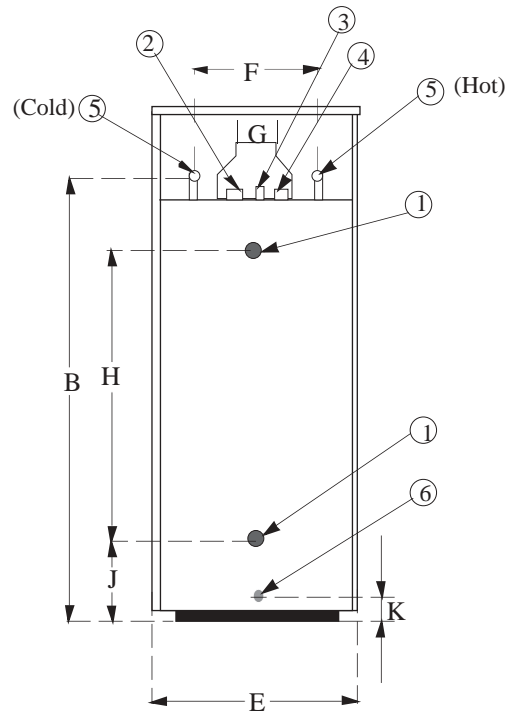


Fig. 19: Rear view

Legend

- 1. Primary Circuit: connections
- 2. Pressure Relief Valve (30 PSI)
- 3. Air Vent
- 4. T-P Relief Valve (150 PSI)
- 5. Cold/Hot Water Outlet
- 6. Primary circuit drain valve

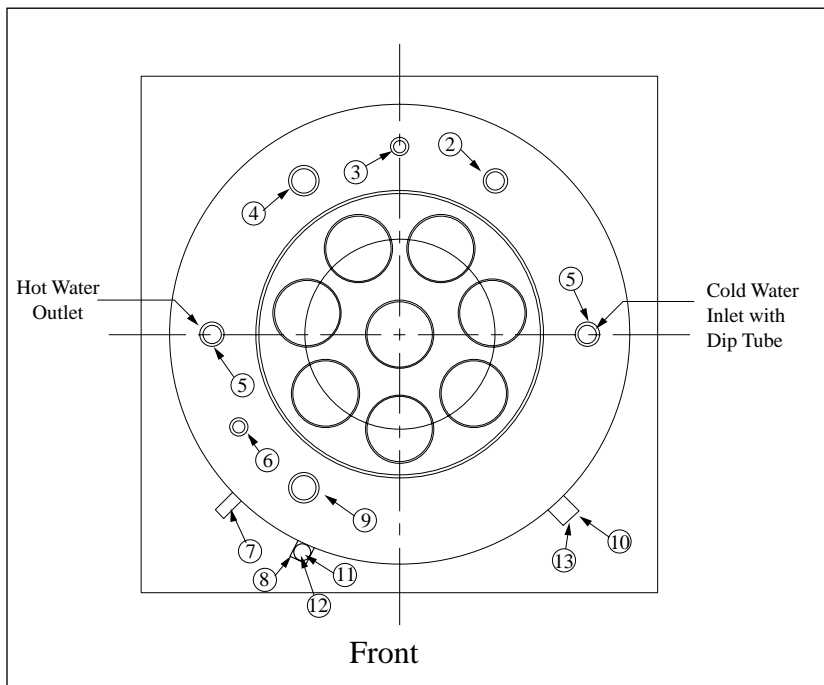


Fig. 20: Top view of Water Heater

Legend

- 2. Pressure relief valve 30 psig ϕ 3/4" NPT
- 3. Air vent ϕ 1/2" NPT
- 4. Domestic temperature/pressure relief valve (150 psi) ϕ 1" NPT
- 5. Domestic cold water inlet & Domestic hot water, ϕ 3/4" NPT
- 6. L.W.C.O. pressure sensor, ϕ 1/2" NPT
- 7. Primary thermostat sensor ϕ 1/2" NPT
- 8. Recirculating circuit connection ϕ 1" NPT
- 9. Manual reset sensor ϕ 1" NPT
- 10. Expansion tank connection ϕ 1/2" NPT
- 11. Automatic reset safety sensor ϕ 1" NPT
- 12. Primary temperature sensor ϕ 1/2" NPT
- 13. Primary pressure sensor

Chart 2: Dimensional Data

Type		HM 40	HM 45	HM 60	HM 80	HM 90	HM 100
Input Nat. Gas	Btu/hr	165,000	199,000	N/A	199,000	300,000	382,000
Oil	GPH	1.17	1.5	1.96	1.5	2.15	2.75
Total Capacity	Gal	40	40	40	82	82	82
Dimensions	Inches						
A		67	67	67	82 1/2	82 1/2	82 1/2
B		62	62	62	80	80	80
C		22.3	22.3	22.3	27.9	27.9	27.9
E		21 1/2	21 1/2	21 1/2	26 7/8	26 7/8	26 7/8
F		15 3/8	15 3/8	15 3/8	15 3/8	15 3/8	15 3/8
G		7	7	7	8	8	8
H		43 1/4	43 1/4	43 1/4	52 1/4	52 1/4	52 1/4
J		11	11	11	11	11	11
K		5	5	5	4 1/2	4 1/2	4 1/2
Connections:							
TP Valve (domestic)		1"	1"	1"	1"	1"	1"
Domestic water	∅	3/4"	3/4"	3/4"	1"	1"	1"
"TR's" connection	∅	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"
Flue [G] - chimney	∅	7"	7"	7"	8"	8"	8"
Drain	∅	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Pres. Relief (primary)	∅	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Air vent	∅	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Empty weight	lb	485	485	485	705	705	705
Heat exchanger surface	Sq. Ft.	26.5	26.5	26.5	42.5	42.5	42.5

Chart 3: Recovery (100° Rise)

Model	GPH	Input BTU/hr
HM 40	165	165,000
HM 45	200	199,000
HM 80	200	199,000
HM 90	300	300,000
HM 100	380	382,000

Sample Specification - Gas Fired

Phase III® HM Series Gas Fired Water Heater
HM _____ or equal.

1. The Water Heater(s) shall be Phase III® Model _____ having gas input of _____ BTU/hr and a recovery rate of _____ GPH at 100° temperature rise.
2. The construction consists of an annular stainless steel heat exchanger with center flue-way, immersed in a primary fluid for indirect firing.

The primary fluid - also cooling off the base of the combustion chamber - prevents a direct contact of the flame and combustion gases with the corrugated hot water tank. This unique design insures a possible 180° F continuous hot water production .
3. The heat exchanger made with high grade stainless steel shall have a minimum of _____ Square Feet of heat transfer surface and will be corrugated. The working pressure rating shall be 150 Psi.
4. The water heater shall be factory equipped with an adjustable thermostat at 90°F - 180 °F, and a safety limit aquastat set at 205°F with manual reset.

The outer tank containing the primary fluid shall be protected by a Low Water Cut-Off device, and a pressure relief valve set at 30 psi.

The inner tank shall be protected by a 150 psi Temperature and pressure relief valve.

6. The complete unit(s) shall be insulated with rigid polyurethane foam insulation and installed in a steel cabinet which has been finished with a baked enamel paint.
7. The water heater shall be covered by a limited 15-year warranty against leaks and corrosion.
8. The water heater shall be equipped with a gas burner.

Sample Specification - Oil Fired

Phase III® HM Series Oil Fired Water Heater
HM _____ or equal.

1. The Water Heater(s) shall be Phase III® Model _____ having oil input rate of _____ GPH and a recovery rate of _____ GPH at 100° temperature rise.
2. The construction consists of an annular stainless steel heat exchanger with center flue-way, immersed in a primary fluid for indirect firing.

The primary fluid - also cooling off the base of the combustion chamber - prevents a direct contact of the flame and combustion gases with the corrugated hot water tank. This unique design insures a possible 180° F continuous hot water production .
3. The heat exchanger made with high grade stainless steel shall have a minimum of _____ Square Feet of heat transfer surface and will be corrugated. The working pressure rating shall be 150 Psi.
4. The water heater shall be factory equipped with an adjustable thermostat at 90°F -180°F, and a safety limit aquastat set at 205°F with manual reset.

The outer tank containing the primary fluid shall be protected by a Low Water Cut-Off device, and a pressure relief valve set at 30 psi.

The inner tank shall be protected by a 150 psi Temperature and pressure relief valve.

6. The complete unit(s) shall be insulated with rigid polyurethane foam insulation and installed in a steel cabinet which has been finished with a baked enamel paint.
7. The water heater shall be covered by a limited 15-year warranty against leaks and corrosion.
8. The water heater shall be equipped with an oil burner.

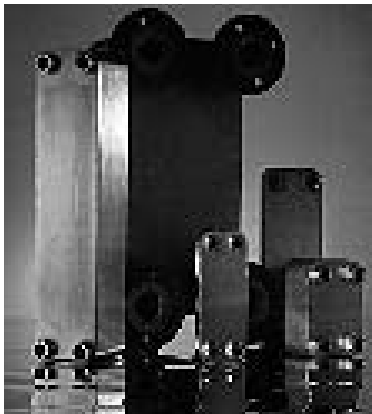
**Additional quality water heating equipment available
from
Triangle Tube/Phase III**

Phase III Indirect Fired Water Heaters



- Exclusive Tank-in-Tank design
- Stainless steel construction
- Available in 8 sizes and 2 models
- Limited LIFETIME residential warranty
- 15 year limited commercial warranty
- Self cleaning/self descaling design

TTP Brazed Plate Heat Exchangers



- For domestic water, snow melting, radiant floor, refrigeration
- Plates made of stainless steel, with a 99.9 % copper and brazed, ensuring a high resistance to corrosion
- Self cleaning and self descaling
- Computerized sizing available from Triangle Tube/Phase III
- Available in capacities from 25,000 BTU/hr to 5,000,000 BTU/hr

Maxi-flo Pool and Spa Heat Exchangers



- Construction of high quality corrosion resistant stainless steel (AISI 316)
- Specially designed built-in flow restrictor to assure maximum heat exchange
- Compact and light weight
- Available in 5 sizes that can accommodate any size pool or spa



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