



Technical Specifications

Installation & Maintenance Manual



smart₃₁₆

30 - 40 - 50 - 60 - 80 - 100 - 120
INDIRECT FIRED WATER HEATER

WARNING

This document is intended to be used by a factory trained and qualified heating contractor or service technician only. Read all Instructions within this document and within the relevant Boiler Installation and Maintenance Manual before proceeding. It is recommended to follow the procedures in the steps given. Skipping or missing procedural steps could result in substantial property damage, serious injury, or death.

CAUTION

- The heat transfer medium must be water or other nontoxic fluid having a toxicity rating or class of 1, as listed in Clinical Toxicology of Commercial Products, 5th edition.
- The pressure of the heat transfer medium must be limited to a maximum of 30 psig by an approved safety or relief valve.

NOTICE

- When receiving the SMART unit, any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.
- Customer must register unit within sixty (60) days of installation in order to gain warranty coverage. See Warranty Card for details.
- Leave all documentation received with appliance with the owner for future reference.
- Installation and service should only be performed by a qualified installer or service technician.
- Installations and service should be performed by a licensed plumber or gas fitter in the Commonwealth of Massachusetts.



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PRODUCT AND SAFETY INFORMATION

IMPORTANT SAFETY INFORMATION FOR THE HOMEOWNER AND THE INSTALLER

This manual contains important information for the installation, starting up and maintenance of the appliance.

This manual must be provided to the Homeowner, who will keep it in a safe place for future reference.

Triangle Tube accepts no liability for any damage, injury, or loss of life resulting from incorrect installation, alteration of any factory supplied parts, or the use of parts or fittings not specified by Triangle Tube. If there is a conflict or doubt about the proper installation of the unit or any factory supplied replacement parts please contact Triangle Tube Technical Support.

DEFINITIONS

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 substantial property damage, serious injury, or death.

⚠ WARNING

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

CAUTION

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

NOTICE

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

BEST PRACTICE

Indicates recommendations made by Triangle Tube for the installers, which will help to ensure optimum operation and longevity of the equipment.

⚠ DANGER

Hot Water Can Scald!

- Water temperatures over 125°F can cause severe burns instantly or death from scalding.



Water Temp.	Time for 3rd degree burn to occur
104 ° F	Safe for bathing
120 ° F	5 minutes
125 ° F	2 minutes
130 ° F	10 seconds
140 ° F	3 seconds
148 ° F	2 seconds
155 ° F	1 second

- 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 anyone using hot water in the building fits the above description or if local codes or state laws require specific water temperatures at hot water faucet, it is recommended:
 - To install a thermostatic mixing valve at this appliance or at each water faucet.
- or
- To set the thermostat knob for the lowest temperature which satisfies your hot water needs.
- Water drained from the system drain valves may be extremely hot. To avoid injury:
 - Make sure all connections are tight.
 - Direct water flow away from any person.

⚠ WARNING

Bacteria can develop in the domestic water system if certain minimum water temperatures are not maintained. Failure to maintain at least 140°F [60°C] domestic hot water temperature (using the Antilegionella function of your boiler, if any) can result in bacteria development, which can result in serious injury, or death.

PRODUCT AND SAFETY INFORMATION

CAUTION

- It is prohibited to carry out any modifications to the appliance without prior written consent from Triangle Tube.
- Faulty parts must only be replaced by genuine Triangle Tube factory parts.
- Failure to comply with these instructions can result in minor property damage, or injury.

CAUTION

- To prevent damage to the inner tank, the Installer must:
 - Always fill inner tank prior to outer tank and always drain outer tank prior to inner tank.
 - Relieve primary system pressure (boiler water system pressure) below 15 psig prior to draining inner tank.
- Failure to comply with these instructions can result in minor property damage, or injury.

CAUTION

- Protection must be taken against excessive temperature and pressure! Installation of the Temperature & Pressure (T&P) relief valve, supplied from the factory with the appliance, is required.
- Failure to comply with these instructions can result in minor property damage, or injury.

NOTICE

- *In case of any concerns, please call your qualified service technician.*
- *Make sure to reference the unit's model number and serial number from the rating label when inquiring about service or troubleshooting.*
- *Triangle Tube reserves the right to change the technical characteristics, components and features of its products without prior notice. Check for an updated version of this manual at www.triangletube.com.*

1.1. Codes Compliance

Water heater installation must conform with the instructions in this manual and where applicable:

- local, state, provincial, and national codes, laws, regulations and ordinances.
- in Canada - CAN / CGA B149.1 or B149.2 Installation Code.

The Triangle Tube Smart 316 indirect-fired water heaters are exempt from the scope of ASME Section VIII, Division 1. An indirect-fired water heater's input is, by definition, the amount of heat that can be transferred to the tank. This heat transfer is determined by size and capacity of the tank's heat exchanger.

This is supported by ASME's interpretation VIII-1-86-136, dated May 22, 1987, which specifically states that an indirect-fired water heater with a heat exchanger capacity of less than 200,000 BTUH is not considered within the scope of Section VIII, Division 1, even when its heat source is a heating boiler with an input above 200,000 BTUH.

NOTICE

SMART Series water heaters will absorb less than 200,000 BTU/hr when domestic water outlet temperature is 210°F and boiler water supply temperature is 240°F. Listed outputs are based on ASME Section VIII Interpretation VIII-1-86-136.

The Smart water heater is for operation at outlet water temperature(s) not in excess of 180°F

Where instructions in this manual differ from local, or national codes, the local or national codes take precedence.

1.2. Codes Restrictions

Single wall heat exchanger in the SMART water heater complies with National Standard Plumbing Code, provided that:

- Boiler water (including additives) is practically non-toxic, having toxicity rating or class of 1, as listed in **Clinical Toxicology of Commercial Products, 5th Edition**, and
- Boiler water pressure is limited to maximum 30 psig by approved relief valve.

Single wall heat exchangers are permitted under the Uniform Plumbing code - Paragraph 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.

Other heat exchanger designs may be permitted where approved by the Administrative Authority.

1.3. Operating Restrictions

- Maximum domestic hot water temperature is 180°F (82°C) for commercial applications and 160°F (71°C) for residential applications.
- Maximum boiler water temperature is 210°F.
- Maximum working pressure for inner (domestic water) tank is 150 psig.
- Maximum working pressure for the outer (boiler water) tank is 30 psig.
- Water quality limitations (based on E.P.A National Secondary Drinking Water Regulations). See *Table 2*.

BEST PRACTICE

In hard water areas (more than 7 grains of hardness) use a water softener on the cold domestic supply water to the appliance to prevent scaling.

NOTICE

- *Any water conditioning system for potable domestic water must be installed and maintained in accordance with manufacturer's specifications.*
- *Do not install the water heater on any application if the boiler piping contains non-oxygen barrier tubing or if the boiler piping is considered an "open system". Exposing the tank of the water heater to oxygen contamination will lead to premature tank failure and denial of the warranty.*

NOTICE

- *Artificiality softened boiler/heating water from a salt based water softener is not allowed on the heating side of the water heater*
- *Distilled or RO water is not allowed on the heating side of the water heater*

Table 1 - Boiler/Heating Water Quality

Boiler water hardness	Less than 7 grains/gallon 120 ppm or mg/l
pH level	Between 6.0 and 8.0
Chlorine	Less than 4 ppm (mg/l.)
Chlorides	Less than 150 ppm (mg/l.)
Conductivity	100 to 300 µS/cm
TDS (Total Dissolved Solids)	50 to 300 ppm (mg/l.)
Molybdate Corrosion Inhibitor	100 to 300 ppm
Glycol	50% maximum inhibited propylene glycol only non-toxic

The Smart Tank Indirect water heater requires both the closed loop boiler heating water and the open loop domestic water to meet certain criteria to ensure the safe and reliable operation of the unit and to maintain the warranty. The guidelines laid out below must be followed for all installations of the Smart Tank Indirect Water Heater.

NOTICE

Failure to follow the instructions contained in this section will void the Triangle Tube Warranty.

CHAPTER 1 - PRE-INSTALLATION

1.4. Potable DHW Water Quality Requirements

The domestic water supplied to the water heater must be potable water that is free from contaminants, sediment, corrosive chemicals, and debris. It is the responsibility of the installer to ensure the water meets all the guidelines laid out in this manual. Water quality that exceeds the guidelines and results in damage or failure of the indirect tank is not covered by warranty.

If the domestic potable water quality is not within the allowable levels laid out in the document the water must be treated. Special attention should be taken in regard to sediment, hard water, pH, and chlorides.

- If sediment in the water supply is 5 microns or greater, a water sediment filter must be used.
- If there is hard water, a water softening system should be used.
- If the chlorides or pH are out of range, a water treatment company should be consulted to correct all water quality issues. Any water treatment/conditioning system must be installed and maintained in accordance with the manufacturer's specifications.

Table 2- Drinking Water Quality

Chloride	less than 150 ppm or mg/l.
pH value	min. 6, max. 8
Total hardness	3 - 7 grains/gallon or 50-120 ppm or mg/l.
Total Dissolved Solids (TDS)	less than 120 ppm or mg/l.
Iron	less than 0.3 ppm or mg/l.
Aluminum	less than 0.2 ppm or mg/l.
Copper	less than 1 ppm or mg/l.
Manganese	less than 0.05 ppm or mg/l.
Zinc	less than 5 ppm or mg/l.
Dissolved Carbon Dioxide (CO ₂)	less than 15 ppm (mg/l)
Sulfate	less than 250 ppm (mg/l)
Corrosivity	Non-corrosive
Fluoride	less than 2 ppm (mg/l)
Foaming agents	less than 0.5 ppm (mg/l)

1.5. Closed Loop Boiler Heating Water Quality Requirements

CAUTION

To maintain efficient operation of the heat exchanger in the Smart Tank the following instructions must be followed. Failure to follow these instructions will result in poor operation of the appliance, lead to potential failure of the product, and will void the warranty.

During installation and during the annual maintenance, the water quality must be checked and if found outside of the requirements, must be corrected.

A micro bubble air elimination device is required to be installed in all heating systems. An air scoop or an automatic air vent are not an acceptable substitute for a micro bubble air elimination device and may not be used as a substitute in the installation. A few examples of acceptable devices are:

- Taco 4900 Series
- Caleffi Discal
- Spirovent

If an automatic feed valve is installed in the heating system, it may not be left open indefinitely. A continuous feed of fresh water could damage the system. It is required that after a short period of time, between one to four weeks following the installation of Smart Tank Indirect water heater into a heating system, the automatic feed valve be closed and the water quality be checked.

Plastic tubing such as PEX might be used in a heating system for piping or underfloor radiant heat. If oxygen permeable tubing is used in the heating system with the Smart Tank, it must be separated from the rest of the heating system with a heat exchanger. Only oxygen barrier tubing can be used in the heating system side that connects to a Smart Tank indirect water heater.

1.6. Glycol

Boiler water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in Clinical Toxicology of Commercial Products, 5th Edition. A maximum 50/50 mixture of inhibited propylene glycol is allowed. Less than a 20% concentration of glycol is not permitted. Glycol will acidify because of thermal degradation overtime and could cause damage to components in the heating system.

This degradation is why heating system specific propylene glycol only must be used, these glycols contain additives and inhibitors or are meant to work with specific system inhibitors. The service technician must follow the antifreeze manufacturer's instruction. Antifreeze at a minimum must be checked on an annual basis or what is specified by the manufacturer of the antifreeze. Antifreeze must be replaced at a minimum every 3-5 years or what is specified by the manufacturer of the antifreeze.

When using antifreeze in the heating system circulator sizing must be considered because of the increase viscosity of the glycol mixture, a higher head circulator may be required. The glycol will also lower the heat capacity and the BTU output will be reduced by approximately 16-20% when using a mixture of 50% propylene glycol and 50% water. The reduced heating capacity at a 50/50 mixture will vary depending on the brand and makeup of the glycol. Glycol will reduce the efficiency and output of the indirect water heater because of this. When adding other additives to the heating system glycol water mixture make sure they are compatible with the brand of glycol that is being used. Not all glycol and additives are compatible.

DANGER

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

1.7. Locating Water Heater

- This water heater is not intended for outdoor installations.
- Keep distance between boiler and water heater to a minimum to:
 - Reduce piping heat loss
 - Provide minimal friction loss
- Locate water heater 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 SMART Series Water Heaters are designed for vertical installation only.

1.8. Recommended Clearances

Water heater should be installed to allow adequate clearance for servicing.

Zero clearance is permissible to any side of the SMART Series water heater that has no connection, but information labels must be visible for inspection.

The clearance required for any accessory or fitting that will be installed on either the heating and/or domestic circuits must be taken into account.

BEST PRACTICE

- *Recommended top or vertical clearance is 12" minimum.*
- *Refer to boiler manual for boiler clearances.*

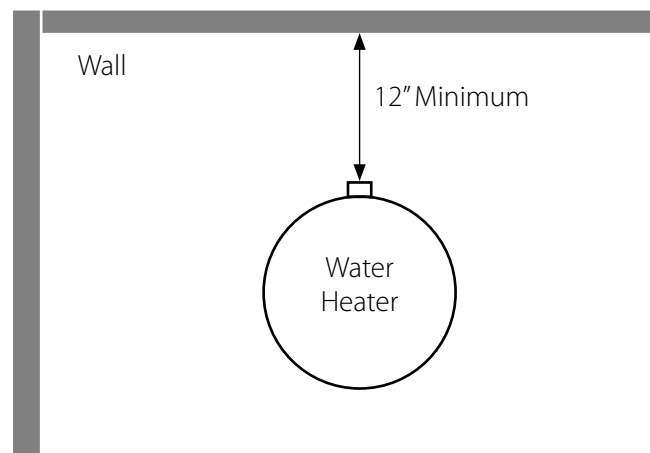


Fig. 1 - SMART Clearances - View from the Top

CHAPTER 2 - INSTALLATION - PIPING

2.1. Temperature & Pressure (T&P) Relief Valve

CAUTION

To reduce risk of excessive pressures and temperatures in the water heater, install temperature and pressure protective equipment required by local codes, but no less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, as meeting the requirements for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22. This valve must be marked with a maximum working pressure of the water heater.

- Every SMART water heater must be protected with a T&P relief valve.
 - Every Smart Tank water heater is supplied with a combination temperature and pressure relief valve. See specifications in *Table 3 below*.
 - Always verify that the combination temperature and pressure relief valve supplied with the water heater complies with local codes.

Table 3 - T&P Valve Characteristics

	SMART	
	30-40-50-60	80-100-120
Inlet thread	3/4" M	
Probe length	8"	
CSA rating	105,000 BTU/hr	205,000 BTU/hr
ASME rating 75 Psi	—	1,034,000
ASME rating 100 Psi	—	1,327,00
ASME rating 125 Psi	500,000	1,619,000
ASME rating 150 Psi	500,000	1,912,000

2.1.1 Standard Installation

- Install T&P relief valve in the **Temperature and Pressure Relief Valve** connection located behind the air vent on the top of the water heater (Refer to *Fig. 2 on page 8* and *Fig. 3 on page 9*).

2.1.2 Commonwealth of Massachusetts Installation

In the Commonwealth of Massachusetts and in all jurisdictions requiring a vacuum breaker to be installed on the domestic cold water inlet, follow these requirements :

- The water heater shall be protected against loss of water from siphoning due to loss of supply pressure by a vacuum relief valve installed in the cold water supply line at a level above the top of the heater or tank.
- The vacuum relief valve shall be in accordance with the Standard ANSI Z21.22 at the latest revision.
- Valves shall have minimum ½-inch diameter orifice and the air inlet opening on any vacuum valve shall not be smaller than the nominal pipe size of the valve
- Valves shall be sized to have a cross sectional area equal to a pipe, not less than one pipe diameter smaller than the tank supply or drain, whichever is larger.

2.1.3 T&P Relief Valve Discharge Piping

- **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.
 - fitted with a discharge piping, within 6" of the floor
- **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 drain. Refer to local codes.
 - Plugged, reduced, blocked, capped, threaded, or restricted .
 - Subject 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 substantial property damage, serious injury, or death.

2.2. Drain Valve

No drain valve is supplied with the unit. For information on draining the tank see page 23.

2.2.1 Standard Installation

- Install a tee connection at the domestic cold water inlet (Refer to *Fig. 2 on page 8*).
- Pipe the drain piping with drain valve from the tee connection to:
 - a suitable place for disposal or
 - terminate within 12" of the floor

2.3. Manual Air Vent

1. A manual air vent is factory installed.
2. Open manual air vent. Once the tank is full and air has stopped escaping, close the manual air vent.

2.4. Thermal Expansion

If a backflow preventer, check valve or pressure reducing valve is piped on cold water supply piping of water heater, install a potable water 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 installation instructions for proper sizing.

2.5. 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 device manufacturer's instructions for application and installation.

NOTICE

Water hammering within the domestic piping system can cause premature failure of the inner tank of the water heater. This type of failure is NOT covered under warranty.

2.6. Vacuum Breaker

Installing a vacuum breaker (Watts N36-M1 or equivalent) 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 manufacturer's instructions for application and installation of the vacuum breaker.

2.7. General Piping

- For domestic water piping diagram, refer to *Fig. 2 on page 8 thru Fig. 3 on page 9*.
- For Boiler water piping, refer to *Fig. 7 on page 11 thru Fig. 10 on page 13 Fig. 5 on page 10*.
- For Multiple water heater domestic and boiler piping, refer to *Fig. 8 on page 12 thru Fig. 10 on page 13*.
- See *Table 4 on page 7* for domestic and boiler piping connection sizes.
- All plumbing must meet or exceed all local, state and national plumbing codes.
- Use pipe dope or tape suitable for potable water systems.
- Use isolation valves to isolate system components.

2.8. Domestic Piping

- Union on domestic hot water outlet should be piped 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. It is recommended to 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.
- If copper pipe is used for domestic water connections, first solder or press pipe to a threaded adapter and then screw adapter into cold water inlet on top of water heater. Inlet connection contains an internal plastic dip tube which can be damaged by heat from soldering.

NOTICE

Do not apply heat to the cold water inlet when making sweat connections to water heater. Sweat tubing to adapter before fitting adapter to cold water inlet of heater. It is imperative that no heat be applied to the cold water inlet, as it contains a non metallic dip tube.

CHAPTER 2 - INSTALLATION - PIPING

- When the water supply pressure is higher than 70 psig, it is recommended to install a pressure reducing valve on cold water supply line to prevent water loss through T&P relief valve.
- If the water heater will replace a tankless coil in the boiler, disconnect the piping to coil and allow the water to drain from coil. Do not plug the tankless coil.



Plugging tankless coil inlet and outlet will result in substantial property damage, serious injury, or death.

2.9. Thermostatic Mixing Valve

- It is recommended to install an optional mixing valve on the domestic hot water outlet.
- Mixing valve must comply with ASSE 1017

2.10. Recirculation Piping

- A stainless steel or bronze circulator is required on potable water systems.
- Install automatic mixing valve either at the hot water outlet of water heater or each hot water faucet.

2.11. Multiple Water Heater Systems

- Parallel Pipe Recirculation Systems - Manifold recirculation return to all water heaters.
- Install an automatic mixing valve either at the hot water outlet of water heater or each hot water faucet.



Failure to install automatic mixing valve where recommended will result in serious injury, or death.

Table 4 - Piping dimensions

Water Heater Model	Connections (inches)			Recommended Minimum Boiler Piping*
	Domestic Water Inlet/Outlet (NPT)	Boiler Water Supply/ Return (NPSC)	Temperature and Pressure Relief Valve Connection (NPSC)	Diameter (Inches)
SMART 30	3/4	1	3/4	1
SMART 40	3/4	1	3/4	1
SMART 50	3/4	1 1/4	3/4	1
SMART 60	3/4	1 1/4	3/4	1 1/4
SMART 80	1 1/2	1 1/2	1 1/2	1 1/4
SMART 100	1 1/2	1 1/2	1 1/2	1 1/2
SMART 120	1 1/2	2	1 1/2	1 1/2

*recommended minimum boiler piping diameter is based on the installer correctly sizing the piping and pump to account for pressure drop as well as any glycol in the system

CHAPTER 2 - INSTALLATION - PIPING

2.12. Boiler Piping

- All PEX tubing used to connect the indirect tank water heater to the boiler must have an oxygen barrier.
- If PEX tubing is used for boiler water piping, it must have a maximum oxygen diffusion rate of 0.1 mg/liter-day for boiler and water heater protection.
- If antifreeze is used in the boiler system, local codes may require a backflow preventer on cold water supply line. Use antifreeze specifically intended for hydronic heating systems. A maximum percentage of 50% is allowed for inhibited propylene glycol.

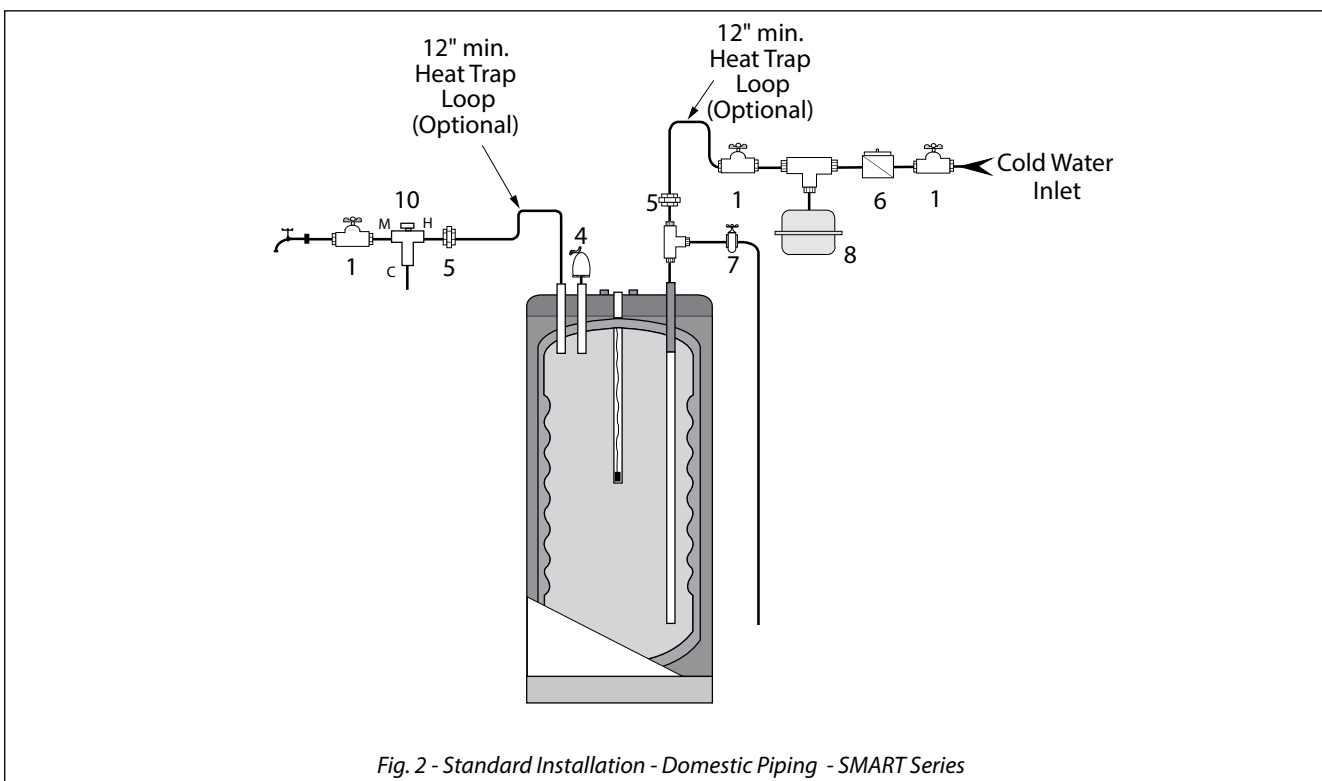
NOTICE

The SMART IDWH must be installed on a closed loop type hydronic system. Failure to provide such a system will result in premature failure of the tank and void the warranty.

- Boiler water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in **Clinical Toxicology of Commercial Products, 5th Edition**.

⚠ DANGER

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



1. Shut-off valve
 3. Flow Check Valve
 4. T&P relief valve
 5. Unions
 6. Backflow preventer or pressure reducing valve(*)
 7. Drain valve
 8. Thermal expansion tank (potable)
 10. Thermostatic mixing valve (*)
- (*) Recommended devices may be required by local codes.

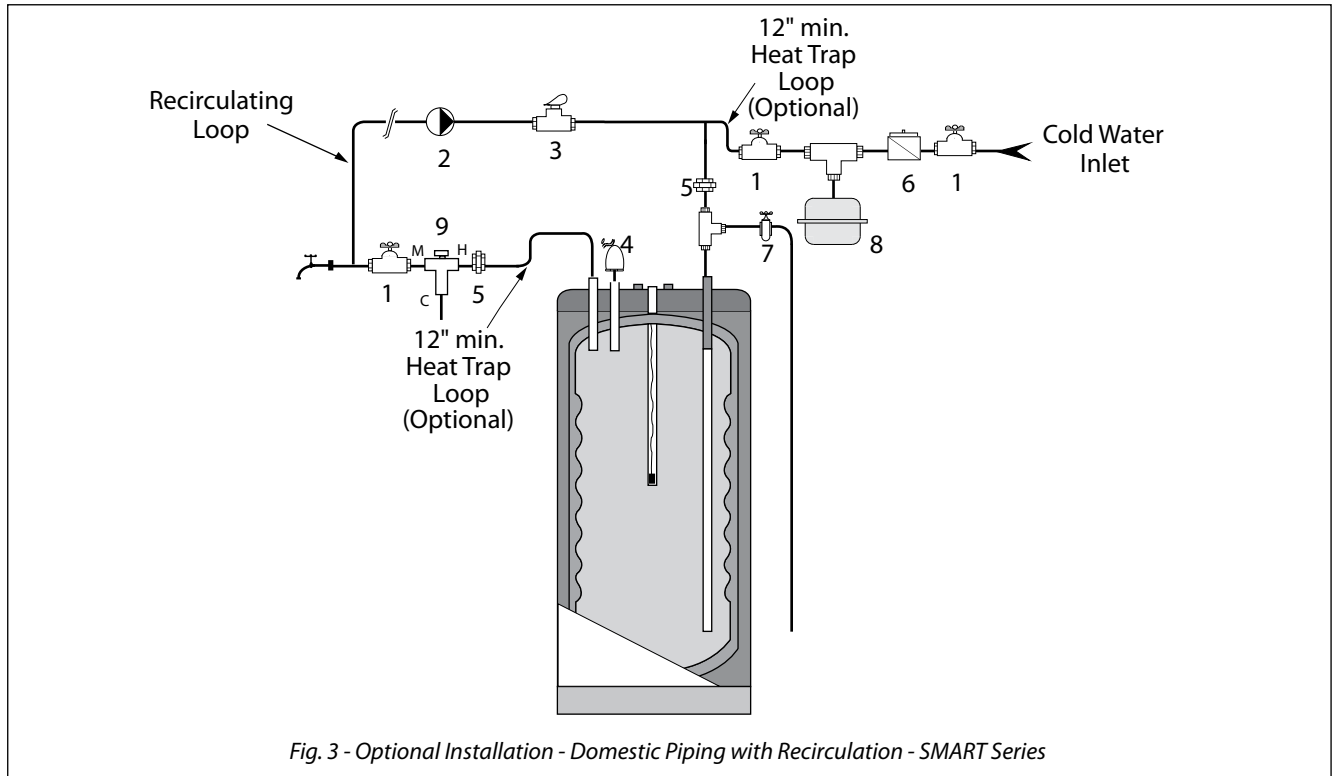


Fig. 3 - Optional Installation - Domestic Piping with Recirculation - SMART Series

- | | |
|---|--|
| 1. Shut-off valve | 7. Drain valve |
| 2. Recirculation Circulator | 8. Thermal expansion tank (potable) |
| 3. Flow Check Valve | 9. Thermostatic mixing valve (*) |
| 4. T&P relief valve | (*) Recommended devices may be required by local codes |
| 5. Unions | |
| 6. Backflow preventer or pressure reducing valve(*) | |

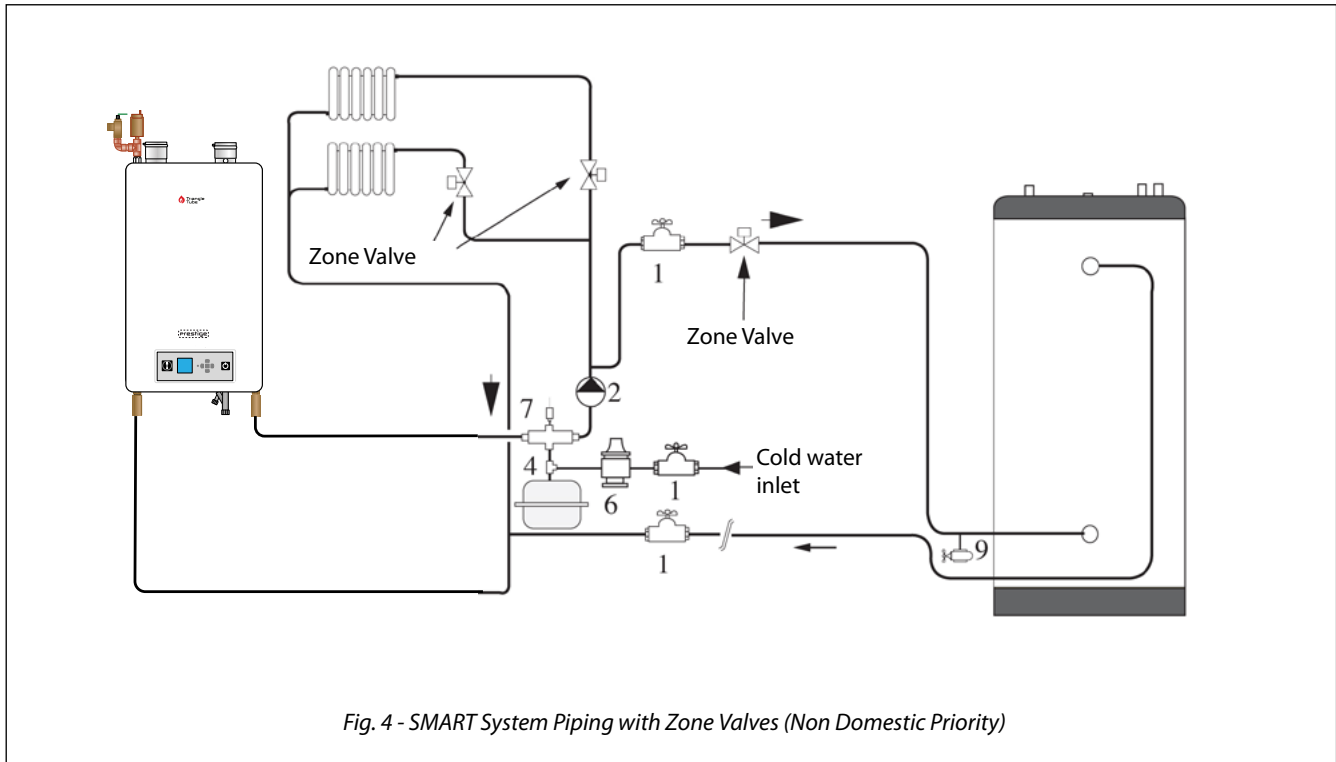


Fig. 4 - SMART System Piping with Zone Valves (Non Domestic Priority)

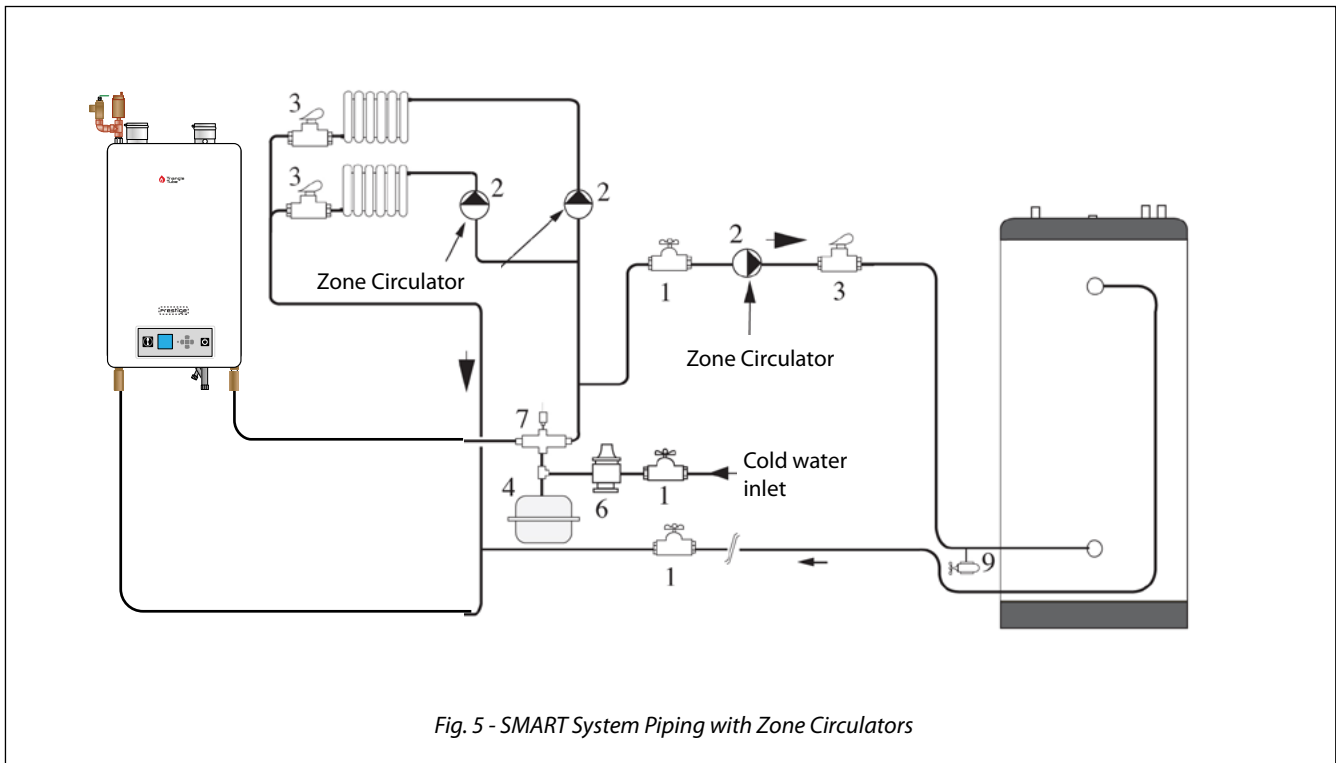


Fig. 5 - SMART System Piping with Zone Circulators

- | | |
|---------------------|------------------|
| 1. Shut-off valves | 5. Drain valve |
| 2. Circulator | 6. Feed valve |
| 3. Flow check valve | 7. Air separator |
| 4. Expansion tank | |

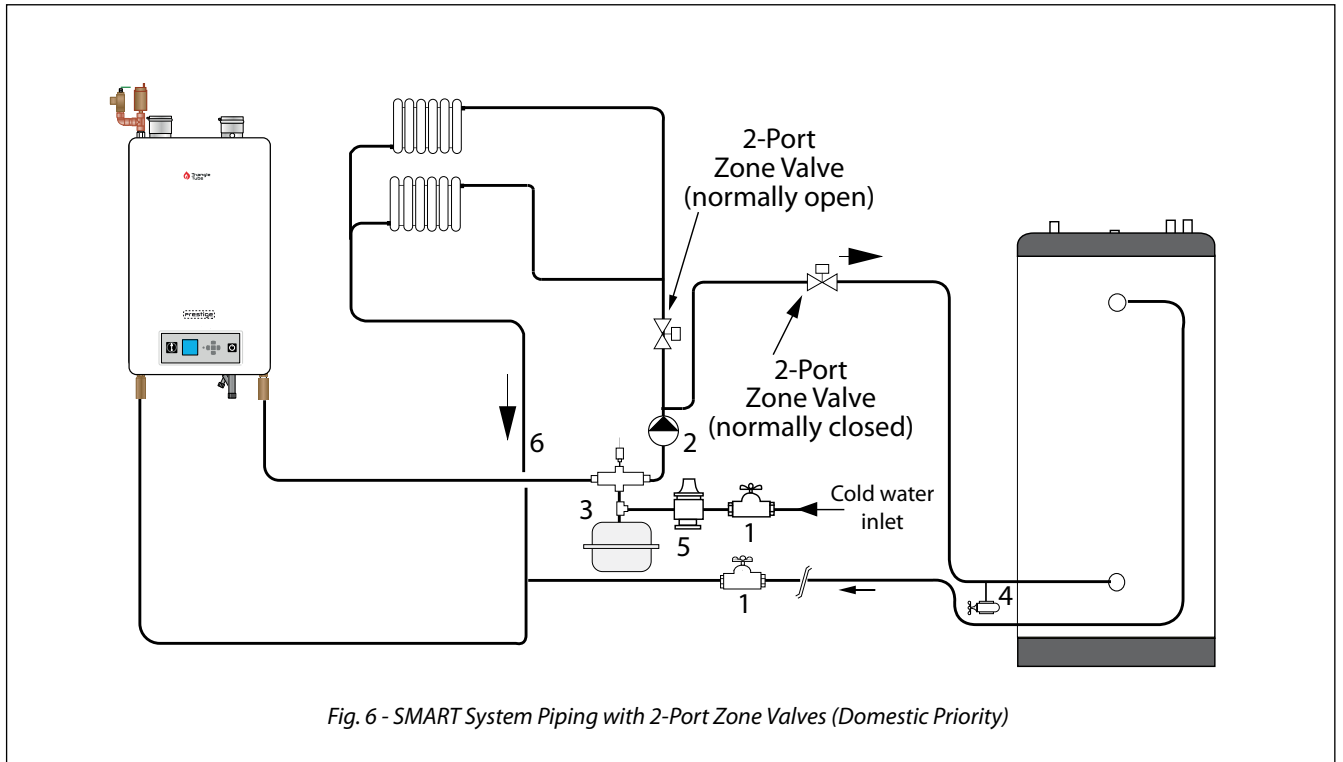


Fig. 6 - SMART System Piping with 2-Port Zone Valves (Domestic Priority)

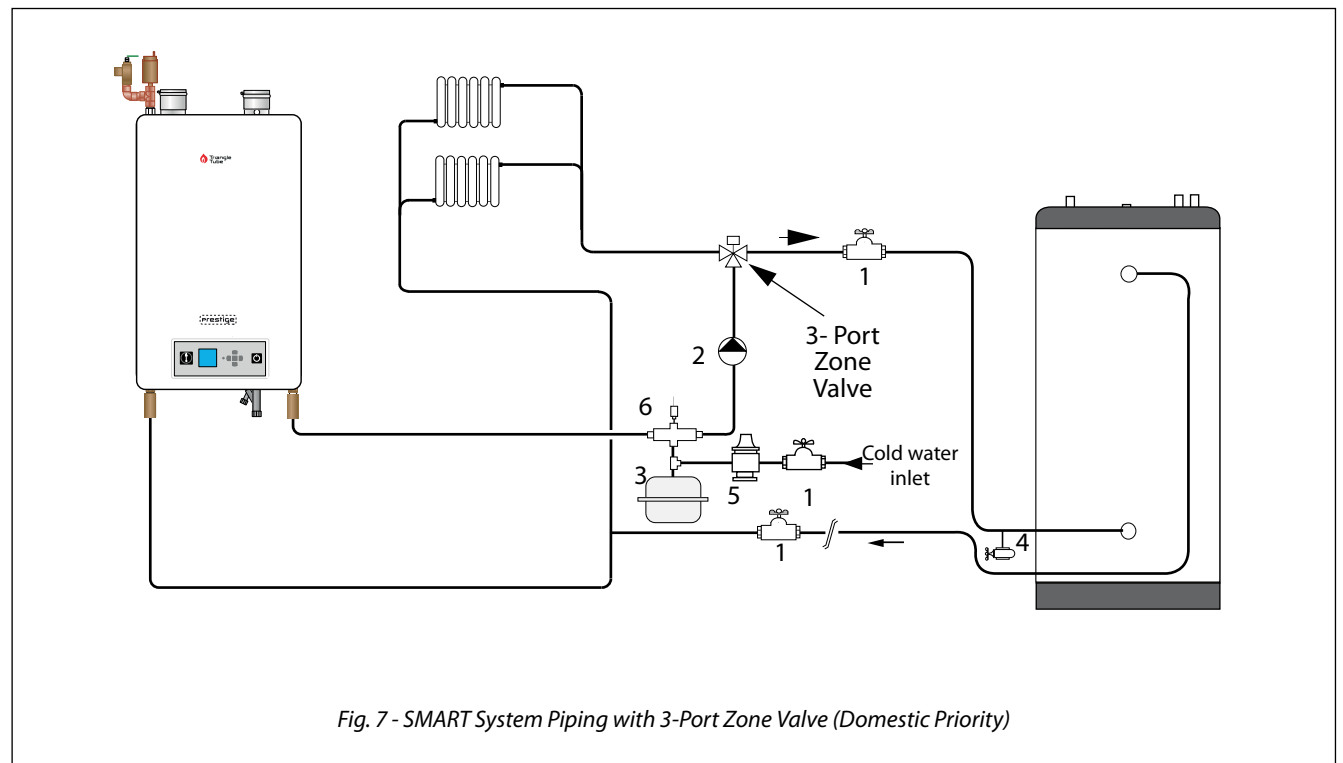
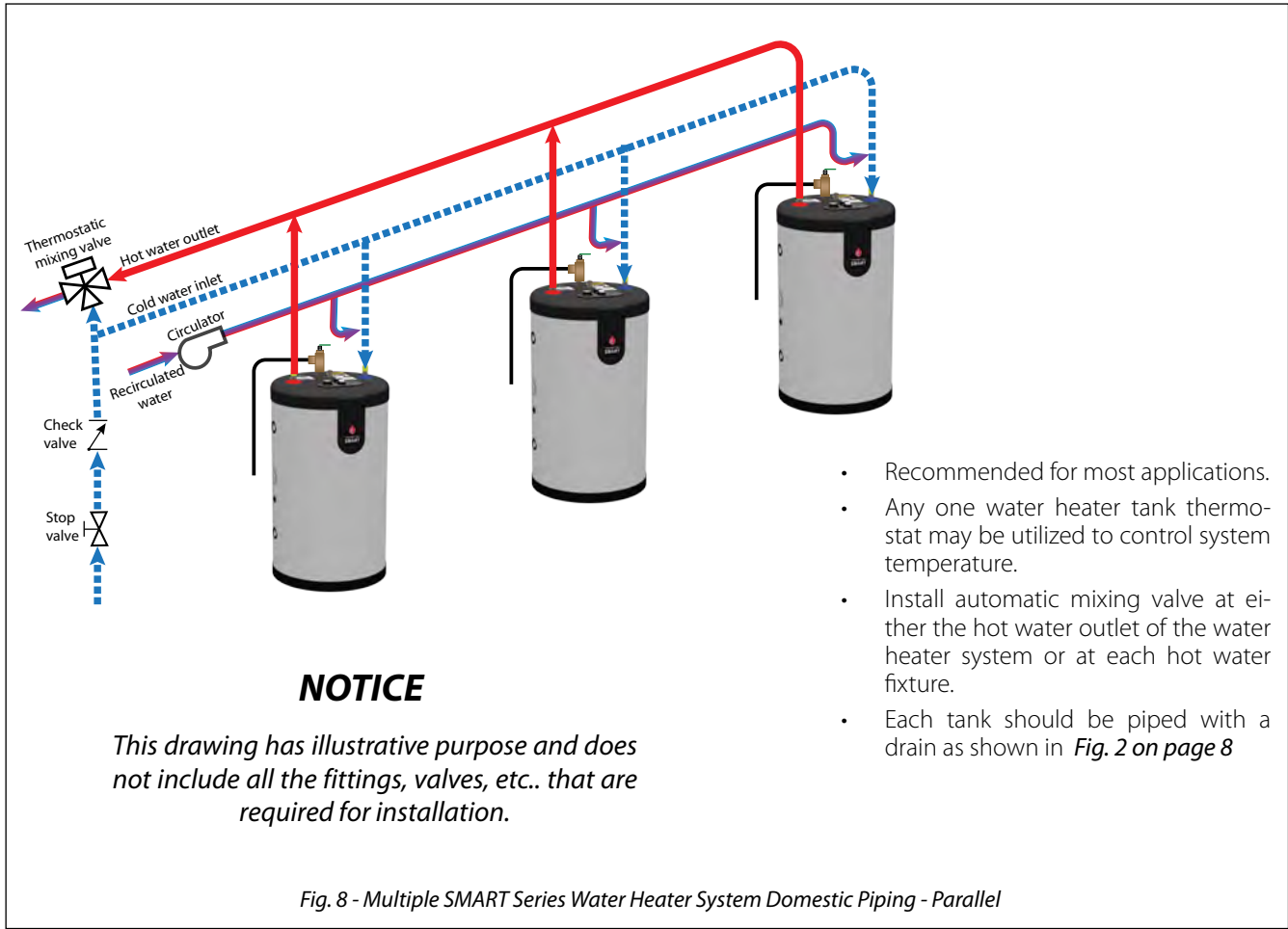


Fig. 7 - SMART System Piping with 3-Port Zone Valve (Domestic Priority)

- | | |
|--------------------|------------------|
| 1. Shut-off valves | 5. Feed valve |
| 2. Circulator | 6. Air separator |
| 3. Expansion tank | |
| 4. Drain valve | |



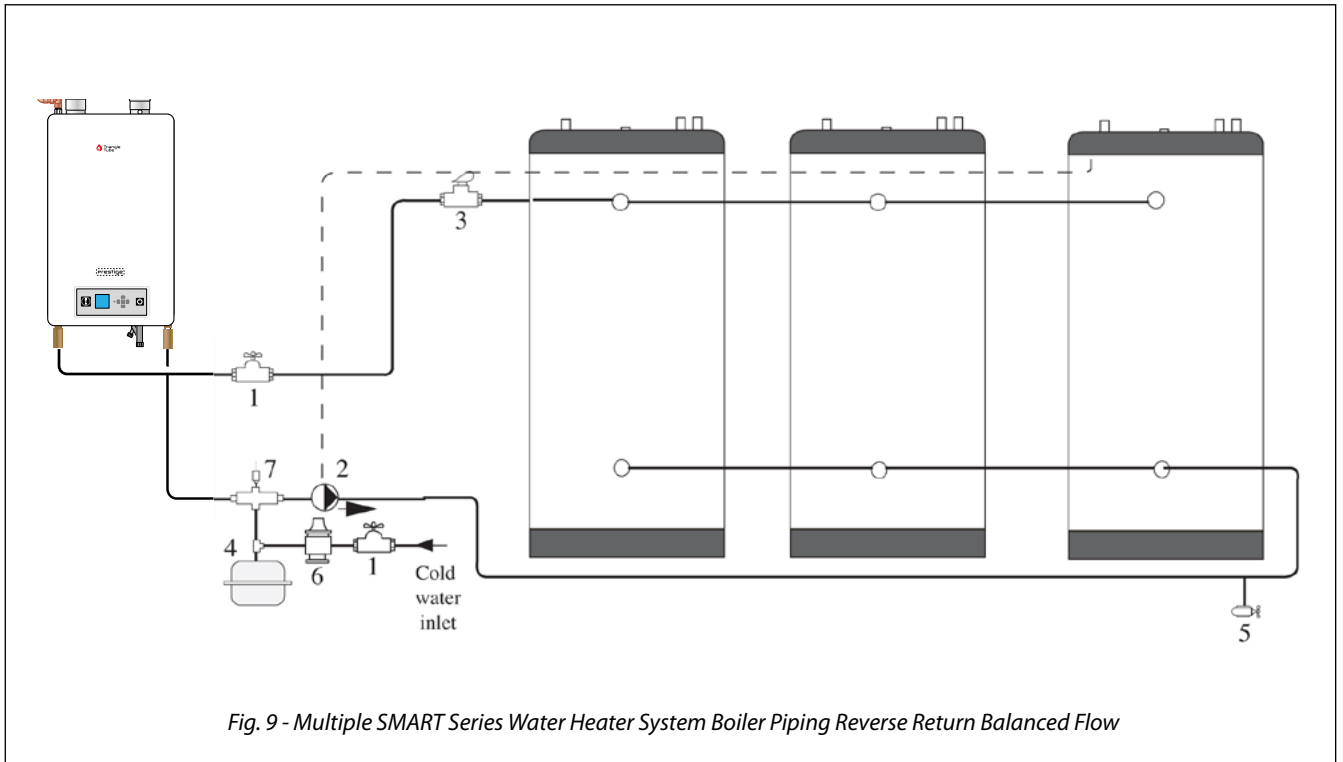


Fig. 9 - Multiple SMART Series Water Heater System Boiler Piping Reverse Return Balanced Flow

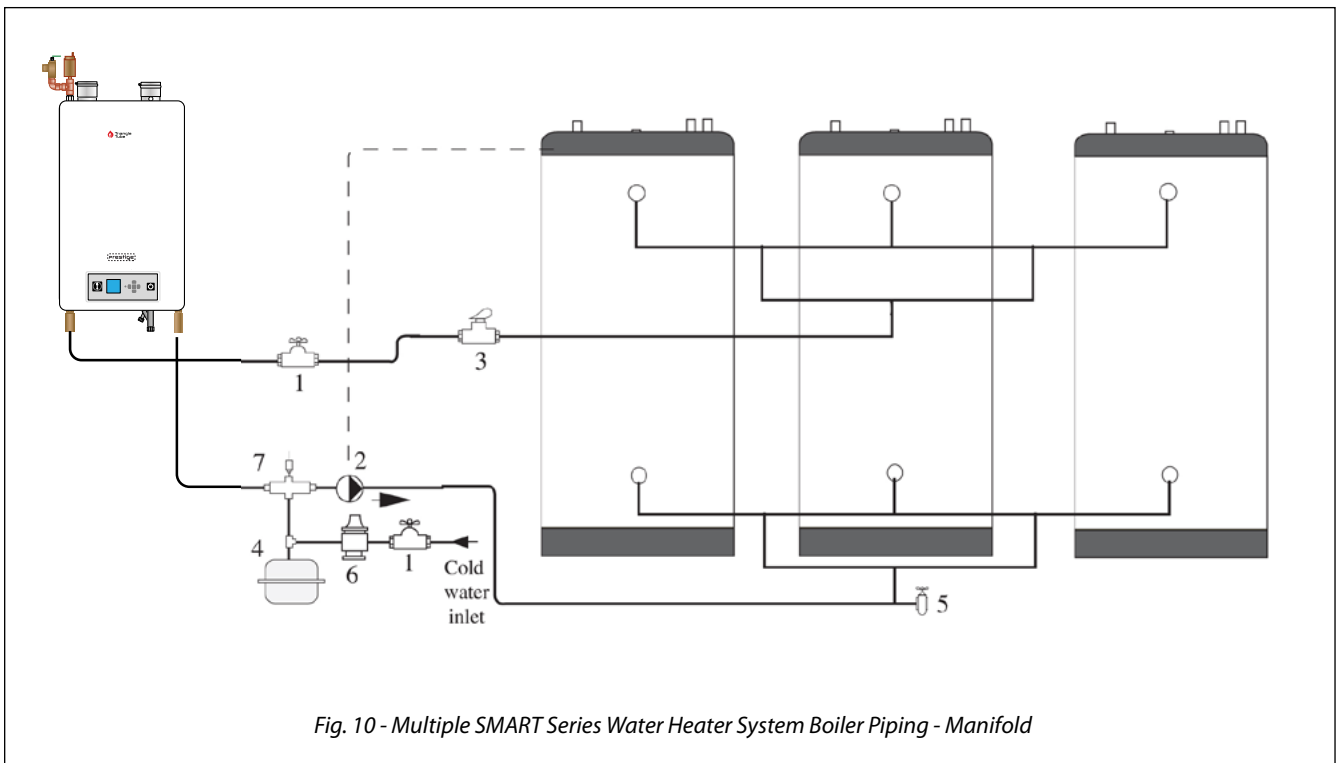


Fig. 10 - Multiple SMART Series Water Heater System Boiler Piping - Manifold

- | | |
|---------------------|------------------|
| 1. Shut-off valves | 6. Feed valve |
| 2. Circulator | 7. Air separator |
| 3. Flow check valve | |
| 4. Expansion tank | |
| 5. Drain valve | |

CHAPTER 3 - INSTALLATION - WIRING

3.1. Wiring Requirements



Electrical shock hazard can cause substantial property damage, serious injury, or death. Disconnect power before installing and/or servicing.

1. All wiring must be a minimum of 18 gauge and installed in accordance with:
 - U.S.A. - National Electrical Code 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.
2. If original wire supplied with appliance must be replaced, Type 90°C or its equivalent must be used.
3. Refer to control component instructions packed with boiler for application information.

NOTICE

The thermostat supplied with the Smart tank indirect water heater is intended for use in low voltage (24 V) circuits only at maximum 1 A..

4. An optional service switch may be installed in water heater electrical circuit. This switch would only shut off the water heater, not the home heating system. Do not shut off water heater if there is a chance of freezing.
5. All electrical contacts shown do not have power applied - off the shelf condition. *See pages 15 to 19.*

3.2. Circulators

Priority relay must be sized for total amp draw of all circulators.

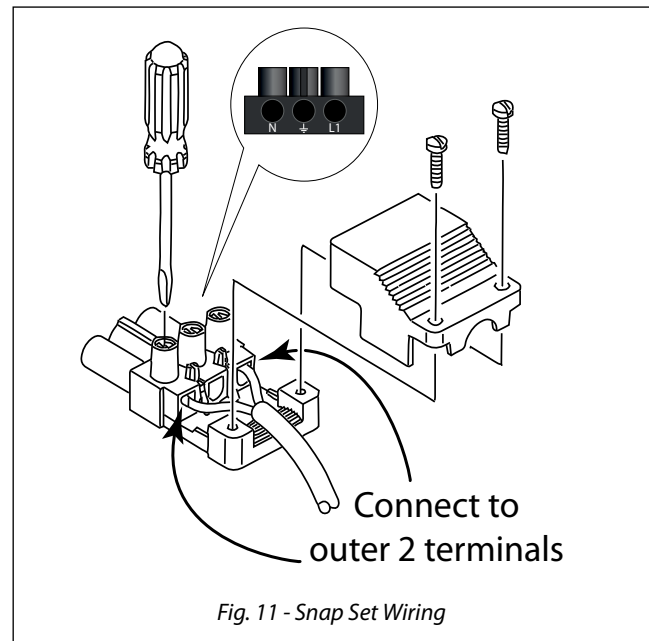
3.3. Zone Valves

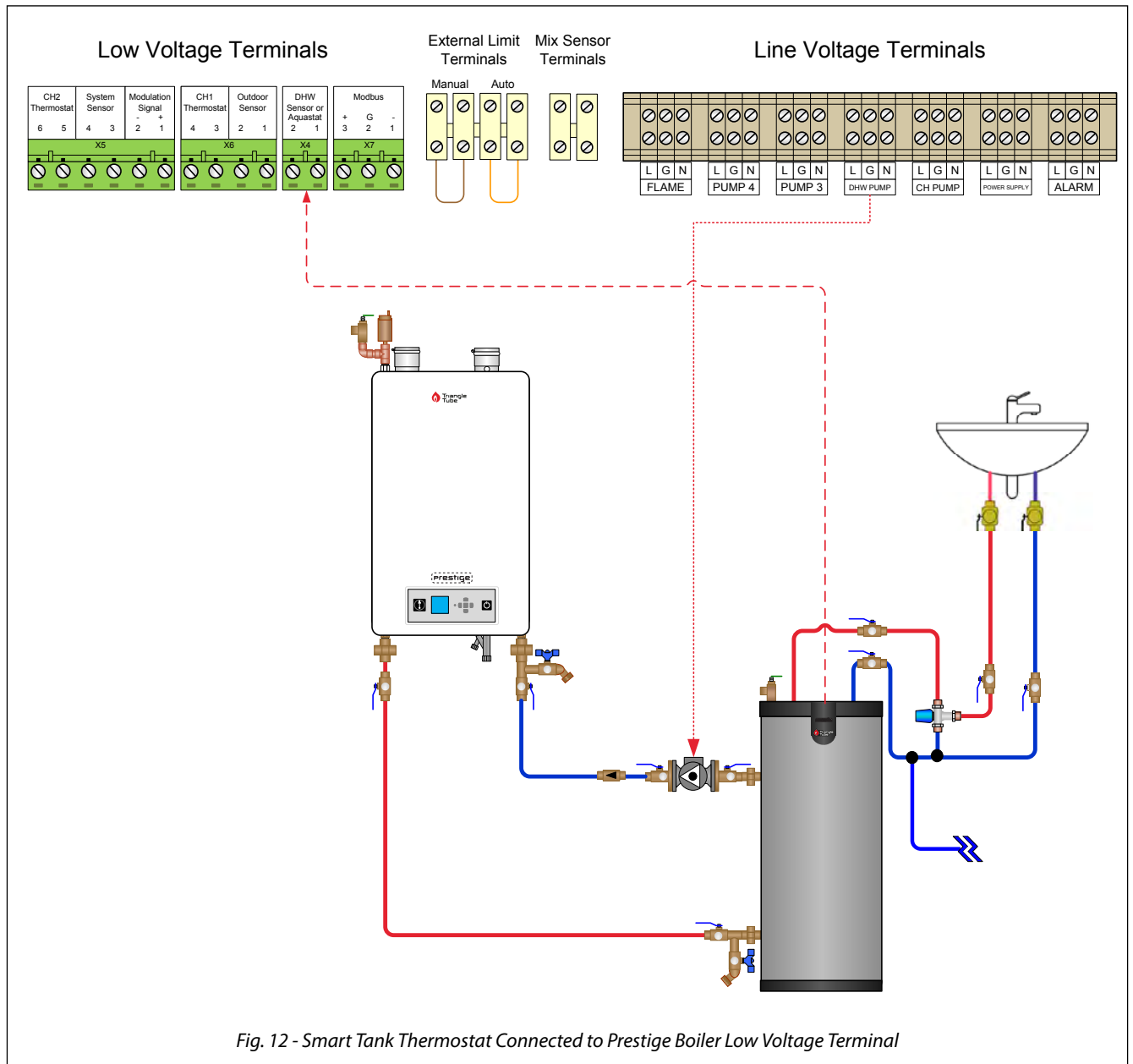
Transformer must be sized for maximum load of all zone valves.

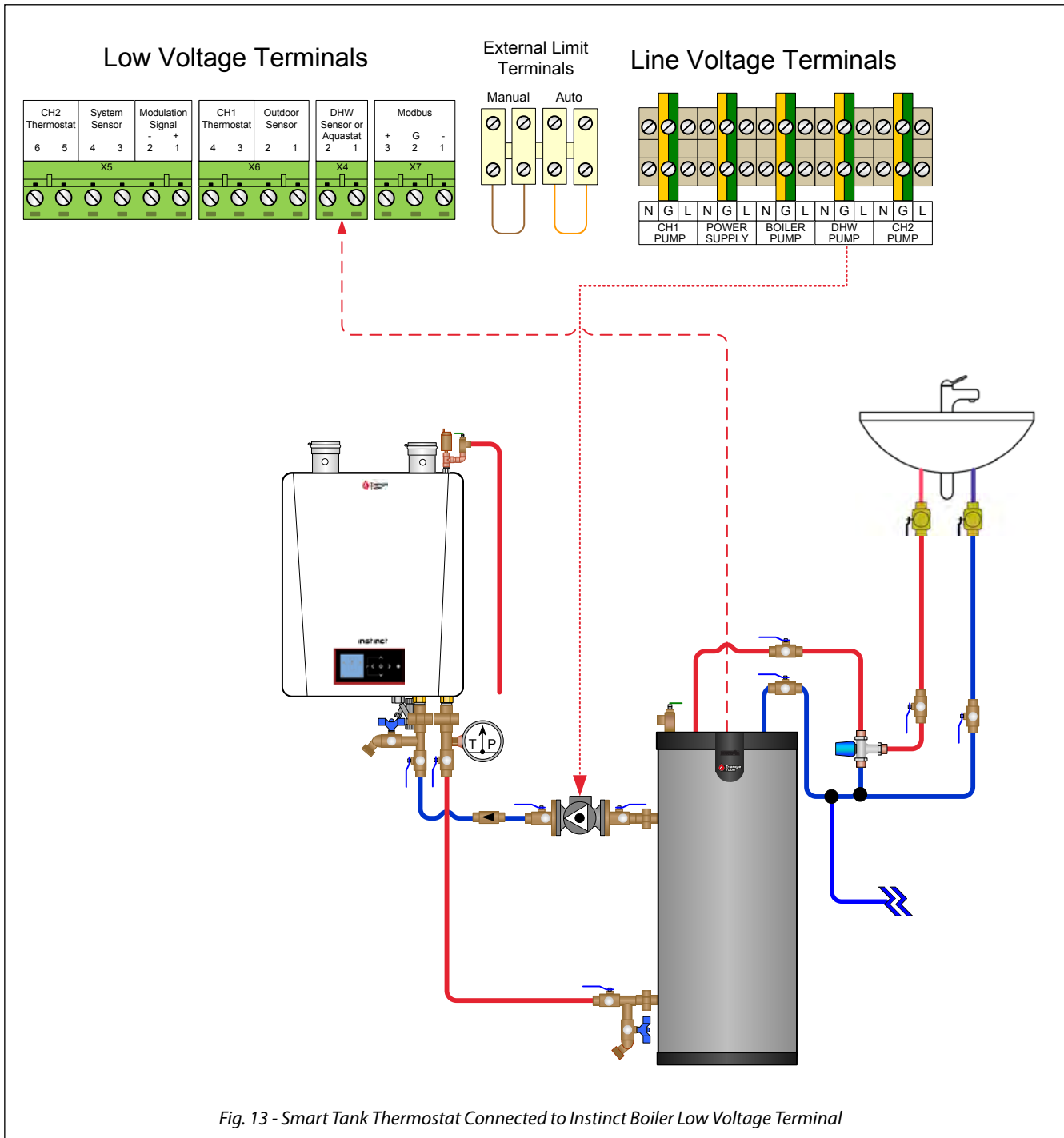
3.4. Snap Set Connection

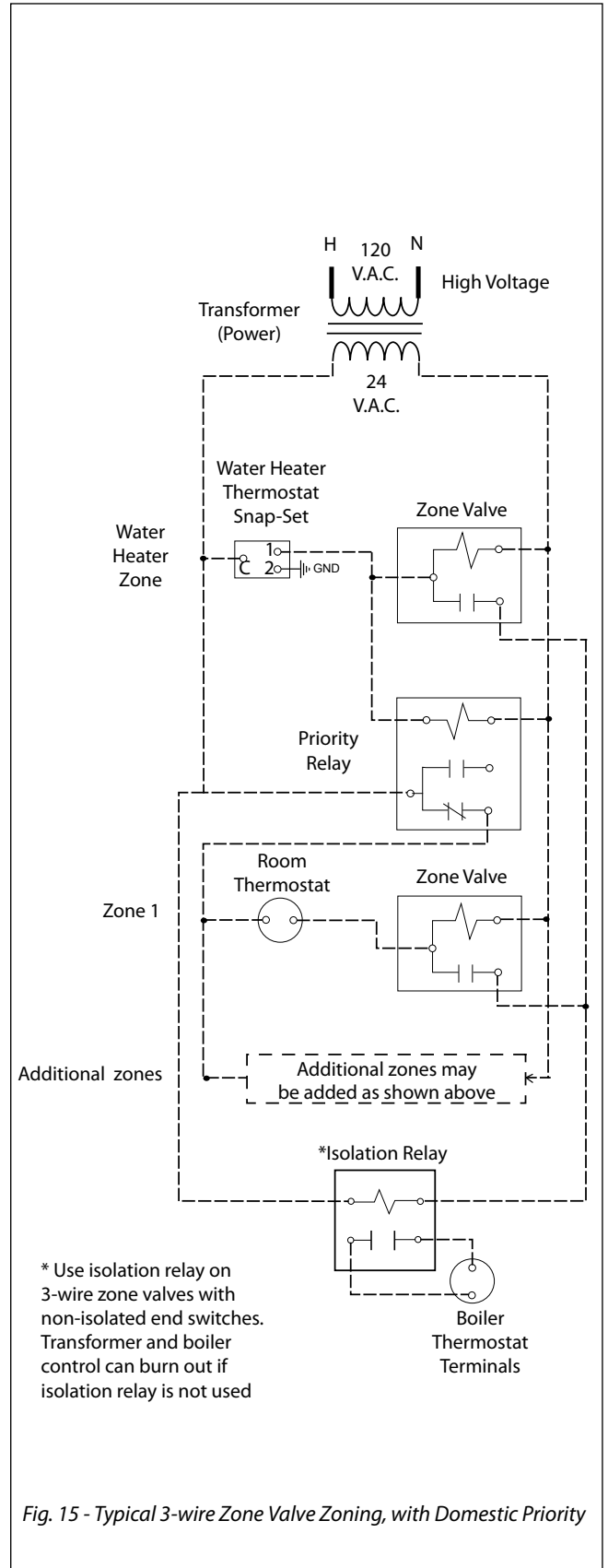
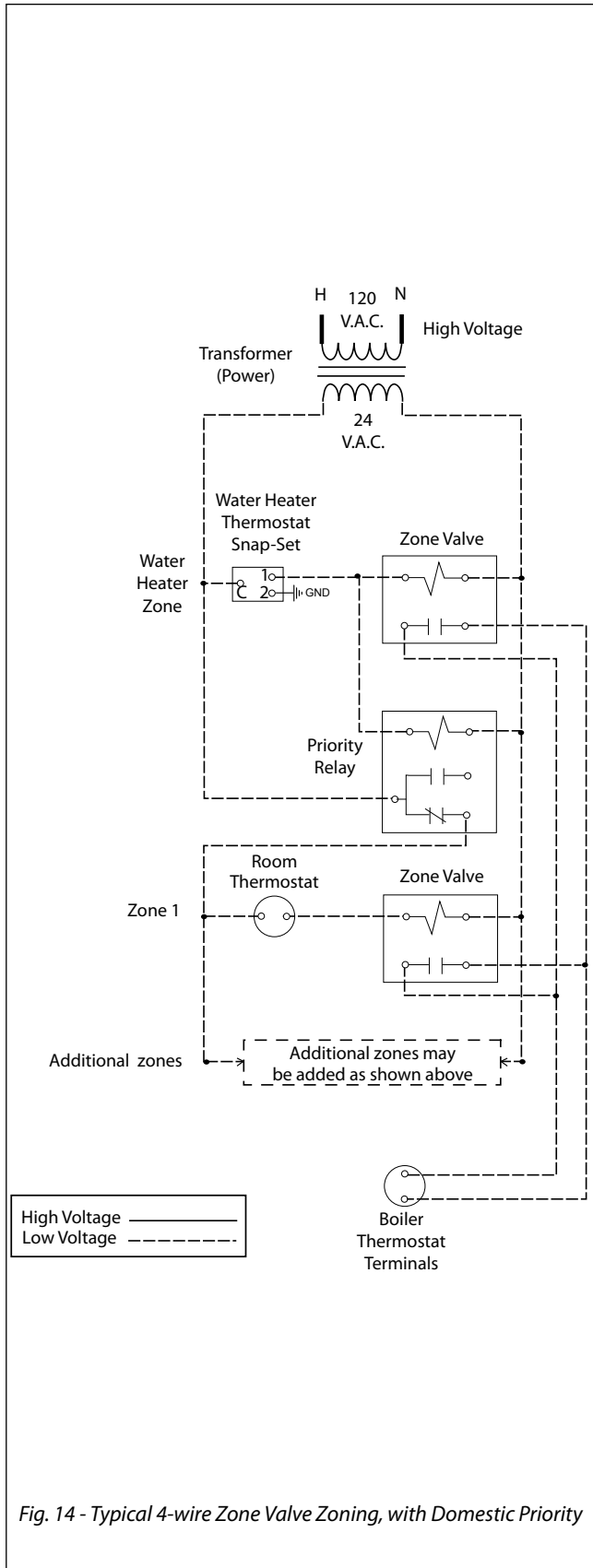
For easy wiring between water heater thermostat and boiler controls see wiring diagrams in following pages (refer to *Fig. 14 on page 17 thru Fig. 20 on page 20*).

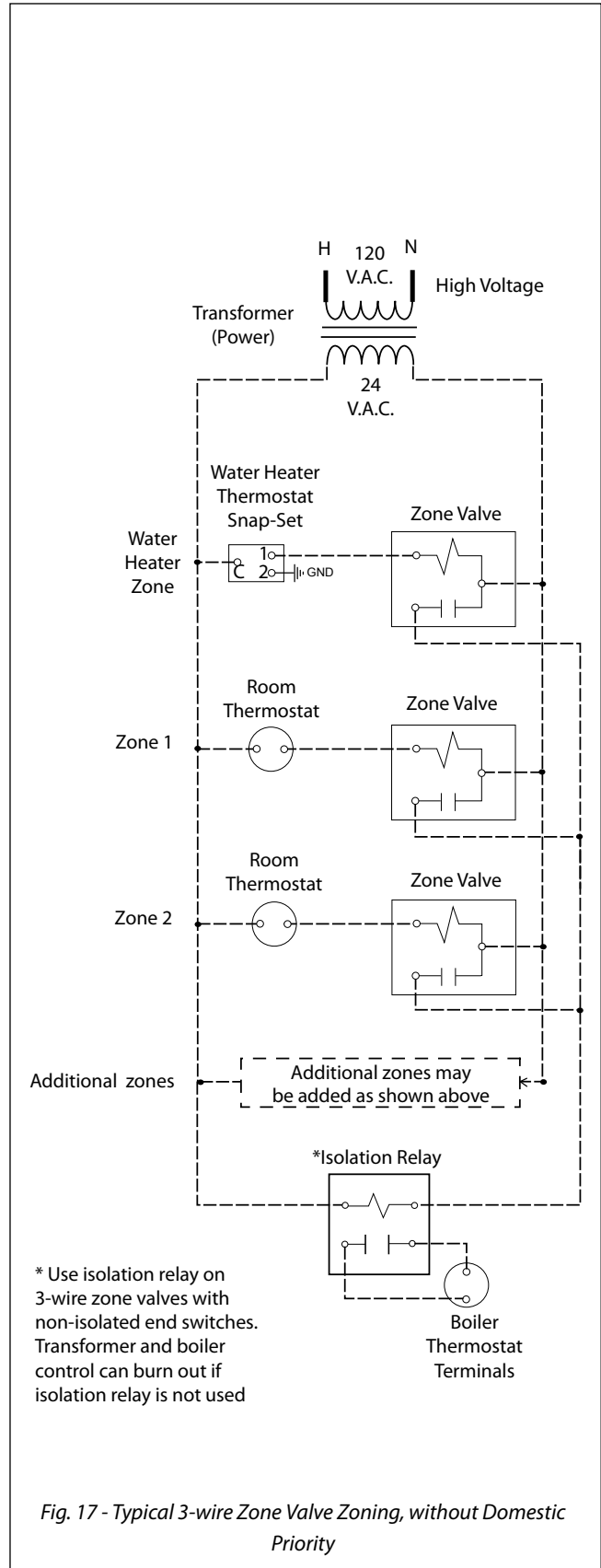
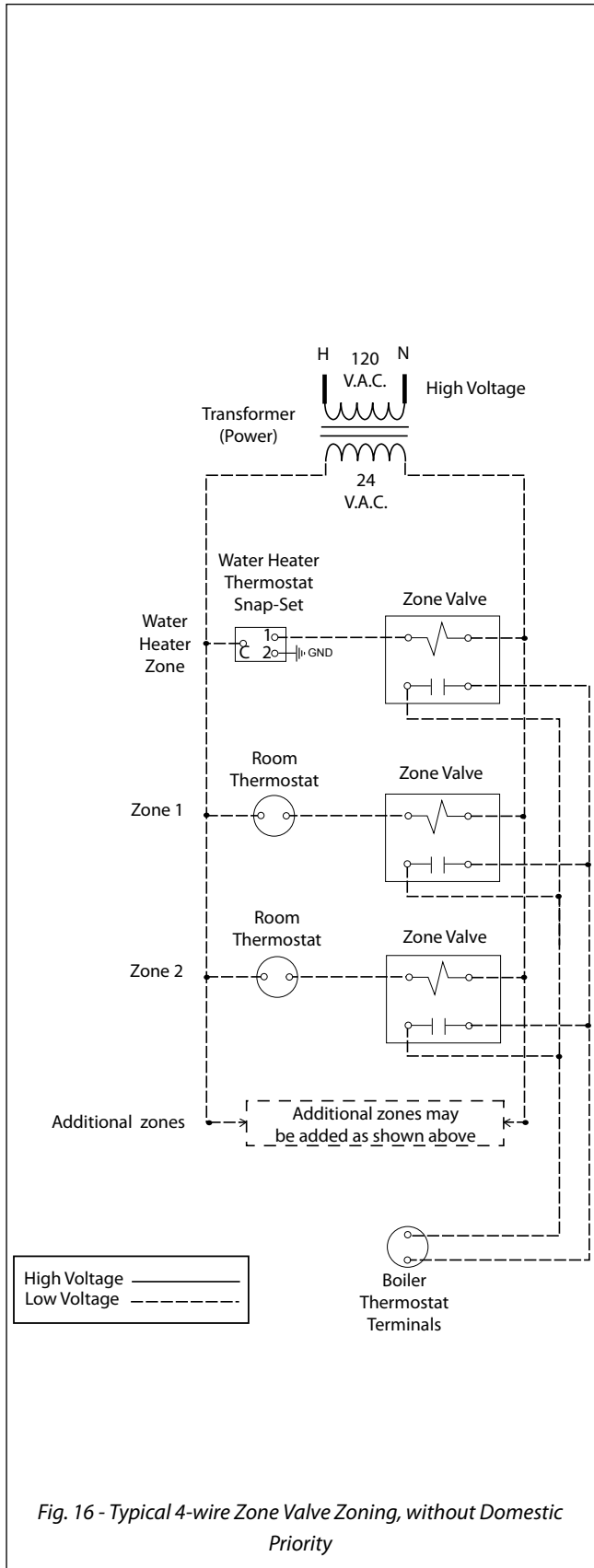
Make sure snap set is firmly snapped together after wiring.











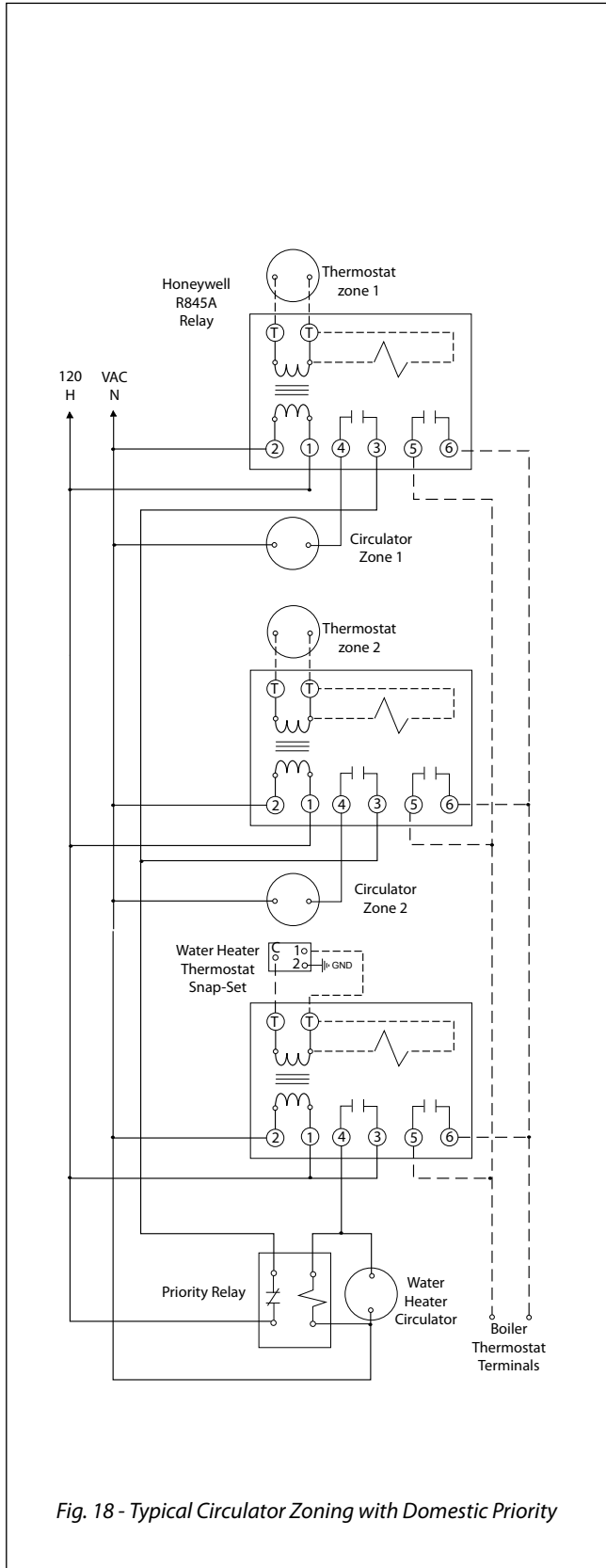


Fig. 18 - Typical Circulator Zoning with Domestic Priority

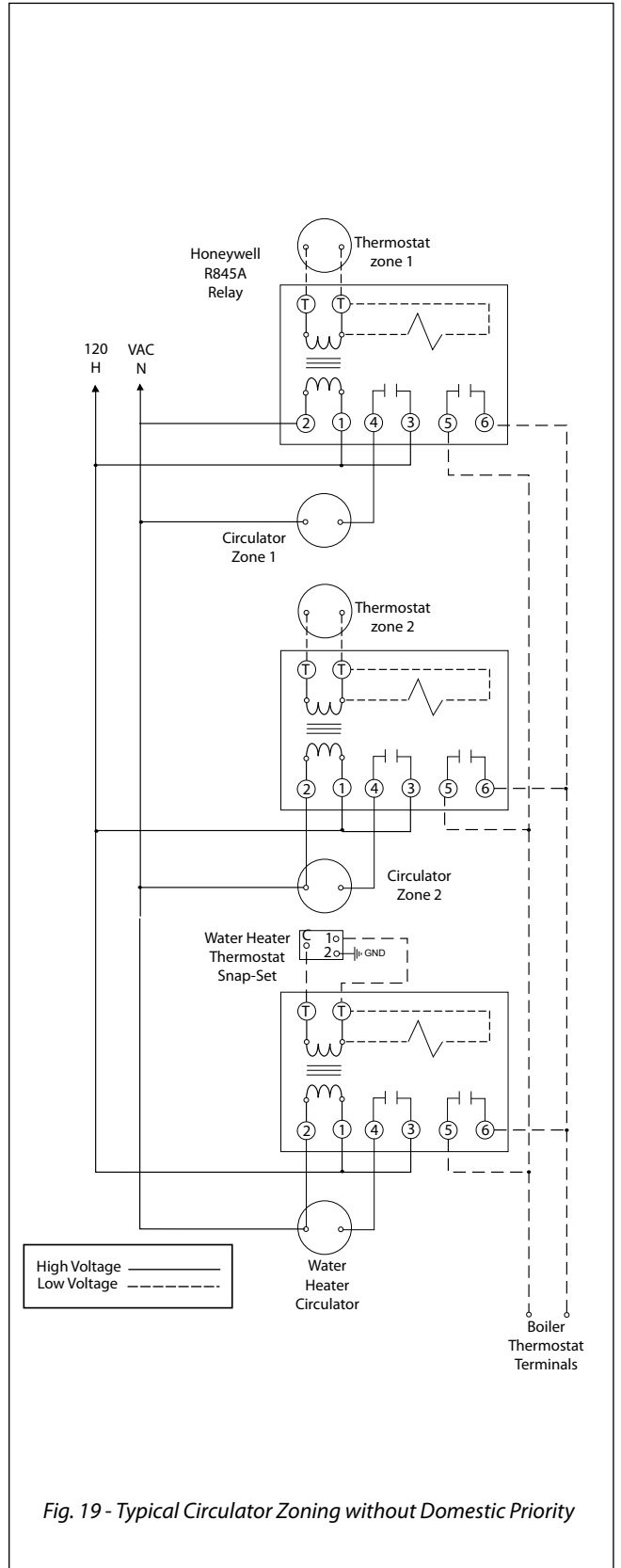


Fig. 19 - Typical Circulator Zoning without Domestic Priority

Note: Maximum of 4 total circulator zones when wiring 1 zone for priority

High Voltage ———
Low Voltage - - - - -

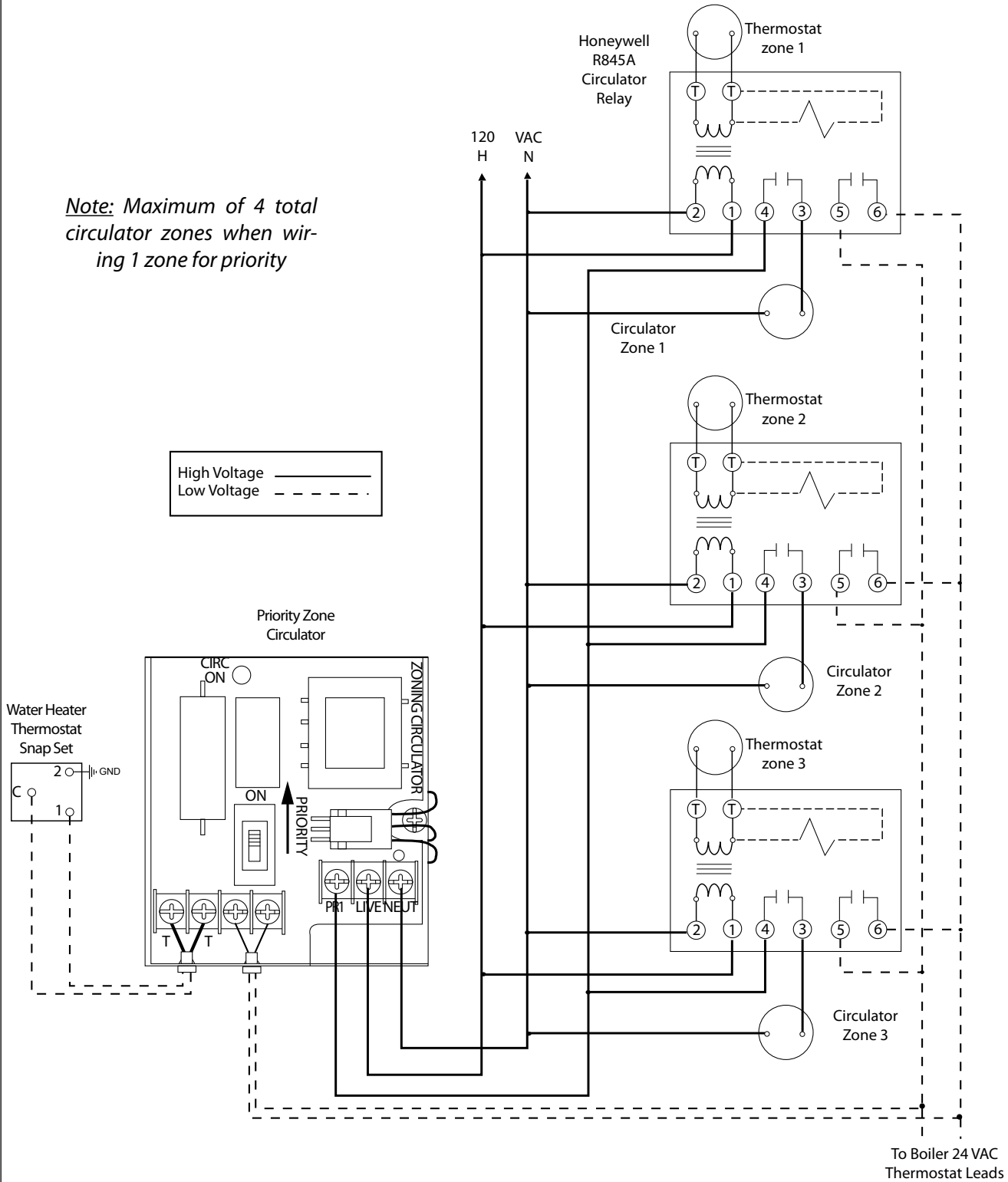


Fig. 20 - Priority Zone Circulator Wiring

CHAPTER 4 - WATER HEATER START-UP

4.1. Filling the Inner (Domestic Water) Tank

CAUTION

- Never use water heater unless inner and outer tanks are completely filled with water.
 - Inner tank must be completely filled and pressurized before pressurizing outer tank.
1. Close domestic water drain valve.
 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.

4.2. Filling the Outer (Boiler Water) Tank

CAUTION

- Never use water heater unless inner and outer tanks are completely filled with water.
 - Inner tank must be completely filled and pressurized before pressurizing outer tank.
1. Close boiler water drain valve at boiler water outlet of water heater.
 2. Open water heater's boiler water isolation valves.
 3. Allow air to escape from outer (boiler water) tank by opening manual air vent, located on top of water heater.
 4. Follow instructions furnished with boiler to fill with water.
 5. When tank is full, and air stops escaping, close the manual air vent.
 6. If antifreeze is used in boiler water, check concentration. Boiler water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in Clinical Toxicology of Commercial Products, 5th Edition.

WARNING

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

DANGER

HOT WATER CAN SCALD!

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



Water Temp.	Time for 3rd degree burn to occur
104 ° F	Safe for bathing
120 ° F	5 minutes
125 ° F	2 minutes
130 ° F	10 seconds
140 ° F	3 seconds
148 ° F	2 seconds
155 ° F	1 second

- Feel water before bathing or showering.
- Consumer Product Safety Commission and some states recommend temperatures settings of 120°F or less. Setting thermostat higher than 120°F 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.

WARNING



It is prohibited to set the boiler limit control above 210°F. This can cause substantial property damage, serious injury, or death if ignored.

NOTICE

- 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, resulting in very hot water coming out at the faucet.
- It is therefore recommended to either lower the thermostat setting or install automatic mixing valves as indicated in these instructions in order to reduce water temperature levels. Consult your installer or service technician.

4.3. 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.

The white mark on the temperature control corresponds to a water temperature of 120°F (49°C).

NOTICE

The marking indicating 120°F (49°C) on the thermostat is the preferred starting point for setting the temperature control.



Bacteria can develop in the domestic water system if certain minimum water temperatures are not maintained. Failure to maintain at least 140°F [60°C] domestic hot water temperature (using the Antilegionella function of your boiler, if any) can result in bacteria development, which can result in serious injury, or death.

- 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.
- When adjusting thermostat, be sure boiler limit control is set a minimum of 20°F higher.

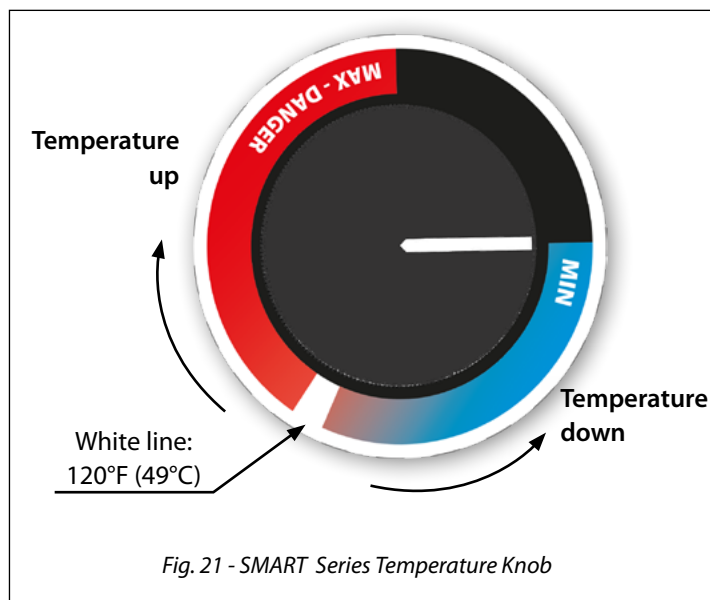


Fig. 21 - SMART Series Temperature Knob

CHAPTER 5 - WATER HEATER MAINTENANCE

5.1. Maintenance Schedule

5.1.1 Annual service by qualified service technician should include the following:

- Any procedure required by local codes.
- Check air vent operation.
- Verify system pressure. Air venting procedure may require adding water to bring system up to pressure, typically 12 psig.
- Manually operate T&P relief valve at least once a year. This will release some hot water.



Before operating T&P relief valve, make sure no one is in front of or around T&P relief valve discharge piping. Hot discharge water can cause substantial property damage or serious injury.

- Move operating lever to open position for a few seconds and then move it back, allowing it to snap closed. After T&P relief valve is operated, if it continues to release water, close cold water inlet to water heater immediately. Follow draining instructions, to relieve pressure from the tank and replace T&P relief valve. If T&P relief valve weeps periodically, it may be due to thermal expansion see *“Thermal Expansion” on page 6*. Do not plug T&P relief valve or discharge piping.



Plugging T&P relief valve or discharge piping can cause excessive pressure in water heater, resulting in substantial property damage, serious injury, or death.

- Follow instructions on circulator to oil it, if required.
- Check mixing valve, valves, pipes and fittings for leaks.
- Check function of field-installed controls and valves. See component manufacturer’s instructions.
- Review homeowner’s maintenance responsibilities and their frequencies, including any not listed in the following section.

5.1.2 Homeowner monthly maintenance to include:

- Check for air.
 - Manual air vent-open and close briefly to release any air.
- Check for leaks.
 - Visually check valves, pipes and fittings for leaks. Call qualified service technician to repair any leaks.

5.2. Filling Water Heater

See *“Filling the Inner (Domestic Water) Tank” on page 21* and *“Filling the Outer (Boiler Water) Tank” on page 21*.

5.3. Draining Water Heater

Drain the water heater if it will be shut off and exposed to freezing temperatures. Freezing water will expand and damage water heater.

- If boiler water contains sufficient antifreeze, then only the domestic water needs to be drained.



Close boiler water isolation valves and relieve system pressure to below 15 psig in outer tank before draining inner tank to prevent damage to inner tank.

- If boiler water does not contain sufficient antifreeze, then the boiler water and domestic water must be drained.

If antifreeze is used in boiler water, check concentration.

Boiler water (including additives) must be practically non-toxic, having toxicity rating or class of 1, as listed in *Clinical Toxicology of Commercial Products, 5th Edition*. A maximum 50/50 mixture of inhibited propylene glycol is allowed. Follow antifreeze manufacturer’s instruction.

Antifreeze must be checked on an annual basis or what is specified by the manufacturer of the antifreeze. Antifreeze must be replaced every 3-5 years or what is specified by the manufacturer of the antifreeze.



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



WARNING

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

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

5.3.1 Preparation for Draining the Tank.

1. Turn off domestic operations on the boiler so that the boiler will not fire while draining the tank. Reference the boiler technical manual for more information.

5.3.2 Draining Outer (Boiler Water) Tank.

1. Stop the domestic pump on the boiler water side of the tank.
2. Isolate the boiler circuit by closing the shutoff valves
3. Connect the drain valve to the sewer using a flexible hose.
4. Open the tank's air bleed valve to accelerate drainage.
5. Open the drain valve and drain the water from the primary heating circuit to the drain.
6. Close the drain valve and air bleed valve after draining the tank.

5.3.3 Draining inner (Domestic Water) Tank.



WARNING

Domestic water may be very hot. Hot domestic water can cause substantial property damage or serious injury.

1. Open fully the hot water tap at a plumbing fixture in the building until cool water is coming out of the hot water tap.

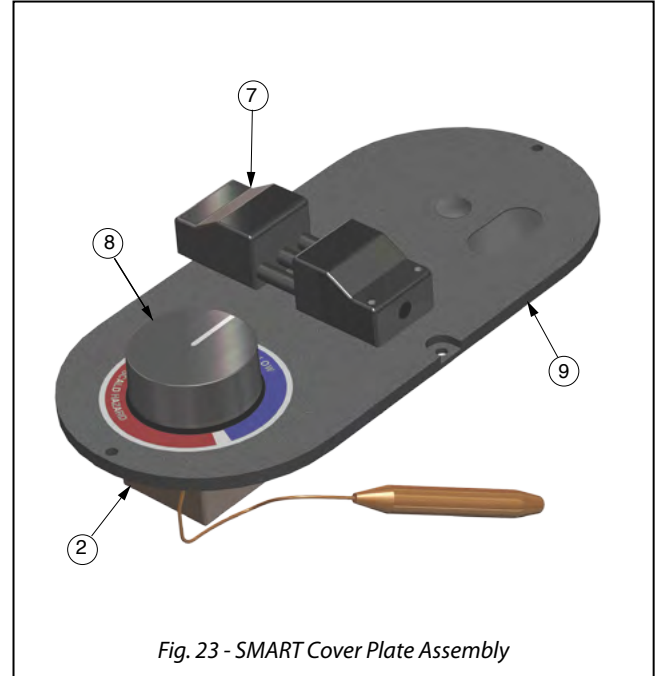
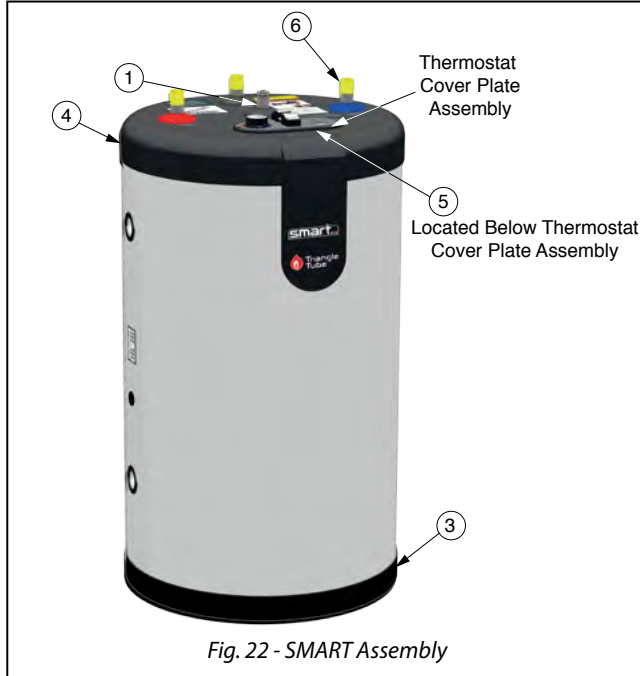
BEST PRACTICE

Opening multiple hot water taps will speed up the process.

2. Close the DHW cold water valve and allow water flow to stop.

3. Close the DHW cold and hot valves.
4. Disconnect the cold DHW inlet and hot DHW outlet piping from the plumbing system in the building. Residual water may flow out of the piping.
5. Remove the temperature and pressure relief valve from the temperature and pressure relief valve connection
6. Feed small tube hose such as ½ inch tubing into the temperature and pressure relief valve connection on the top of the tank
7. Ensure that the DHW side of the tank is open to atmosphere so as to not create a vacuum.
8. Connect the ½" tubing to the inlet side of a transfer pump.
9. Connect the outlet side of the transfer pump to flexible garden hose and drain the hose into a sewer.
10. Turn on the transfer pump and drain the water from the DHW tank to the sewer.
11. Once water has stopped flowing from the garden hose no more water can be removed from the tank.
12. Close the drain valve and the hot water tap after having drained the DHW tank.

CHAPTER 6 - REPLACEMENT PARTS



Item	Part #	Model	Description
1	P3KITAV02	All	Air vent, manual
2	P3KITTH01	All	Aquastat - 160°F residential
	SMRKIT200	All	Aquastat - 180°F commercial
3	P3KITBTM02	SMART 30, 40, 50 60	Bottom cap
	P3KITBTM03	SMART 80, 100	
	P3KITBTM04	SMART 120	
	P3KITTOP02	SMART 30, 40, 50 60	
4	P3KITTOP03	SMART 80, 100	Top cap
	P3KITTOP04	SMART 120	
	P3DW05	SMART 30	
5	P3DW01	SMART 40	Drywell
	P3DW02	SMART 50	
	P3DW03	SMART 60, 80	
	P3DW04	SMART 100, 120	
6	P3WKITDT01	SMART 30	Dip tube
	P3WKITDT02	SMART 40	
	P3WKITDT03	SMART 50	
	P3WKITDT04	SMART 60	
	P3WKITDT08	SMART 80, 100	
	P3WKITDT09	SMART 120	
7	P3KITWRS01	All	Snap-set wire harness
8	P3KNB02	All	Knob
9	P3CVR04	All	Cover plate
Not shown	SMRKIT201	All	3/4" Coupling
Not shown	SMRKIT202	All	1 1/2" x 3/4" Red. Coupling
Not shown	SMRKIT203	All	T&P Relief valve commercial
Not shown	SMRKIT204	All	T&P Relief valve residential

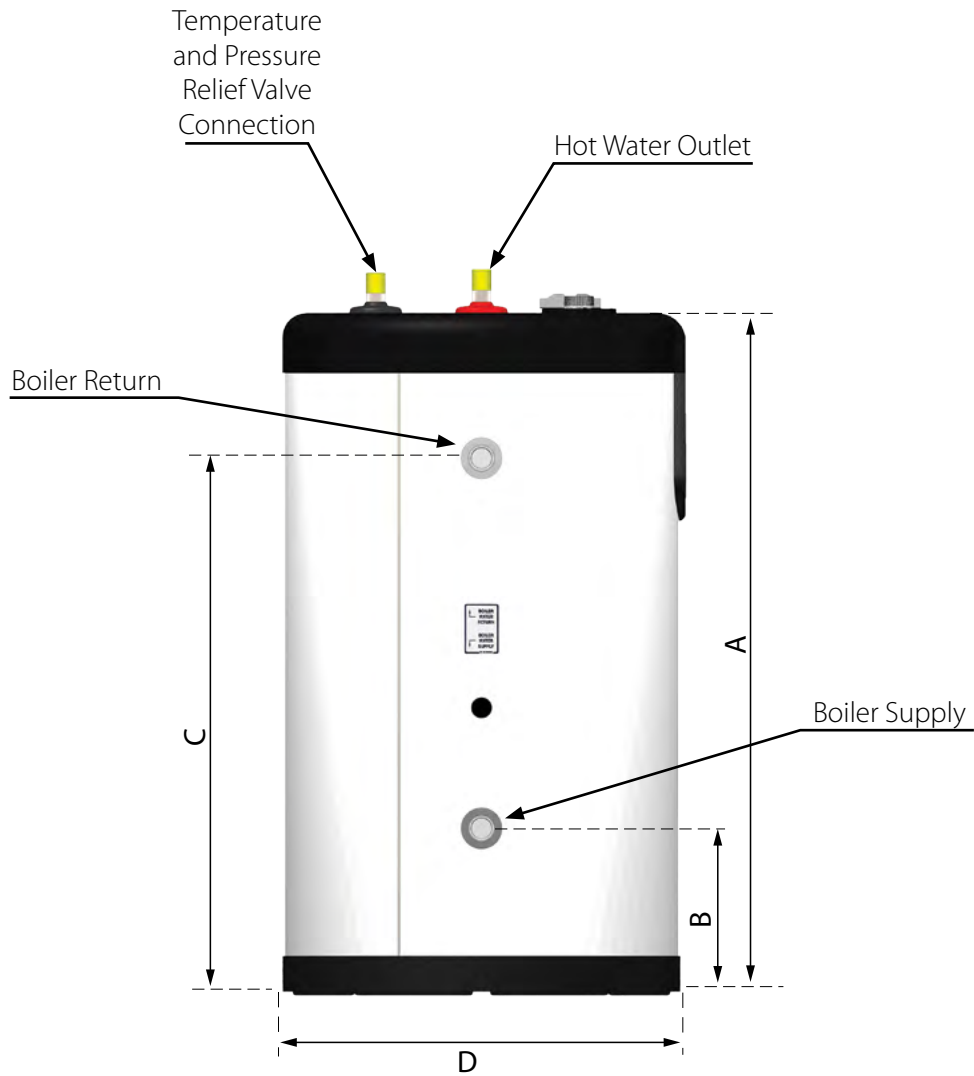


Fig. 24 - SMART Dimensions - Side View

CHAPTER 7 - WATER HEATER SPECIFICATIONS AND PERFORMANCES

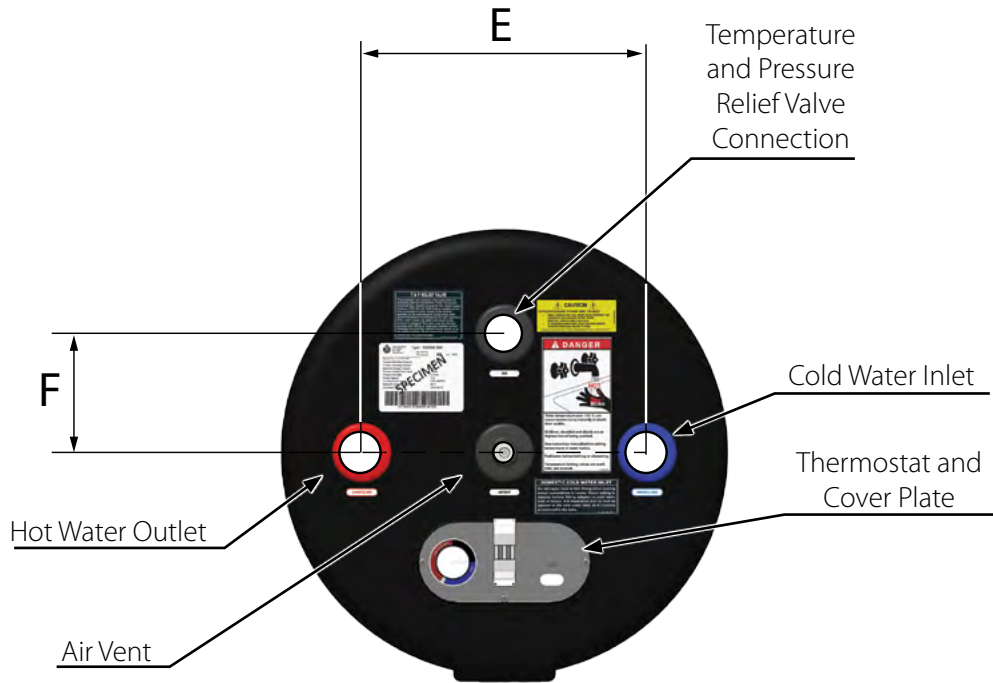


Fig. 25 - SMART Dimensions - Top View

Table 5 - SMART Water Heater Specifications

		SMART						
Model		30	40	50	60	80	100	120
Capacity	Gal.							
Domestic		28	36	46	56	70	95	119
Boiler		5	6	8	8	14	25	43
Heating Surface	Sq. Ft.	13	16	20	24	28	36	42
Head Loss Boiler Side	Ft.	3/4	1	1 1/4	1 1/2	2	2	2 1/2
Piping Connections	Inches							
Domestic	Ø	3/4	3/4	3/4	3/4	1 1/2	1 1/2	1 1/2
Boiler	Ø	1	1	1 1/4	1 1/4	1 1/2	1 1/2	2
Temperature and Pressure Relief Valve	Ø	3/4	3/4	3/4	3/4	1 1/2	1 1/2	1 1/2
Dimensions	Inches							
A		38	46	57	66	61	78	72
B		9	9	9	9	10	10	10
C		30	38	49	58	50 1/2	68	64
D		22	22	22	22	26	26	32
E		14	14	14	14	10 1/2	10 1/2	10 1/2
F		6	6	6	6	10 1/2	10 1/2	5
Dry well length	Inches	25	29	37	47	47	51	51
Empty weight	Lbs.	115	135	165	190	271	362	479

CHAPTER 7 - WATER HEATER SPECIFICATIONS AND PERFORMANCES

Table 6 - SMART Water Heater Performance at 200°F boiler water supply (140°F DHW outlet)

Model	Boiler Heating Capacity MBH	Peak Flow Gal./10 min.	1st Hour Flow Gal./Hour	Continuous Flow Gal./Hour	Circulator Min. GPM
SMART 30	87	40	140	115	5
SMART 40	112	50	180	150	7
SMART 50	140	65	220	185	8
SMART 60	270	100	410	360	16
SMART 80	300	125	460	400	18
SMART 100	337	150	525	450	25
SMART 120	420	190	650	560	28

Conditions:

- 50°F Domestic cold water inlet temperature
- 140°F Domestic hot water outlet temperature
- 200°F Boiler water supply temperature

Table 7 - SMART Water Heater Performance at 200°F boiler water supply (115°F DHW outlet)

Model	Boiler Heating Capacity MBH	Peak Flow Gal./10 min.	1st Hour Flow Gal./Hour	Continuous Flow Gal./Hour	Circulator Min. GPM
SMART 30	115	60	235	210	8
SMART 40	130	70	270	240	9
SMART 50	180	95	370	330	12
SMART 60	320	145	635	590	21
SMART 80	340	165	690	630	24
SMART 100	380	185	775	700	26
SMART 120	445	235	915	820	30

Conditions:

- 50°F Domestic cold water inlet temperature
- 115°F Domestic hot water outlet temperature
- 200°F Boiler water supply temperature

NOTES

A series of horizontal dotted lines for taking notes.

Additional quality water heating equipment available from Triangle Tube

Maxi-Flo Pool and Spa Heat Exchangers



- Constructed of high quality corrosion resistant stainless steel (AISI 316) or titanium
- Specially designed built-in flow restrictor to assure maximum heat exchange
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- Available in 8 sizes to accommodate any size pool or spa

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- 95% AFUE
- High Efficiency Condensing Boiler & Combi
- Power Range 80, 110, 155, 175, 250, 299, 399 MBH
- Turn Down Ratio up to 5:1
- Natural Gas or Propane
- Outdoor Reset

Instinct WHB & FSB Condensing Boilers



- 95% AFUE
- High Efficiency Condensing Boiler & Combi
- Power Range 110 MBH, 155 MBH, 199 MBH
- Turn Down Ratio up to 8:1
- Natural Gas or Propane
- Universal Top Adapter (PVC/PP/SST)
- Outdoor Reset

TTP Brazed Plate Heat Exchangers



- For domestic water, snow melting, radiant floor
- Plates made of stainless steel, with 99.9 % copper brazing, ensuring a high resistance to corrosion
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