PATTERSON-KELLEY

P-K COMPACT®

Semi-Instantaneous Water Heater

(Steam and Water)

ASME Code, Section VIII
Certified by Patterson-Kelley

Installation Date: _____

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INSTALLATION & OWNER'S MANUAL

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1.0 INTRODUCTION

This manual covers installation, operation, and maintenance of the P-K COMPACT® semi-instantaneous water heater. While details may differ slightly, basic operation is the same for all models. The P-K COMPACT® water heater is built to operate using steam or boiler water as the heating medium.

The P-K COMPACT® water heater is only a part of the complete hot water supply system. The P-K COMPACT® water heater may be fully operational and yet, because of poor circulation, controls, heat source failure, or other operating conditions, may not deliver hot water as desired. Additional equipment such as steam or hot water boilers, temperature sensors, pumps, flow switches or valves will be required for satisfactory operation of any system. Patterson-Kelley cannot be held responsible for the design or operation of such systems and a qualified engineer or contractor must be consulted.

P-K COMPACT® water heaters are completely packaged, ready to connect to services.

A standard P-K COMPACT® water heater configured for use with **boiler water** includes the following trim:

- Shell insulated and covered with a reinforced PVC jacket
- Boiler water control valve
- Dual temperature limit system
- Circulation pump
- Dial thermometer
- Relief valve

A standard P-K COMPACT® water heater configured for use with **steam** includes the following trim:

- Shell insulated and covered with a reinforced PVC jacket
- Steam control valve
- Dual temperature limit system
- Circulation pump
- Dial thermometer
- Relief valve
- Steam pressure gauge
- Steam trap

2.0 SAFETY

⚠ WARNING It is **essential** to read, understand, and follow the recommendations of this manual before installing, operating, or servicing this equipment. Failure to do so could result in serious injury, death, and/or property damage.

⚠ CAUTION Installation and service must be performed by a qualified and knowledgeable installer or service agency.

2.1 GENERAL

The P-K COMPACT® semi-instantaneous water heater **must** be:

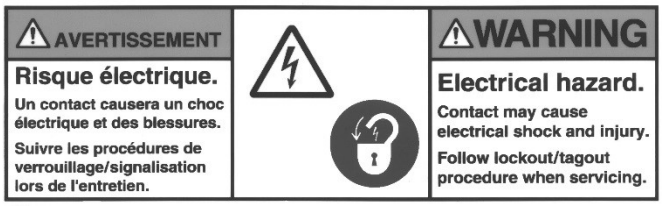
Installed, operated, and serviced in accordance with instructions contained in this manual.

Installed in accordance with designs prepared by qualified facility engineers including structural, mechanical, electrical, and other applicable disciplines.

Operated and serviced in accordance with a comprehensive safety program determined and established **by the customer**. Do not attempt to operate or service the unit until such a program has been established.

Operated and serviced by qualified and knowledgeable personnel in accordance with all applicable codes, laws, and regulations.

2.2 TRAINING



Proper training is the best protection against accidents. Operating and service personnel must be thoroughly familiar with the basic construction and operation of the P-K COMPACT® semi-instantaneous water heater, and all applicable safety precautions. If any of the provisions of this manual are not fully and completely understood, contact the Patterson-Kelley Technical Service Department at (877) 728-5351. Please have the serial number of the unit available. The serial number is located on the name plate attached to the main flange. The serial number is also stamped into the tube-sheet of the bundle.

2.3 SAFETY FEATURES

It is the responsibility of the customer to maintain the safety features of this water heater such as guards, safety labels, safety controls, interlocks and lockout devices.

2.4 SAFETY LABELS

The following signal words are used in this manual to denote the degree of seriousness of the individual hazards.

DANGER indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, **may** result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE! - NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol is not used with this signal word.

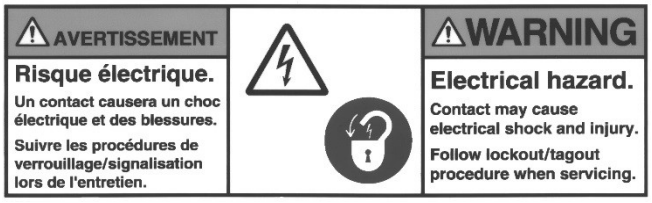
The safety labels shown below are affixed to the unit and dual language labels may also be affixed to the unit. Although the labels are of high quality, they may become dislodged or unreadable over time. Contact Patterson-Kelley for replacement labels.

2.5 SAFETY PRECAUTIONS

Provide a suitable location for the P-K COMPACT® water heater, away from normal personnel traffic, with adequate working space, adequate clearances, proper ventilation and lighting, with a structure sufficiently strong and rigid to support the weight of the P-K COMPACT® water heater, all piping and accessories.

CAUTION Proper lockout/tagout procedures must be employed whenever this unit is serviced.

2.5.1 Electrical Hazards



Shock hazard! Properly lockout/tagout the electrical service and all other energy sources before working on or near the water heater.

Shock hazard! Water heater is not rated for wash-down service.

2.5.2 Burn Hazards

General Warning

Burn hazard! Possible hot surfaces. Do not touch the steam or hot water inlet pipes during operation.

Burn hazard! Valve and piping should be insulated according to valve manufacturer's specifications to prevent contact with hot surfaces.

Burn hazard! Contains hot fluids. Allow P-K COMPACT® water heater to cool before servicing or draining the water heater.

2.5.3 Crush Hazards

General Warning

Lifting hazards! Use properly rated lifting equipment to lift and position the P-K COMPACT® water heater. The load is unbalanced. Test balance before lifting 3 ft. above the floor. Do not allow personnel beneath the lifted load. The approximate weights of the P-K COMPACT® water heater models are listed in the chart at the right. Weights may vary based on options and component selection.

Model	Weight
PK06	680 lbs
PK08	780 lbs
PK10	1270 lbs
PK12	1550 lbs

2.5.4 Pressure Hazards

General Warning

Pressure hazard! Contains hot fluids under pressure. Install isolation valves on steam or boiler water inlet and outlet. Make sure isolation valves are closed before servicing the P-K COMPACT® water heater.

Pressure hazard! Contains hot fluids under pressure. Test the relief valve as recommended by the manufacturer during operation and after any prolonged period of inactivity. Do not operate the water heater with a faulty relief valve.

2.5.5 General Hazards

General Warning

Tripping hazard! Do not install piping on floor surfaces. Maintain clear path around the P-K COMPACT® water heater.

Slip and fall hazard! Use a drip pan to catch water while draining the P-K COMPACT® water heater. Maintain dry floor surfaces.

Bump hazard from overhead piping. Install piping with adequate vertical clearance.

3.0 INSTALLATION

3.1 RECEIVING AND STORAGE

3.1.1 Initial Inspection

Upon receipt of this P-K COMPACT® semi-instantaneous water heater, please inspect the unit for any damage. The P-K COMPACT® water heater was thoroughly inspected and tested prior to shipment. Note any damage or shortage on the freight bill and file all claims for shortage or damage with the carrier.

3.1.2 Storage Prior to Installation

If the P-K COMPACT® water heater is not installed immediately, it must be stored in a location adequately protected from the weather, preferably indoors. If this is not possible, then it should remain in the shipping container and be covered by a tarpaulin or other waterproof covering.

NOTICE! Controls and other equipment that are damaged or fail due to weather exposure are not covered by warranty.

3.2 COMPLIANCE WITH CODES

The P-K COMPACT® semi-instantaneous water heater is constructed and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII. Other codes or approvals which apply will be labeled on the P-K COMPACT® water heater.

Installation of the P-K COMPACT® water heater must be performed by qualified personnel. The installation must conform to all national, state or provincial and local code requirements established by the authorities having jurisdiction as well as specific instructions in this manual. Authorities having jurisdiction should be consulted before installations are made.

3.3 PLACEMENT

Provide a firm, level foundation, preferably of concrete. The P-K COMPACT® water heater should be secured to the building floor or mounting pad. Four holes are provided in the base for attachment to the foundation. Note: Seismic anchorage information is available upon request. Contact your local sales representative for more information.

The P-K COMPACT® water heater is top-heavy. Proper rigging techniques should be followed while moving heavy equipment to avoid injury.

The P-K COMPACT® water heater must be plumb and level to function properly.

The P-K COMPACT® water heater should be placed with at least 10” headroom above it to permit removal of the relief valve.

All P-K COMPACT® steam water heaters should be placed to permit gravity flow of condensate to the condensate return system (see Section 3.5.2).

3.4 ELECTRICAL CONNECTIONS

All field wiring connections for power and controls are in the junction box on the front of the P-K COMPACT® water heater. The wiring label is attached to the inside front door of the control box. An external electrical disconnect (not supplied with the water heater) with adequate overload protection is required. The water heater must be grounded in accordance with national, state or provincial, and local codes.

Connect the system to the correct voltage. The P-K COMPACT® water heater requires 120V AC, 15A service with ground (H, N, G) supplied from a suitable circuit breaker or fused disconnect. The circulation pump has a 120V constant speed fractional HP motor that operates continuously when the power to the unit is on.

NOTICE! Do not operate the pump without water in the unit! Do not turn on power before filling with water! Failure to do so can cause damage to the pump.

3.5 HEATING MEDIA PIPING

Install unit using steam or boiler water as listed on the unit. The steam or boiler water piping should be appropriately sized and include a strainer, isolation valves and over pressure protection where required. A self–contained, pneumatic or electric steam or boiler water control valve is required. Connection to the valve should be made according to the installation diagrams in this manual.

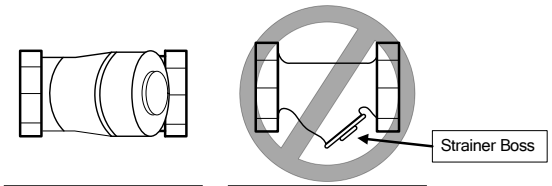
⚠ WARNING Only steam or hot water heating media is to be used.

3.5.1 Steam Piping

Steam supply piping should be sized to deliver the correct volume of steam at sufficient pressure to the control valve. Consideration should be given to steam pressure, steam volume, and supply line pressure drop. The control valve should be mounted directly to the steam bonnet on the base of the unit with no pipe runs between the control valve and the steam bonnet.

The steam supply, including a strainer and isolation valves, must be connected to the inlet of the steam control valve. The strainer protects the control valve from any foreign materials carried through the steam line. A drip leg with a condensate trap should be installed in the steam line just before the steam valve to prevent condensate from collecting in the line. Condensate in the line may impact the valve at such a velocity that damage to the valve could occur. A blow down valve on the wye strainer is recommended for periodic cleaning of the strainer.

NOTICE! When installing the wye strainer in the horizontal steam piping configuration, the boss must be in the same plane as the pipe. DO NOT point the screen at a downward angle!

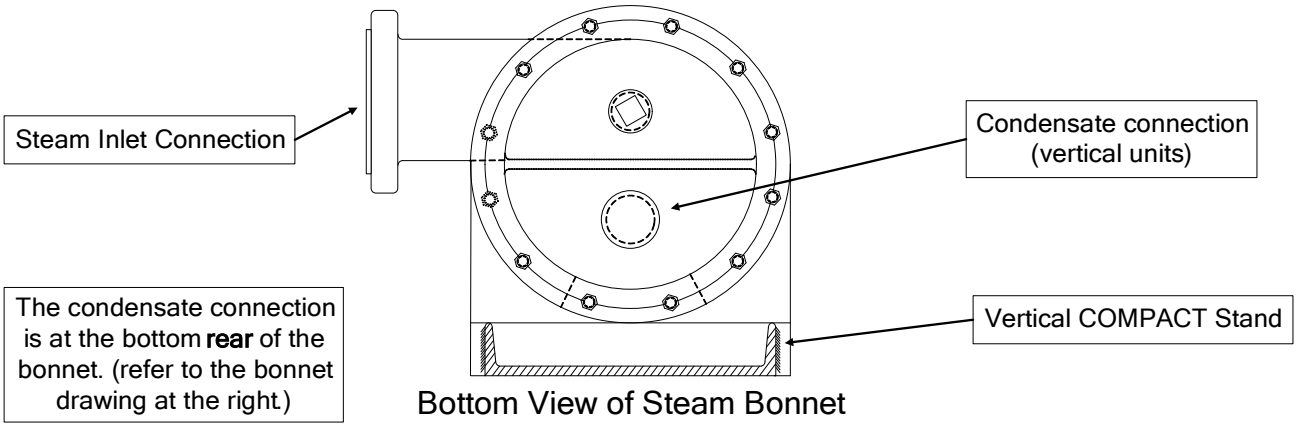


3.5.2 Condensate Piping

Proper condensate drainage from the tubes of the P-K COMPACT® water heater is needed to avoid:

- Possible tube rupture
- Damage to steam traps
- Damage to the temperature control valve
- Erratic water temperature control

The P-K COMPACT® water heater requires the rapid removal of condensate that accumulates as the heat energy from the steam is transferred into the domestic hot water. A properly sized steam trap is supplied loose for field installation and must be piped to the condensate connection of the unit.



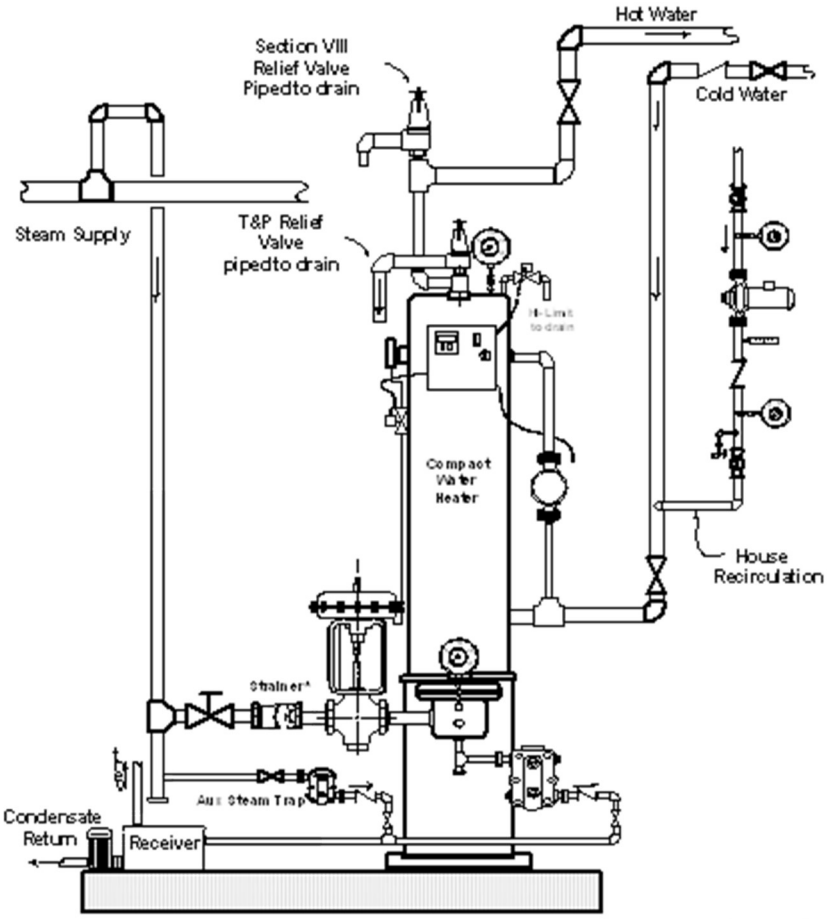
Bottom View of Steam Bonnet

NOTICE! The condensate must be drained from the P-K COMPACT® water heater into a receiver or piping vented to atmosphere.

NOTICE! Do not attempt to lift condensate above the condensate outlet without a condensate pump. Failure to comply will cause erratic temperature control and may result in premature tube bundle failure.

Vertical Configuration (Standard)

NOTICE! The condensate must be drained from the P-K COMPACT® water heater into a receiver or piping vented to atmosphere.



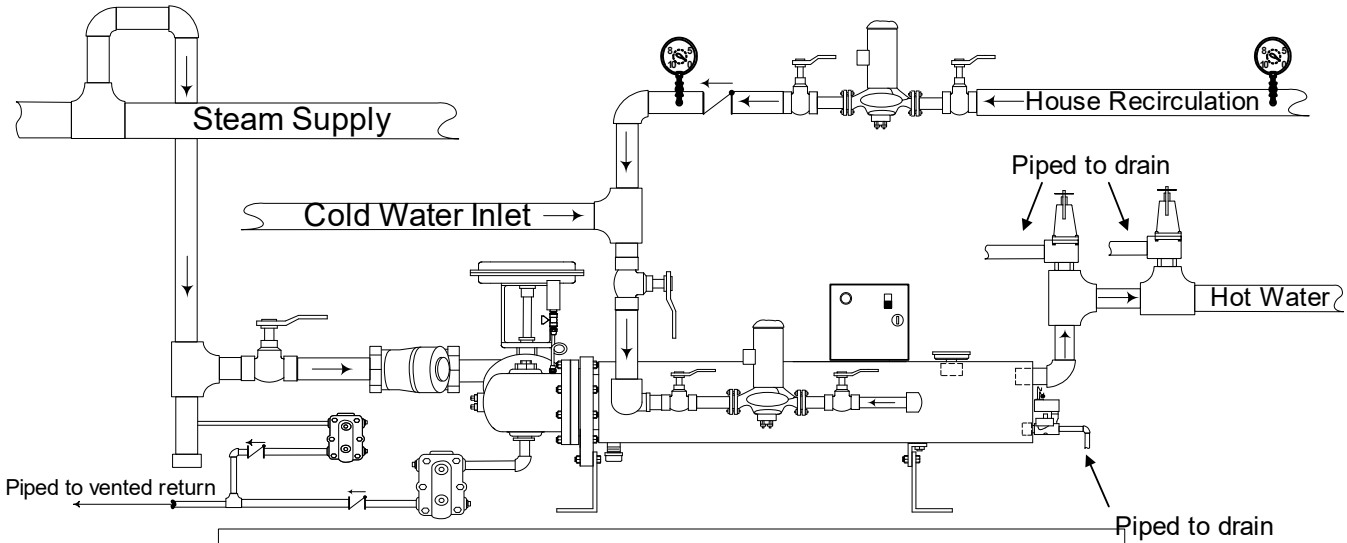
NOTICE! Do not attempt to lift condensate above the condensate outlet without a condensate pump. Failure to comply will cause erratic temperature control and may result in premature tube bundle failure.

The figure above illustrates proper piping for removal of the condensate, both in the inlet steam pipe and from the condensate outlet for the standard (vertical) P-K COMPACT® water heater configuration. The inlet steam pipe has an Auxiliary Steam Trap to remove any condensate that forms in the steam supply line. This trap protects the valve and the unit from damage during operation. All condensate is shown draining vertically downward by gravity.

The temperature control valve regulates the steam flow according to the requirements of the domestic water flow. This regulation is accomplished by varying the orifice size of the valve while maintaining a pressure drop across the orifice, which results in reduced pressure in the tube bundle. The reduced pressure is not sufficient to lift the condensate above the trap level. Therefore, the condensate must be drained from the P-K COMPACT® water heater by gravity to a floor drain or condensate return system.

Horizontal Configuration

NOTICE! The condensate must be drained from the P-K COMPACT® water heater into a receiver or piping vented to atmosphere.



Horizontal P-K COMPACT® Piping Diagram

NOTICE! Do not attempt to lift condensate above the condensate outlet without a condensate pump. Failure to comply will cause erratic temperature control and may result in premature tube bundle failure.

The figure above illustrates proper piping for removal of the condensate, both in the inlet steam pipe and from the condensate outlet for the horizontal P-K COMPACT® water heater configuration. The inlet steam pipe has an Auxiliary Steam Trap to remove any condensate that forms in the steam supply line. This trap protects the valve and the unit from damage during operation. All condensate is shown draining vertically downward by gravity.

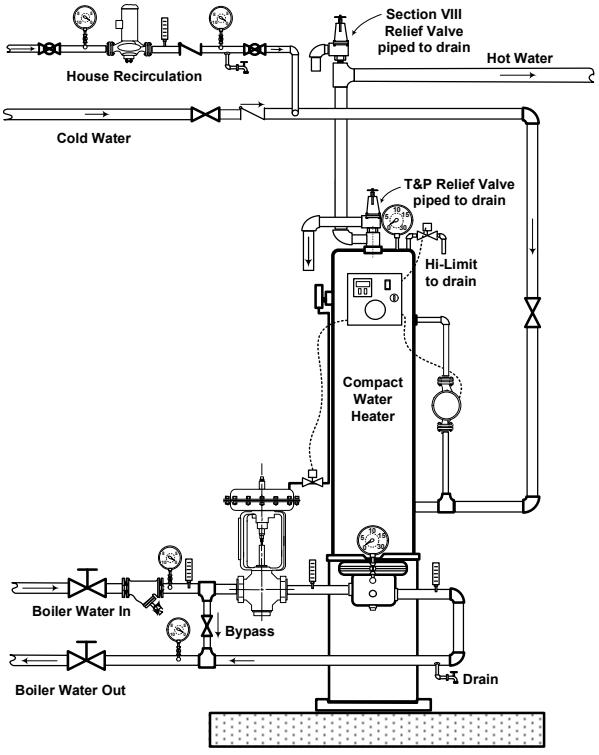
The temperature control valve regulates the steam flow according to the requirements of the domestic water flow. This regulation is accomplished by varying the orifice size of the valve while maintaining a pressure drop across the orifice, which results in reduced pressure in the tube bundle. The reduced pressure is not sufficient to lift the condensate above the trap level. Therefore, the condensate must be drained from the P-K COMPACT® water heater by gravity to a floor drain or condensate return system.

3.5.3 Boiler Water Piping

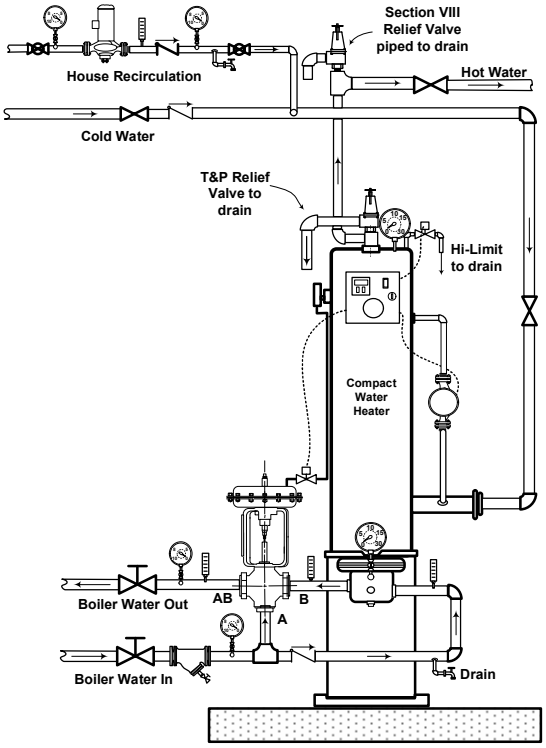
The boiler water supply & return piping should be sized to deliver sufficient hot water to the P-K COMPACT® water heater without excessive pressure drop throughout its capacity range. The boiler water supply piping should include isolation valves, strainer, pressure gauges and a drain valve as illustrated in the piping diagrams below.

⚠ WARNING When using a two-way valve, the boiler water passes through the valve and then through the tube bundle. On a **three-way valve** the valve is mounted such that the common port (AB) faces **away** from the water heater.

The systems illustrated below depict two-way and three-way control valve arrangements.



PIPING ARRANGEMENT
BOILER WATER – 2 WAY VALVE



PIPING ARRANGEMENT
BOILER WATER - 3-WAY VALVE

The three-way control valve arrangement is recommended for boiler water applications but is not mandatory. Use of a three-way control valve provides continuous flow through the water heater "zone", so that flow through the boiler is not upset when the water heater receives a call for heat.

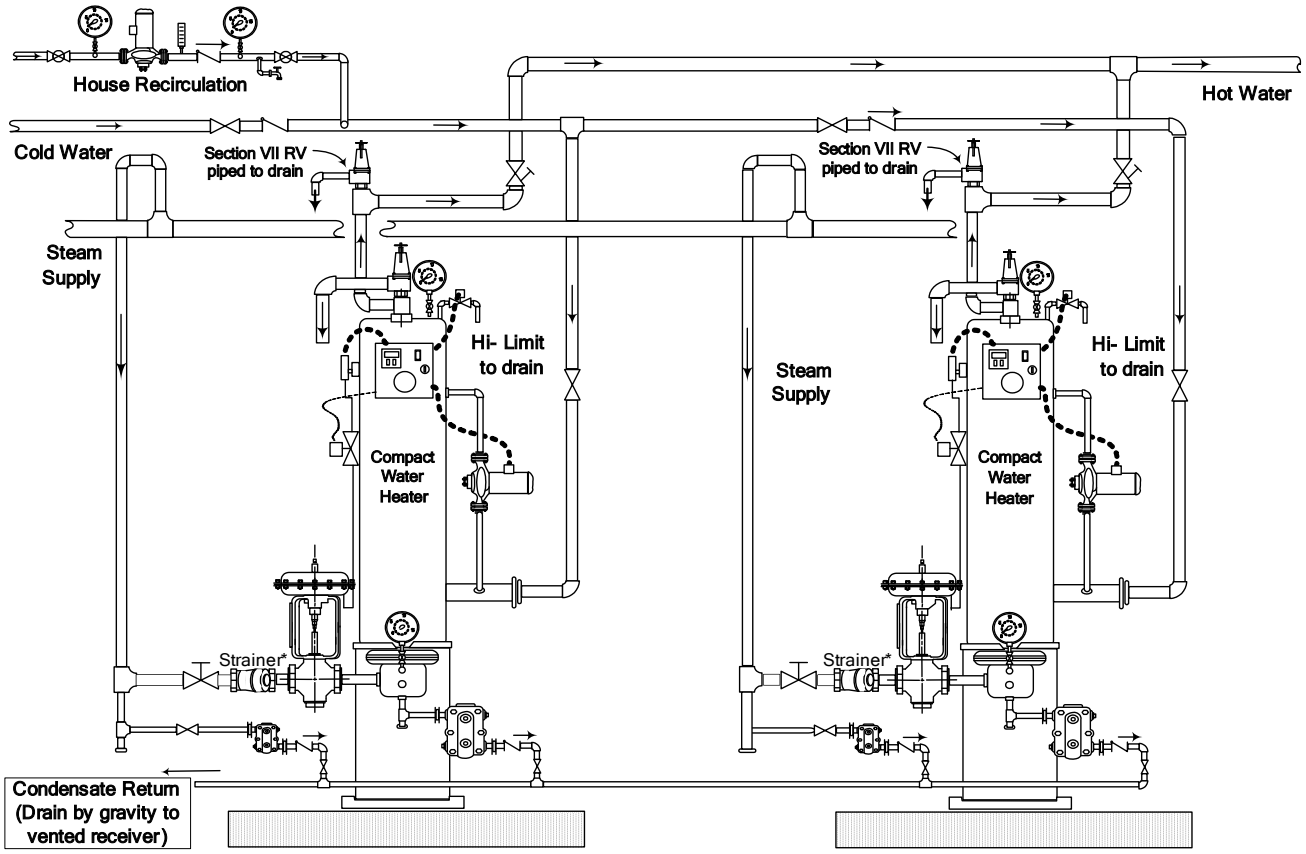
Two-way control valves should be used only when the P-K COMPACT® water heater is piped as a zone on the heating loop. Note that a bypass is recommended when using two-way valves to avoid "deadhead" operation of the boiler water loop. Flow through the bypass must be adjusted to provide sufficient flow to the P-K COMPACT® water heater at maximum capacity. When two or more water heaters are piped in parallel, it is important that the boiler water flow is balanced through all units.

3.5.4 Domestic Water Connections

NOTICE! Domestic hot water piping may be required to be separated from domestic cold-water piping by means of an approved backflow preventer. Please refer to state and local for specific details.

Properly sized water service lines should be connected to the heater. The domestic water piping should include isolation valves to assist in servicing the equipment. Patterson-Kelley strongly recommends using a circulated hot water system as illustrated below. This type of system will deliver hot water to fixtures quickly and help to reduce the overall water usage.

When two or more heaters are piped in parallel, it is important that the piping systems are balanced to assure the full combined capacity is realized. The branches for the building recirculation line should also be balanced to ensure equal flow.



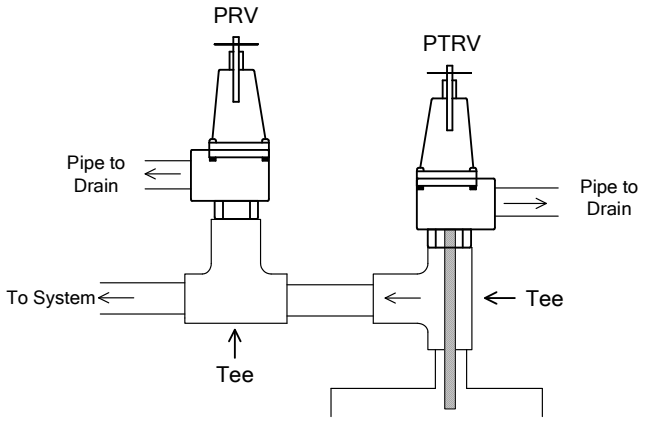
MULTIPLE UNIT PIPING

* Y-Strainer should be installed on it's side on all horizontal pipe configurations .

3.6 ADDITIONAL PIPING

3.6.1 Relief Valves

A Pressure and Temperature Relief Valve (PTRV), sized to relieve the full capacity of the water heater, is installed on the connection provided on top of the P-K COMPACT® water heater. In addition, in accordance with ASME and NBIC requirements, a Pressure Relief Valve (PRV) is shipped loose and must be installed downstream from the pressure temperature relief valve. The drawing to the right illustrates the configuration for this installation. The relief valve(s) **must** be piped to a drain. Decreasing the discharge pipe size or installing any restrictions or isolation valves in the discharge piping is not permitted by code.



⚠ WARNING Failure to pipe to a drain could cause a hazardous condition as well as flooding of the equipment room.

3.6.2 Over Temperature Control System

The high temperature limit control is located inside the control panel on each P-K COMPACT® water heater. The high temperature limit control should be set 15°F above the desired operating temperature. When the high temperature limit trips, the over temperature control system is activated. The over temperature control system has three functions:

First, a ½" solenoid valve, located adjacent to the hot water outlet, opens and dumps hot water into a drain. The solenoid valve discharge **must** be piped to a drain. This prevents high temperature water from entering the hot water supply to the building. Second, as the hot water dumps to the drain, cold water is forced to fill the system, which reduces the water temperature inside the unit. Third, the over temperature control system isolates the steam or boiler water supply as follows:

- **Pneumatic of Self-Contained:** A second solenoid valve closes and cuts off the pressure signal to the control valve, forcing the valve to close.
- **Electric:** The power circuit to the control valve opens, forcing the valve to close.

⚠ WARNING Failure to pipe to a drain could cause a hazardous condition as well as flooding of the equipment room.

⚠ CAUTION The over temperature control system should not be used as the operating temperature control. Refer to Section 3.8 for adjusting the operating temperature control.

3.6.3 Integral Circulator Pump

All P-K COMPACT® water heaters feature a lead-free bronze circulator pump which maintains a constant water flow over the tube bundle. This prevents the water from stagnating inside the water heater, maintains an accurate temperature reading at all times, and “primes” the domestic hot water system by maintaining a constant outlet temperature. The standard recirculation pump configuration is not intended to function as a building recirculation pump, however, the “NY Trim” recirculation pump configuration does provide accommodations for building recirculation flow. Contact your local sales representative for more information.

⚠ CAUTION Do not run the pump dry as seal damage may occur. The system must be filled with water and all the air must be vented from the unit before starting the pump.

The integral circulator pump is designed to provide years of trouble free service. It is recommended that periodic inspections be made to check for potential problems with the pump. If any leakage or evidence of leakage is present, repair or replace the pump accordingly.

3.7 Water Quality & Other Considerations

The water hardness should be between 1 grain and 6 grains per gallon (17 ppm and 103 ppm). If the water hardness exceeds these levels, water softening may be required to prevent premature tube bundle failure.

NOTICE! Do not use deionized water with a P-K COMPACT® water heater.

Air elimination from the domestic water is extremely important in any hot water system. Ensure that automatic air vents are installed in areas of piping that are prone to trap pockets of air.

Water hammer occurs when there are dramatic fluctuations of the water pressure inside the domestic hot water system and can be heard throughout the domestic water piping. This can occur when the hot water fixtures open and close too quickly, forcing the water pressure to surge momentarily. This can also occur when the pressure reducing valve for the makeup water opens and closes too quickly, which also forces the pressure to surge momentarily. If the domestic water system features these types of fixtures or pressure reducing valves and water hammer is occurring, water hammer arrestors or an expansion tank may be required to dampen the pressure spikes.

NOTICE! Water hammer can lead to premature failure of the tube bundle and baffles. Consider including water hammer arrestors or an expansion tank to dampen the spikes in water pressure.

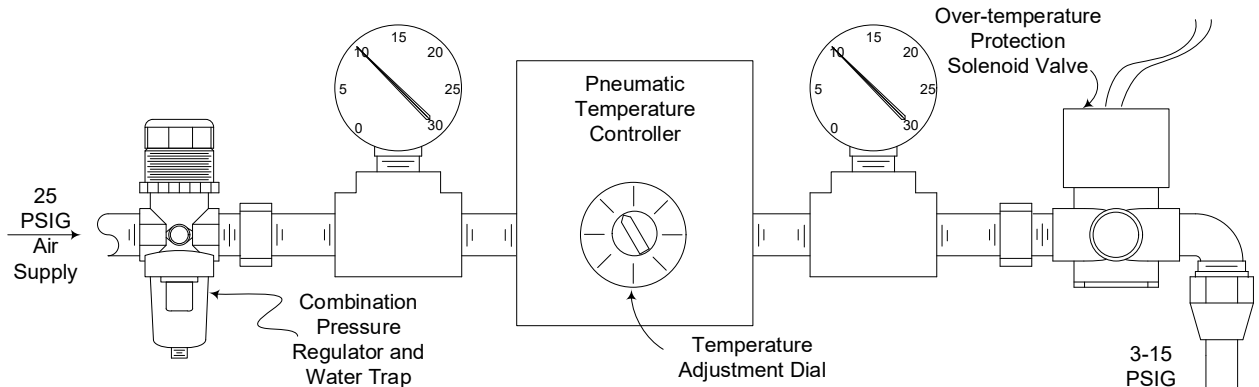
3.8 SETTING THE TEMPERATURE CONTROL

The P-K COMPACT® water heater is available with pneumatic, self-contained or electrically operated temperature control valves, which are described in the following sections:

3.8.1 Pneumatic Temperature Control

⚠ CAUTION Read instructions and understand operation before operating or making adjustments to the pneumatic temperature control system.

The pneumatic temperature control system (below) controls the air operated control valve (not shown) on the P-K COMPACT® water heater. Note that this system does not require instrument quality air.



Pneumatic Temperature Control System

The pneumatic temperature control system regulates the air pressure to the control valve based on the outgoing domestic water temperature. The air pressure is delivered to a diaphragm on the valve body, opening the valve. A spring return closes the valve when the air pressure is reduced or removed. There is a manually operated dial on the front of this temperature control. To increase the domestic water temperature, turn the dial clockwise. Turn the dial counterclockwise to decrease the domestic water temperature.

The pilot system comes pre-assembled, with a solenoid valve that interrupts the supply of compressed air to the diaphragm in an over-temperature condition (Section 3.6.2).

Temperature Control Set-Up

For initial valve adjustment, turn the pneumatic temperature control dial counterclockwise until it is fully closed and apply the air pressure (0.5 CFM at 25 psi). Slowly increase the temperature dial until the thermometer at the outlet indicates the desired water temperature.

NOTICE! Wait several cycles for the temperature to stabilize before making additional changes.

NOTICE! Do not adjust the sensitivity screw on the pneumatic temperature control system!

3.8.2 Self-Contained Temperature Control

⚠ CAUTION Read instructions and understand operation before operating or making adjustments to the self-contained temperature control system.

The self-contained temperature control system (below right) does not require compressed air or an electronic signal to operate. The pilot system shown comes pre-assembled, with a solenoid valve that interrupts the steam supply during an over-temperature condition (Section 3.6.2).

The self-contained pilot is actuated by a hermetically-sealed system of bellows, capillary tube and bulb assembly. The bulb is installed in the upper portion of the P-K COMPACT® water heater and measures the domestic hot water outlet temperature. As the water temperature rises around the bulb, the volatile liquid (or gas) inside the bulb, capillary and bellows expands and transmits a force moving the valve stem downward, restricting the steam supply.

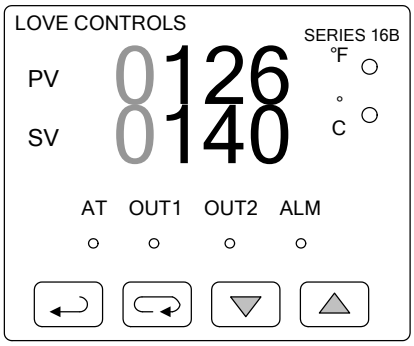
Conversely, as the water temperature around the bulb decreases, the liquid (or gas) contracts, allowing the regulating spring to compress the bellows and move the valve stem upwards, increasing the steam supply. The regulator can easily be adjusted to any point within its temperature range (75°F – 165°F standard) by simply rotating the adjustment wheel with the metal rod tethered to the pilot housing.

Temperature Control Set-Up

Provide a domestic water load equal to the rated capacity of the water heater by opening sufficient hot water fixtures or taps in the system. Then, open the heating medium isolation valve to allow steam or boiler water to flow into the water heater. Monitor the outlet temperature by watching the dial thermometer on the top of the P-K COMPACT® water heater. To increase the temperature set point, turn the adjustment wheel bushing to match the desired outlet temperature. It is very important to wait several minutes after each adjustment to monitor the system and response of the P-K COMPACT® water heater to the system conditions. Then, open the heating medium isolation valve in small increments to allow steam to flow into the water heater and ride gradually.

3.8.3 Electronic Temperature Control

⚠ CAUTION Read instructions and understand operation before operating or adjusting the digital temperature control system.



A digital temperature controller (right) positions the valve in response to outlet water temperature. The controller uses a type J thermocouple to monitor the domestic hot water outlet temperature. A 4-20 milliamp signal drives the electronic valve actuator.

The default screen is shown. PV - the top number (red) - is the temperature of the water in the P-K COMPACT® water heater and SV - the lower number (green) - is the setpoint.

The index button changes the parameters displayed on the screen. The PV line lists the parameter name and the SV line lists the parameter value.

Press the enter button to store any value after it is changed.

The up and down buttons are used to change the values of the parameters.

Controller Operation

To change the setpoint, press the up or down buttons to change SV to the desired value. Once the desired value is displayed, press the enter button to store the value.

The temperature control starts in the operation mode. The following table lists the operating parameters, their factory default settings, and a description of the parameters function. Parameters are accessed by repeatedly pressing the index key until the desired parameter is displayed.

Parameter	Default Value	Description of Parameter Function
Home Screen = Setpoint	120°F	Setpoint temperature of outlet water
r-S	RUN	Run – Stop output control. Must be in run for control to operate
SP	0	Sets the number of digits to the right of the decimal point
AL1H	20	Alarm 1 High Set Point, Alarms at setpoint + AL1H value
LoC	Off	Set front panel security, Off = no security, On = settings are locked
OUt1	###	Output value of controller, 0 – 100%

3.8.3.1 LOVE Control Settings: Electric Actuators

Press and Hold Right Button - #1

Parameter	Description	Value
At	Auto Tune	OFF
R-5	Select Run – Stop Output Control	RUN
SP	Number of digits to the right of the decimal	0
AL-IH	Alarm 1 High Set Point	20
LOC	Set front panel security lock	OFF
OUt	Display the % output value for output 1	(0-100%)

Press and Hold Left Button - #3

Parameter	Description	Value
CNPt	Temperature Input Selection	J
tPur	Temperature Units	F
tP-H	Scale Height Limit	220
tP-L	Scale Low Limit	25
CtrL	Control Mode	Pcd
S-HC	Heat/Cool Selection	HeAt
ALA1	Alarm 1 Setting	2
ALA2	Alarm 2 Setting	0
ALA3	Alarm 3 Setting	0
SALA	System Alarm Setting	OFF
COSH	Communications Write Function Feature	ON
C-SL	Communications protocol language	rtu
C-no	Controller Address: Set from 1 to 247	1
bP5	Baud Rate Setting	1
Len	Communication Data Length	8
PRt4	Communication Parity Bit	EVEN
StoP	Communication Stop Bit	1

Press #1 & #2 Together - #2

Parameter	Description	Value
At	Auto Tune	OFF
PCd1	Selection of PID profile	119
SU1	Target Set Value associated with each PID profile	119

Factory Settings:

Parameter	Description	Value
PI	Proportional Band Setting	20.0 (Proportional Band)
CI	Integral time (reset time)	30.0 (Integral Band)
dI	Derivative time (rate time)	0.0 (Derivative Band)

3.8.4 Electric Control Valves Setup

The electric control valve **MUST** open when the hot water demand increases and close when the hot water demand decreases.

⚠ WARNING If power is removed or an over-temperature condition occurs, the control valve **MUST** fail in the closed position. This **MUST** be verified prior to placing the unit in service.

Watson McDaniel Valve Actuators:

NOTICE! A linear trim valve is typically the preferred type for steam to water heaters provided the valve is properly sized. For water to water applications or when valve is oversized, equal percentage valves are the preferred type.

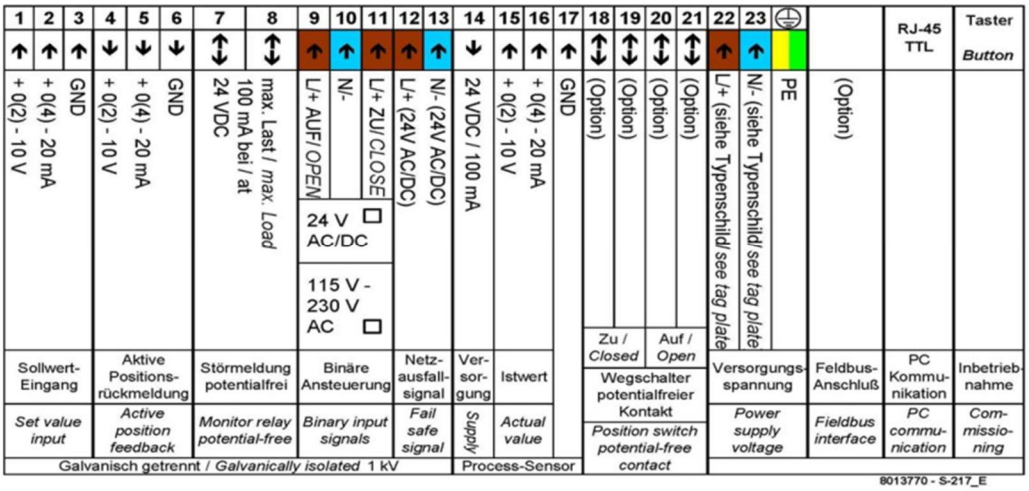
All of the Watson McDaniel valves have a manual override control knob on the top of the valve actuator

- A handwheel is supplied in order to operate the actuator in case of power loss or during installation work such as mounting onto a valve or setting the limit positions.
- The handwheel is permanently engaged and turns during motor operation of the device series PSL201-210 and PSL214.
- The actuators PSL320 - 325 have a handwheel which has to be engaged for manual operation. The button on the cover has to be depressed to engage the handwheel

⚠ WARNING Do not exceed the adjusted electrical stroke limits by handwheel. The mechanical limits must be set accordingly. If these instructions are not observed, it may result in malfunction or damage to the actuator.

⚠ WARNING Do not operate the handwheel using excessive force. If these instructions are not observed, it may result in malfunction or damage to the actuator.

Watson McDaniel Terminal connections are shown below:



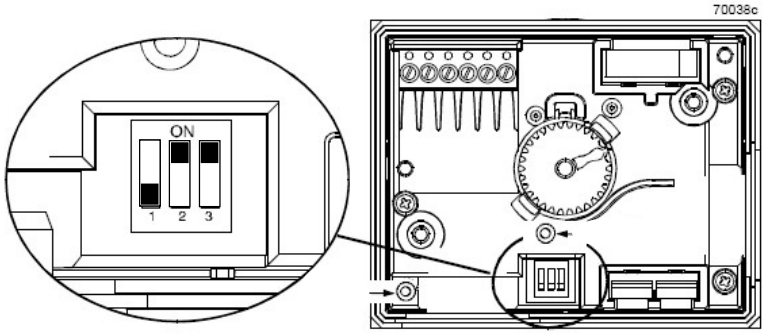
Siemens Valve Actuators:

All of the Siemens valves have a manual override control knob on the top of the valve actuator. The knob must be set to “Auto” for the valve to function normally. There are three styles of actuators: MXG/MXF, MVP and MVF. Each actuator style is slightly different in its setup configuration.

During the initial equipment startup, check the DIP switches to verify correct positioning. The DIP switches are found inside the valve actuator’s housing. The following pictures illustrate the correct positioning for the various valve actuators.

MXG and MXF

The MXG and MXF series actuators have 3 DIP switches labeled “1 2 3” and the ON position is marked. These actuators have a similar setup which is shown in the image and table below:



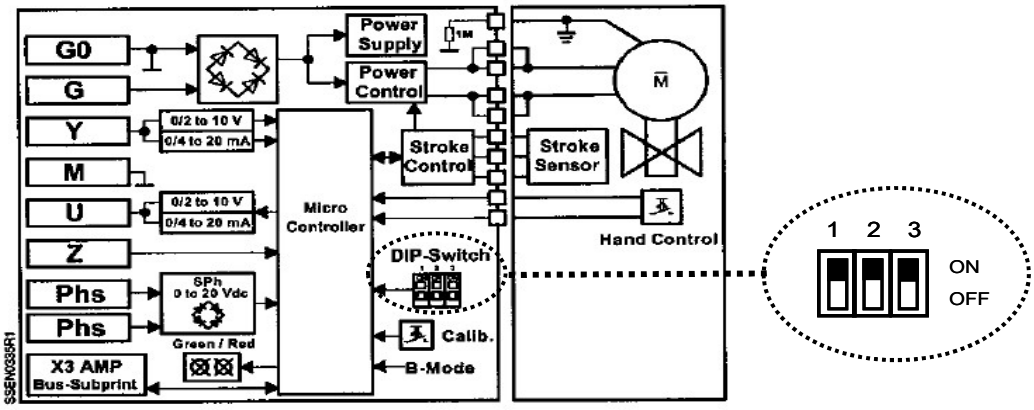
Switch	Function	OFF	ON	Factory Setting
1	Valve Response Type	Linear	Equal Percent	ON
2	Control Signal Range	0-10 VDC	2-10 VDC or 4-20 mA	ON
3	Input Selector	0/2-10 VDC	4-20 mA	ON

MVP

The MVP series actuators have no configurable components. Do not change the factory wiring.

MVF

The MVF series actuators have 3 DIP switches labeled “1 2 3” and the ON/OFF positions are marked as shown in the image below and described in the table on the next page:



Switch	Function	OFF	ON	Factory Setting
1	Type of Control Signal	Voltage	milliAmps	ON
2	Control Signal Range	0-10 VDC or 0-20mA	2-10 VDC or 4-20 mA	ON
3	Valve Response Type	V_{log}: Equal Percentage	V_{lin}: Linear	OFF

3.9 PRE-START CHECK LIST

Before attempting to startup the P-K COMPACT® water heater for the first time, make sure the following items have been completed.

⚠ WARNING It is **essential** to read, understand, and follow the recommendations of this manual before installing, operating, or servicing this equipment. Failure to do so could result in serious injury, death, and/or property damage.

- ☐ Ensure the P-K COMPACT® water heater is installed with the proper clearances and is firmly anchored to the floor or support structure (Section 3.3).
- ☐ For steam-to-water units, refer to Section 3.5.1 to verify the steam piping is installed correctly and Section 3.5.2 to verify the condensate drain piping and return system is installed correctly. Ensure the steam and condensate piping are the proper size to handle the full design load conditions. **IMPORTANT:** Ensure the steam isolation valve is fully closed before starting up the P-K COMPACT water heater.
    - Patterson-Kelley recommends a strainer on the inlet steam piping to keep foreign debris out of the control valve. If the strainer is installed in a horizontal pipe, verify the strainer basket is in the 3 o'clock or 9 o'clock position (Section 3.5.1).
    - Verify that any condensate lift is provided by a condensate pump (Section 3.5.2).
- ☐ For boiler water-to-water units, refer to Section 3.5.3 to verify the boiler water piping is installed correctly. Ensure the boiler water piping is the proper size to handle the full design load conditions. **IMPORTANT:** Ensure the boiler water isolation valve(s) are fully closed before starting up the P-K COMPACT water heater.
- ☐ Refer to Section 3.5.4 to verify the domestic water piping is installed correctly, and the P-K COMPACT® water heater and domestic system have been completely filled with water and all the air has been purged. Ensure the domestic water piping is the proper size to handle the full design load conditions.
- ☐ Many domestic hot water systems require the use of a thermostatic mixing valve, which blends the domestic hot water supply from the unit and the cold makeup water. If applicable, verify the thermostatic mixing valve is installed and adjusted properly.
- ☐ Refer to Section 3.6.1 to verify the relief valve(s) have been installed correctly, and their discharge piping is routed to a safe location at a floor drain. Ensure the discharge piping does not reduce in size below the nominal outlet of the relief valve(s).

- ☐ Refer to Section 3.6.2 to verify the discharge piping from the over temperature solenoid is routed to a safe location at a floor drain. Ensure the discharge piping does not reduce in size below the nominal outlet of the solenoid valve.
- ☐ Ensure there are no flammable liquids, materials or hazardous fumes present in the environment.
- ☐ Remove all tools and unused parts that could interfere with normal operation of the P-K COMPACT® water heater.
- ☐ Ensure that all panels, covers and guards are properly installed.
- ☐ The P-K COMPACT® water heater must be connected to a 120 volt / 60 Hz / 1 Ph power source with proper polarity, a dedicated earth ground, and an electrical disconnect having adequate overload protection (15 amps) according to the National Electrical Code (NFPA 70, latest edition). Refer to Sections 7.1.1 through 7.1.6 for power and control wiring diagrams for the different control valve offerings on the P-K COMPACT® water heater.

4.0 OPERATION

The P-K COMPACT® semi-instantaneous hot water heater produces domestic hot water and is configured to use either steam or boiler water as a heating media. A control valve regulates the amount of steam or boiler water introduced into the tubes of the heat exchanger bundle.

The domestic water is rapidly heated as it is directed over the outside of the tubes by segmental baffles. The circulation pump maintains proper water velocity across the tubes, allowing the P-K COMPACT® water heater to maintain a high rate of heat transfer. Constant circulation produces extremely high performance and precise temperature control, while mitigating scale formation in all but the harshest hard water conditions.

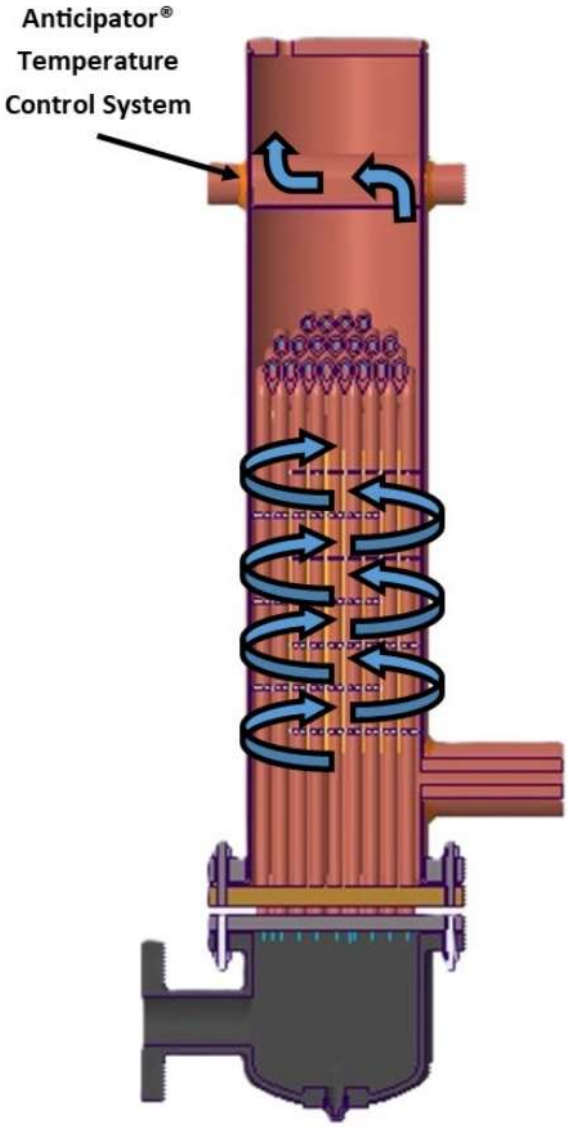
The P-K COMPACT® water heater incorporates a small storage volume in order to provide the anticipator® temperature control sufficient time to respond to changing load conditions. The anticipator® temperature control is located in this storage section directly above the tube bundle shown on next page.

Anticipator® Control System Produces Close Temperature Control

The P-K Compact® features the Anticipator® integral control system which meters the heating medium demand to exact proportions of hot water requirements and regulates hot water temperature to a close tolerance of ±4°F from the setpoint

This schematic shows the general arrangement of the P-K Compact®. Steam passes through the tubes of the heat exchanger bundle. The water is rapidly heated as it is directed over the tubes by segmental baffles inside a cylindrical wrapper. Above the wrapped tube bundle, minimum storage volume is provided to give the controls sufficient time to produce the close temperature control.

Anticipator®



4.1 INITIAL STARTUP

⚠ WARNING It is **essential** to read, understand, and follow the recommendations of this manual before installing, operating, or servicing this equipment. Failure to do so could result in serious injury, death, and/or property damage.

NOTICE! Do not turn on power or operate the pump until the unit is completely filled with water!

- ☐ Refer to Section 3.9 and verify all items on the Pre-Start Check List are complete.
- ☐ Open any isolation valves in the cold water makeup system, and allow the system to completely fill with water.
- ☐ Manually open the lever on the PTRV and allow any entrained air to escape. Once water starts to discharge from the PTRV, close the lever (Section 3.6.1).
- ☐ Before turning on the P-K COMPACT® water heater and operating the recirculation pump, carefully check the following:
  - Is the pump primed with water?
  - Has the air been purged from the domestic water system?
  - Is the domestic system clean and free of foreign debris?
  - Does the power source agree with data on the pump motor's nameplate?
  - Is overload protection provided?
- ☐ Turn on the P-K COMPACT® water heater with the ON/OFF switch on the control panel.

(Continued on Next Page)

- ☐ After turning on the P-K COMPACT® water heater, the recirculation pump will energize. Carefully check the following:
  - Is the motor rotation correct?
  - Does the pump appear to be vibrating excessively?
  - Does the pump operation sound smooth?
  - If any of the above situations occur, immediately remove power from the P-K COMPACT® water heater and correct before proceeding.
- ☐ Manually provide a load roughly equivalent to the full design load conditions by opening fixtures such as faucets, showers and other hot water appliances.
- ☐ Slowly open the isolation valve on the steam supply or boiler water supply piping.
- ☐ Refer to Section 3.8 to setup and adjust the temperature setpoint:
  - Section 3.8.1 for Pneumatic Temperature Control
  - Section 3.8.2 for Self-Contained Temperature Control
  - Section 3.8.3 for Electronic Temperature Control

NOTICE! The outlet temperature setpoint is not pre-set at the factory. The thermostat inside the control panel serves as a high limit and **MUST** not be used to set the desired operation temperature.

- ☐ Manually reduce the load to approximately ½ the full design load conditions by closing half of the fixtures such as faucets, showers and other hot water appliances. Verify the P-K COMPACT® water heater maintains the desired setpoint at the reduced load conditions.
- ☐ After verifying operation of the P-K COMPACT® water heater at full and reduced load conditions, return the domestic hot water system to its normal state by closing the fixtures.

4.2 SHUT OFF PROCEDURES

4.2.1 Normal (short term) Shutdown

Simply move the ON/OFF switch on the control panel to the “OFF” position. This removes power from the circulation pump and forces the control valve to close.

4.2.2 Extended Shutdown

For extended shut-downs, follow the following procedure:

1. Turn off power to the P-K COMPACT® water heater by moving the ON/OFF switch on the control panel to the “OFF” position.
2. Isolate the heating media (steam or boiler water) by manually closing the isolation valve(s).
3. Open the drain valve on the heating media side to drain any remaining condensate or boiler water out of the tube bundle and bonnet.
4. Isolate the water heater by manually closing the isolation valves on the inlet and outlet domestic water connections.
5. Remove the drain pipe cap, or open the drain valve to drain the unit of all domestic water.

5.0 MAINTENANCE

⚠ WARNING Service must be performed by an experienced and knowledgeable service agency, such as an authorized P-K representative or qualified installer.

⚠ WARNING Proper lockout/tagout procedures must be employed when servicing this unit.

A hazard analysis should be performed by the end user to ensure the safety of their employees and/or service technicians. All weekly, monthly and annual maintenance checks should be performed by experienced and knowledgeable personnel.

5.1 MAINTENANCE AND INSPECTION SCHEDULE

⚠ WARNING Label all wires prior to disconnection when servicing the controls. Wiring errors can cause improper and dangerous operation.

The sections below provide guidance for daily, monthly and annual maintenance tasks.

5.1.1 Daily

On a daily schedule, Patterson-Kelley recommends the following inspections:

- Observe the operating temperature and general conditions.
- Determine the cause of any illuminated red indicators, unusual noises or operating conditions and make the necessary corrections.
- Check and drain the air/water separator in the compressed air supply (pneumatic units only).

5.1.2 Monthly

In addition to the recommended daily inspections, perform the following actions on a monthly basis:

- Verify that the outlet water temperature matches the desired setpoint.
- Inspect and clean the Y-strainer in the steam or boiler water piping. Make sure to follow all proper Lockout/tagout procedures for all energy sources.

5.1.3 Annually

In addition to the recommended daily and monthly service, perform the following on a yearly basis:

- Check all joints and pipe connections for tightness.
- Inspect the discharge piping for the relief and dump valves for blockage. Verify this piping is unobstructed to the drain.
- Test the safety relief valve in accordance with the manufacturer's recommendations (see relief valve tag).
- Perform a solenoid dump valve test. Turn down the high limit control by reducing the temperature setting below the operating temperature. Verify that the solenoid valve opens.

5.2 SERVICE TIPS & TROUBLESHOOTING

⚠ WARNING Do not override or place “jumpers” on any limit device or factory setting.

⚠ CAUTION Isolate and de-energize all energy sources prior to maintenance. Steam or hot water could be released and may cause injury.

NOTICE! Consult the appropriate component manufacturer’s instructions prior to servicing.

Note that a linear trim valve is typically the preferred type for steam-to-water units, provided the control valve is properly sized. For boiler water-to-water applications or when the control valve is oversized, equal percentage valves are the preferred type. Improperly applied control valve types can result in poor temperature control or erratic outlet temperatures.

Symptom	Corrective Action(s)	
	Steam-to-Water	**Boiler Water-to-Water**
1. Erratic temperature control	Check for proper operation of the temperature control. Check for proper rotation of integral circulation pump. Check for flow of circulator pump. (Be sure water is flowing through the recirculation pipe) Check valves in pipe line must be operational. Check for condensate lift and drainage. Check for proper steam pressure. Check condensate traps for proper operation.	Check for proper operation of the temperature control. Check for proper rotation of integral circulation pump. Check for flow of circulator pump. (Be sure water is flowing through the recirculation pipe) Check valves in pipe line must be operational. Check for proper boiler water flow.
Symptom	**Corrective Action(s)**	
	Steam-to-Water	**Boiler Water-to-Water**
2. Domestic water temperature is too high or too low.	Check the setting of the temperature control. Check for dirt or foreign materials in bleed ports on self-contained steam piloted valves. Check for proper spring tension on air operated valves. Check temperature sensing element for malfunction.	Check the setting of the temperature control. Check for dirt or foreign materials in bleed ports on self-contained steam piloted valves. Check for proper spring tension on air operated valves. Check temperature sensing element for malfunction

Symptom	Corrective Action(s)	
	Steam-to-Water	**Boiler Water-to-Water**
	Check for proper steam pressure. Check for proper air pressure on pneumatic valves. Check condensate trap for proper operation. Remove bonnet and inspect steam side of tubes for scale or fouling (See Section 5.3). Remove tube bundle and inspect domestic water side of tubes for scale or fouling (See Section 5.4). Check for fouling of steam pilot and self-contained valves due to carry over of steam treatment compounds (steam heated units). Check to be sure heater design rating is not being exceeded (See design specifications for this P-K COMPACT® water heater).	Check for proper boiler water temperature and flow rate. Check for proper air pressure on pneumatic valves Shut down unit – Remove billet and inspect boiler water side of tubes for scale or fouling (See Section 5.3). Shut down unit – Remove tube bundle and inspect domestic water side of tubes for scale or fouling (See Section 5.4). Check to be sure heater design rating is not being exceeded (See design specifications for this P-K COMPACT® water heater).
3. Banging or pinging in heater (steam only)	Check for proper condensate drainage. Do not attempt to lift condensate above the tube bundle. Check for back pressure of condensate line. (Condensate should flow by gravity to a vented receiver.) Check condensate traps for proper installation and orientation.	

5.3 CLEANING/INSPECTING THE TUBES

It is not necessary to disconnect the domestic water piping to inspect and/or service the heating medium side of the tube bundle - the shell remains installed and in place.

1. Remove power from P-K COMPACT® water heater by turning the ON/OFF switch “OFF”.
2. Follow all proper lockout/tagout procedures.
3. Isolate the steam or boiler water supply by manually closing the isolation valve(s).
4. Isolate the domestic water system by manually closing the domestic cold water and domestic hot water supply isolation valve(s).
5. Close recirculation line valve (if applicable).
6. Disconnect the flange or union in the steam or boiler water supply and return lines.
7. Carefully remove the nuts one-by-one from the bottom of the tube bundle flange and disconnect piping as needed to remove the steam bonnet (Cast Iron) or boiler water billet (Carbon Steel).

⚠ CAUTION To avoid injury, ensure that all appendages are free and clear from underneath the steam bonnet or boiler water billet when removing. The steam bonnet or boiler water billet may be too heavy to be lifted by a single person and this operation may require additional support or mechanical assistance (hydraulic bottle jack, manual jack, etc.).

8. After the steam bonnet or boiler water billet is removed, the tubes are now visible for inspection. If there is a leaking tube, plug the tube as a temporary fix using either driven or expansion type tube plugs.
9. If the tubes are fouled, clean either chemically or mechanically, as appropriate. Exercise caution to avoid damaging the tubes.
10. Reassembly is the reverse of removal. If replacing the steam bonnet or boiler water billet, be sure to use new gaskets supplied by Patterson-Kelley.

5.4 REPLACING THE TUBE BUNDLE

⚠ WARNING The heat exchanger tube bundle is heavy and may cause injury if improperly handled. Removal of the heat exchanger should be performed only by knowledgeable and experienced personnel. Use appropriate rigging procedures. These procedures must be established by end user prior to installation and operation of equipment. Owner must perform internal hazard analysis.

To remove the tube bundle, refer to the following steps:

1. Remove power from P-K COMPACT® water heater by turning the ON/OFF switch “OFF”.
2. Follow all proper lockout/tagout procedures.
3. Isolate the steam or boiler water supply by manually closing the isolation valve(s).
4. Isolate the domestic water system by manually closing the domestic cold water and domestic hot water supply isolation valve(s).
5. Close recirculation line valve (if applicable).
6. Disconnect the flange or union in the steam or boiler water supply and return lines.
7. Carefully remove the nuts one-by-one from the bottom of the tube bundle flange and disconnect piping as needed to remove the steam bonnet (Cast Iron) or boiler water billet (Carbon Steel) as described in Section 5.3.

⚠ CAUTION To avoid injury, ensure that all appendages are free and clear from underneath the steam bonnet or boiler water billet when removing. The steam bonnet or boiler water billet may be too heavy to be lifted by a single person and this operation may require additional support or mechanical assistance (hydraulic bottle jack, manual jack, etc.).

8. Carefully remove the nuts one-by-one from the top of the tubesheet studs, and carefully lower the tube bundle to the floor.

⚠ CAUTION To avoid injury, ensure that all appendages are free and clear from underneath the tube bundle when removing. The tube bundle is too heavy to be lifted by a single person and this operation may require additional support or mechanical assistance (hydraulic bottle jack, manual jack, etc.).

9. Reinstall the existing bundle or install the new bundle in the same orientation as the original bundle. The word “TOP” is stamped into the side of the tubesheet. “Top” **MUST** be facing toward the front of the unit (vertical configuration) or top of the unit (horizontal configuration) for proper operation. Failure to do so will cause erratic temperature control, as well as premature tube bundle failure. Follow the procedures above in reverse order to reinstall the bundle. Be sure to use new gaskets supplied by Patterson-Kelley.

5.5 SERVICING THE CONTROL VALVE

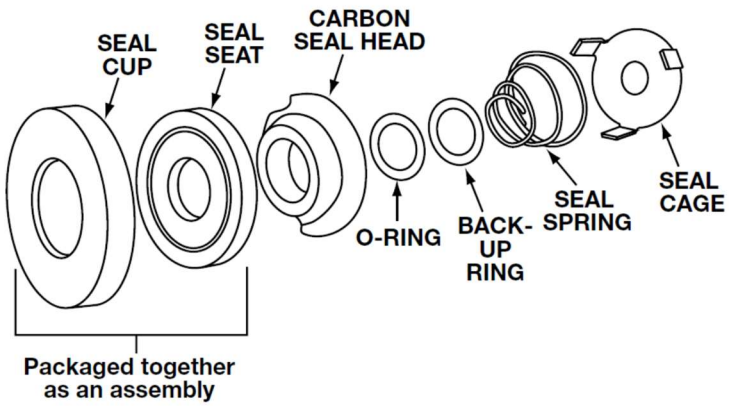
Several different types of control valves are supplied with the P-K COMPACT® water heater and each has unique service procedures. It is important to read the manual for the specific valve on the unit to determine the exact service procedure. These individual manuals are available from Patterson-Kelley upon request.

5.6 SERVICING THE INTEGRAL CIRCULATOR

The circulator requires minimal maintenance. However, periodic inspections should be made to ensure the pump is functioning properly (See Section 3.6.3).

5.6.1 Seal Replacement (if necessary):

1) De-energize the system following proper lock out/tag out procedures.
2) Ensure that the system has been allowed to cool before removing the pump.
3) If isolation flanges are installed, close the valves on the suction and discharge sides of the pump. If no valves have been installed on the pump, drain the system prior to pump removal.
4) Loosen the conduit box cover screw and remove the cover. The electrical supply wires to the pump need to be disconnected. Mark or label the wires so you can install them in their proper location when reinstalling the pump.
5) Remove the four capscrews that hold the motor housing to the pump body and separate the housing from the pump body. The volute does not need to be removed from the piping.
6) Place the pump on a flat work surface, insert a screwdriver into one of the endplate ventilation slots until it engages one of the rotor cooling fins. Hold the rotor with the screwdriver and rotate the impeller clockwise. The impeller is molded around a metal hub with a left hand thread.
7) Remove the impeller from the shaft.
8) Next, remove the seal assembly from the shaft by sliding it off the shaft sleeve. Clean the seal seat with a clean rag and inspect for grooving or cracks. If it shows no grooving or cracks, it may be cleaned and reused.
    a. If the seat seal is to be replaced, the face plate must be removed from the motor housing. Remove it by gently prying it away from the housing.
    b. Remove the seat seal and cup. Lubricate the cup with soapy water and install new parts in the face plate recess. Reposition the face plate on the motor housing. Gently tap the face plate evenly around its diameter to drive it into the recess provided in the motor housings.
9) Clean the shaft and sleeve before installing the new seal.
10) Slide the carbon seal head onto the shaft sleeve until it contacts the seal seat.



11) Slide the new “O-ring” and back-up ring along the shaft sleeve until they fit inside the counter bore in the seal head. Place the seal spring between the back-up ring and the seal cage while positioning the seal cage flush with the end of the sleeve.

12) Place the small end of the spring against the back-up ring. The three driving legs of the seal cage should engage the three slots on the seal head.

13) While holding the rotor assembly with the screwdriver, thread the impeller onto the shaft in a counter clockwise direction. Tighten the impeller with light hand pressure. Take care to avoid bending a rotor cooling fin or damaging the shaft sleeve.

14) Clean the recess in the pump body and install a new body gasket.

15) Install the pump in the body and secure with four capscrews. Apply torque evenly in a crisscross pattern in 40 in-lb increments to a torque of 80 in-lb.

16) Rewire the pump to the unit following the labels used when disconnecting the pump.

17) Reinstall the conduit box cover and secure with the cover screw. If isolation flanges were installed, open the valves, otherwise refill the system with water.

18) Ensure all the air has vented out of the unit and the pump’s rotor has been wetted. Follow the Initial Start-Up instructions in Section 4.1.

⚠ CAUTION

Before operating the pump, carefully check:
Is the pump primed? Has the air been purged from the system?
Is the pump motor’s rotation correct?
Is the system clean and free of debris?

5.7 Recommended Spare Parts

- ☐ Circulator Pump: bearing and seal assembly.
- ☐ Dial Thermometer
- ☐ Temperature sensor – T/C for electric controls only or pilot for self-contained valves
- ☐ Relief Valve
- ☐ Thermostat for over-temperature control
- ☐ Solenoid valve: 3-way for pneumatic, 2-way for self-contained.
- ☐ Replacement tube bundle
- ☐ Tube bundle gaskets
- ☐ Steam trap cage unit (if used)
- ☐ Pressure gauge (for steam)

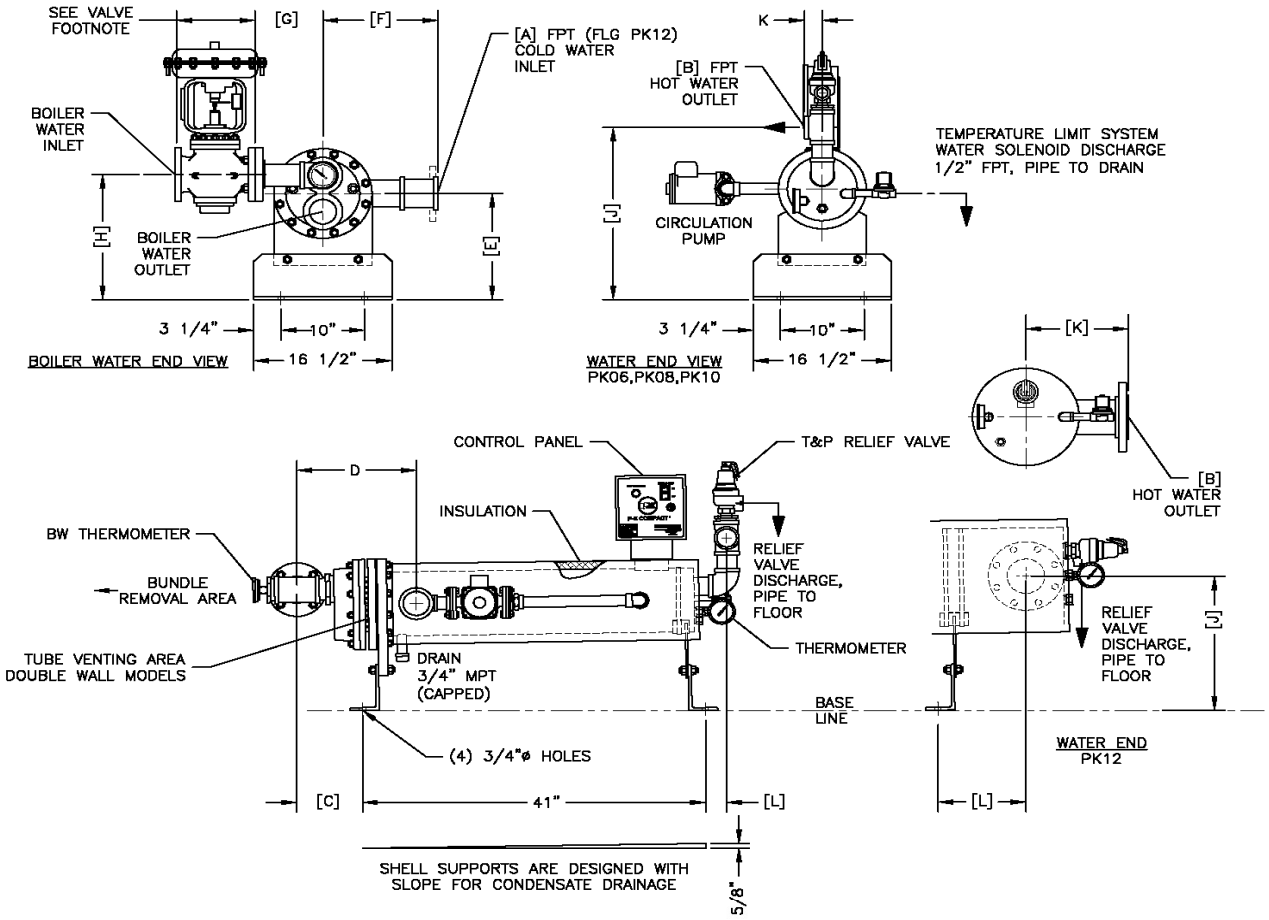
NOTICE! When ordering parts, always mention the **Serial Number**, part name and model and the size of the part needed.

5.8 After All Repairs or Maintenance

1. Follow "Pre-Start Check List" (Section 3.9)
2. Turn on the P-K COMPACT® water heater and verify integral circulator operation.
3. Verify operation, setpoint, and domestic water temperature (Section 4.1)

6.0 P-K COMPACT® DIMENSION DIAGRAMS

6.1 P-K COMPACT® HORIZONTAL STEAM-TO-WATER DIMENSIONS



Model	A	B	C	D	E	F	G	H	J	K	L
PK06H	2"	1 1/2"	7 3/4"	13 1/2"	14"	12"	8"	15 3/4"	22"	2 3/4"	4 1/2"
PK08H	3"	2"	8 1/4"	14 3/4"	14"	13 3/4"	8 3/4"	16 1/2"	22 1/2"	3 1/8"	4"
PK10H	3"	2 1/2"	10 3/4"	17 1/2"	15"	14 3/4"	12"	18"	24 3/4"	3 1/8"	4 1/2"
PK12H	5"–150#FLG	4"–150#FLG	12 1/2"	20"	17"	18"	11 1/4"	20 1/4"	17 5/8"	12 1/4"	17 1/4"

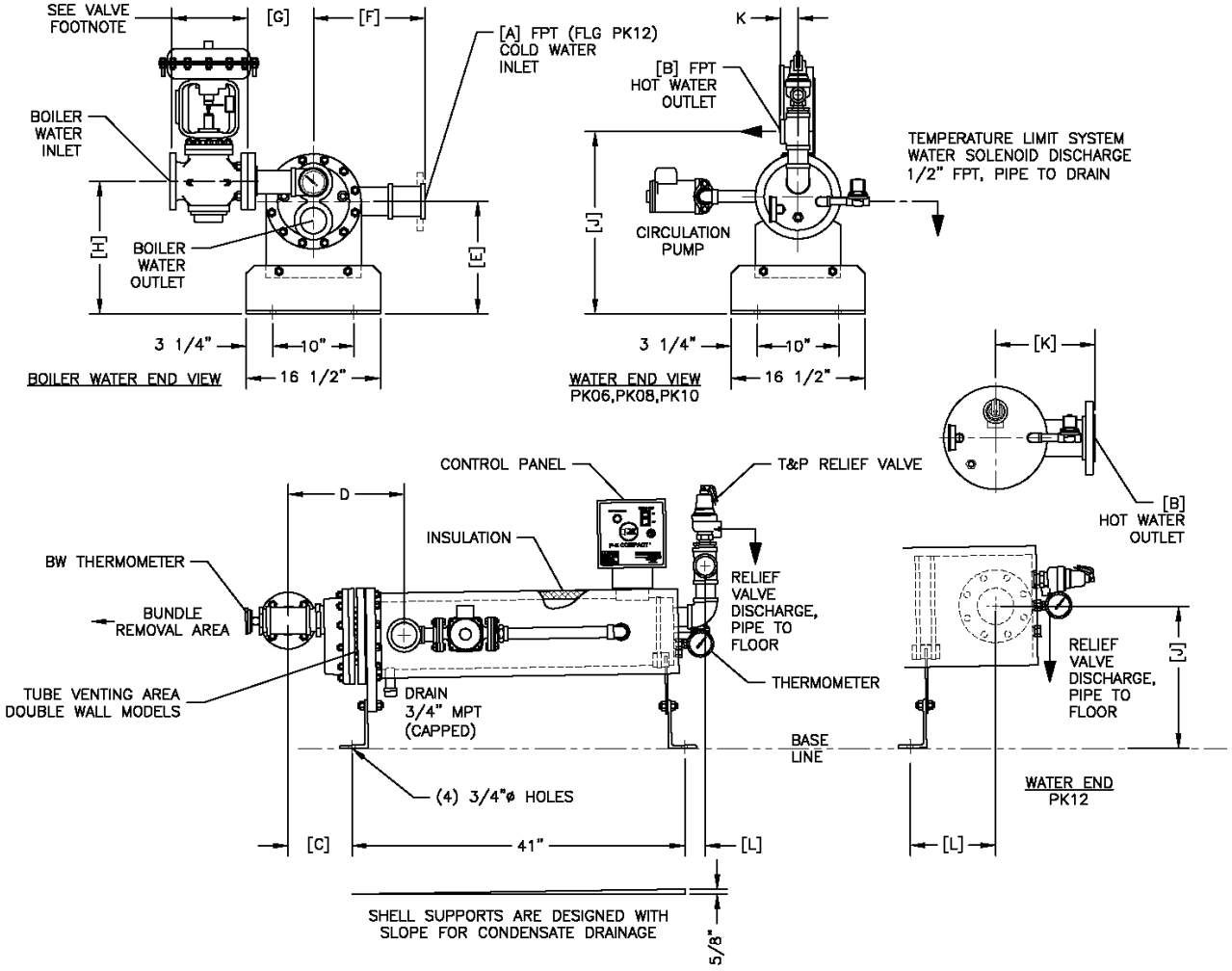
Component		Materials of Construction
Shell Side		SB-171-C706 Copper Nickel
Tube Side	Tubes	SB75-C122 Copper or SB111-C706 Copper Nickel
	Tubesheet (inner)	SB-171-C464 Naval Brass
	Tubesheet (outer)	SA-516-GR70 Carbon Steel (Double wall only)
	Bonnet or Billet	SA-278-Class 30 Cast Iron or SA-516-GR70 Carbon Steel

Customer:

Job Name:

Notes:
1. Dimensions are approximate and for rough in use only.
2. Valve dimensions vary with size and type of valve required. Allow for 16" maximum length.
3. A pneumatic valve is shown. Self contained and electric valves are also available.
4. This information is subject to change without notice.

6.2 P-K COMPACT® HORIZONTAL BOILER WATER-TO-WATER DIMENSIONS



Model	A	B	C	D	E	F	G	H	J	K	L
PK06H	2"	1 1/2"	7 3/4"	13 1/2"	14"	12"	8"	15 3/4"	22"	2 3/4"	4 1/2"
PK08H	3"	2"	8 1/4"	14 3/4"	14"	13 3/4"	8 3/4"	16 1/2"	22 1/2"	3 1/8"	4"
PK10H	3"	2 1/2"	10 3/4"	17 1/2"	15"	14 3/4"	12"	18"	24 3/4"	3 1/8"	4 1/2"
PK12H	5"–150#FLG	4"–150#FLG	12 1/2"	20"	17"	18"	11 1/4"	20 1/4"	17 5/8"	12 1/4"	17 1/4"

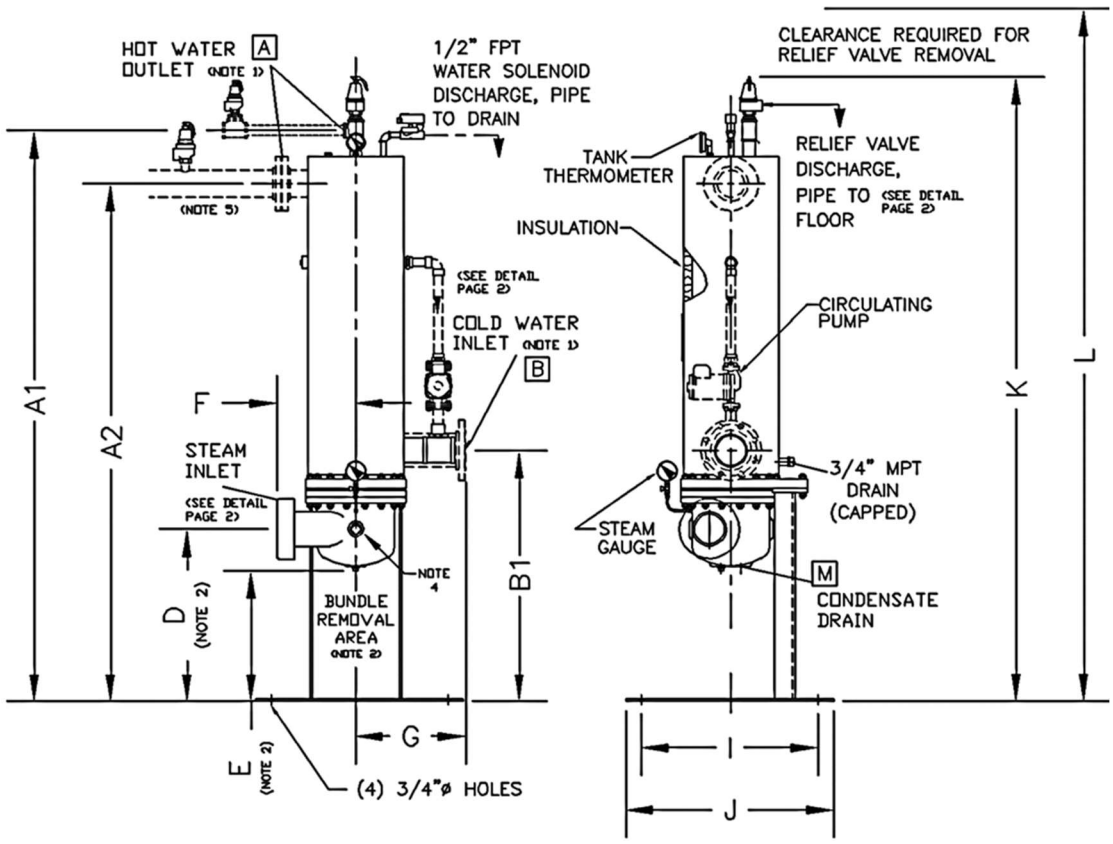
Component		Materials of Construction
Shell Side		SB-171-C706 Copper Nickel
Tube Side	Tubes	SB75-C122 Copper or SB111-C706 Copper Nickel
	Tubesheet (inner)	SB-171-C464 Naval Brass
	Tubesheet (outer)	SA-516-GR70 Carbon Steel (Double wall only)
	Bonnet or Billet	SA-278-Class 30 Cast Iron or SA-516-GR70 Carbon Steel

Customer:

Job Name:

Notes:
1. Dimensions are approximate and for rough in use only.
2. Valve dimensions vary with size and type of valve required. Allow for 16" maximum length.
3. A pneumatic valve is shown. Self contained and electric valves are also available.
4. This information is subject to change without notice.

6.3 P-K COMPACT® VERTICAL STEAM-TO-WATER DIMENSIONS



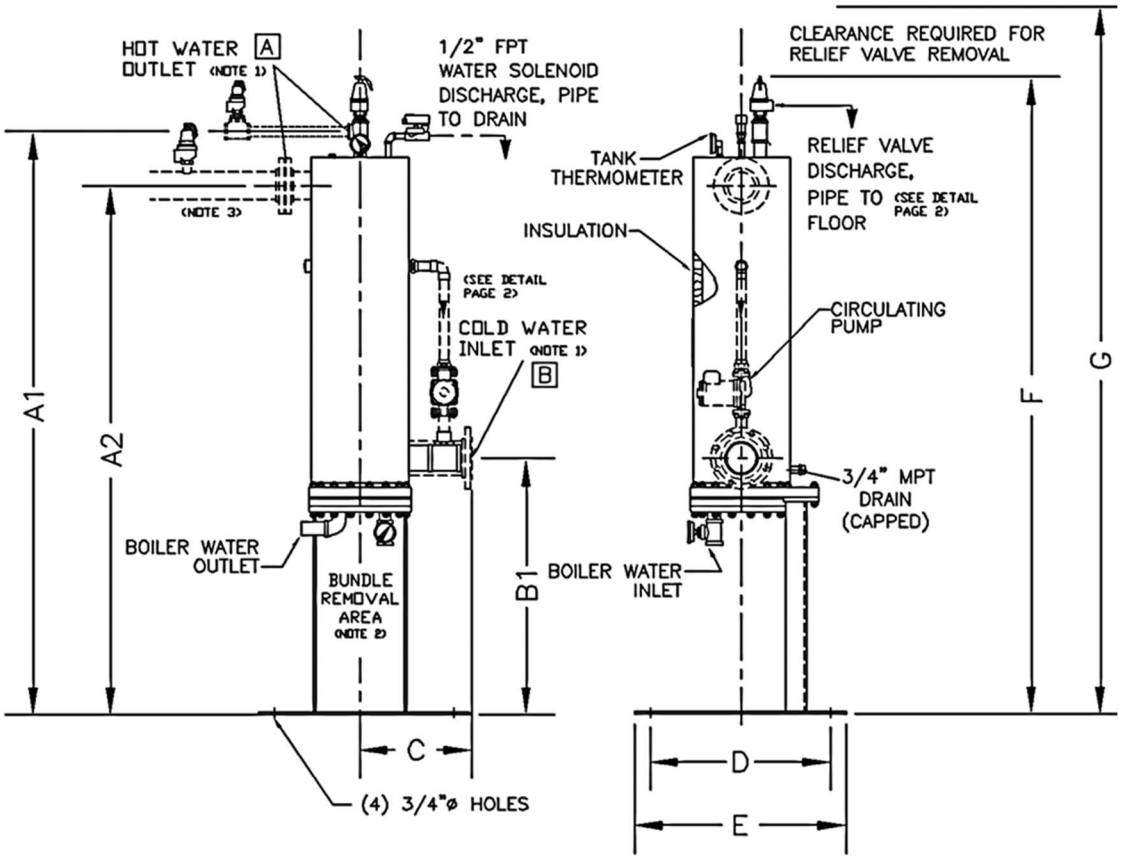
Model	A	A1	A2	B	B1	D	E	F	G	I	J	K	L	M	Weight (lbs)
PK06S	1-½	69-1/8	X	2	31-1/8	22-1/4	18- 1/8	8	12	15	20	78	85	¾	630
PK06D	1-½	69-1/8	X	2	31-1/8	20-5/8	16-½	8	12	15	20	78	85	¾	650
PK08S	2	69-¼	X	3	31-3/8	22-1/2	18	8-¾	13-¾	15	20	78	84	1-½	730
PK08D	2	69-¼	X	3	31-3/8	21-1/2	17	8-¾	13-¾	15	20	78	84	1-½	760
PK10S	2-½	72-¾	X	3	31-1/2	22-5/8	17	12	14-¾	19	24	81-½	89	2	990
PK10D	2-½	72-¾	X	3	31-1/2	21-5/8	16	12	14-¾	19	24	81-½	89	2	1040
PK12S	4	X	85-½	5	41-3/8	29	23	11-¼	18	29	34	97-¾	101	2	1200
PK12D	4	X	85-½	5	41-3/8	27-7/8	27-7/8	11-¼	18	29	34	97-¾	101	2	1300

Dimensions in Inches **Rough-in Dimensions Only**

Seismic Support Stand Available

1. **PK12 Units inlet and outlet connections are ANSI 150# Flanged.**
2. **Single Wall Unit Represented. See chart for different dimensions between single and double wall.**
3. **Pressure only relief valve shipped loose and must be installed by contractor in field as shown.**
4. **A2 is Outlet height for PK12 Compacts.**

6.4 P-K COMPACT® VERTICAL BOILER WATER-TO-WATER DIMENSIONS



Model Number	A	A1	A2	B	B1	D	E	F	G	WEIGHT (lbs)
PK06S	1-1/2	69-1/8	X	2	31-1/8	15	20	78	85	630
PK06D	1-1/2	69-1/8	X	2	31-1/8	15	20	78	85	650
PK08S	2	69-1/4	X	3	31-3/8	15	20	78	84	730
PK08D	2	69-1/4	X	3	31-3/8	15	20	78	84	760
PK10S	2-1/2	72-3/4	X	3	31-1/2	19	24	81-1/2	89	990
PK10D	2-1/2	72-3/4	X	3	31-1/2	19	24	81-1/2	89	1040
PK12S	4	X	85-1/2	5	41-3/8	29	34	97-3/4	101	1200
PK12D	4	X	85-1/2	5	41-3/8	29	34	97-3/4	101	1300

Dimensions in Inches **Rough-in Dimensions Only**
Seismic Support Stand Available

1. **PK12 Units inlet and outlet connections are ANSI 150# Flanged.**
2. **Single Wall Unit Represented. See chart for different dimensions between single and double wall.**
3. **Pressure only relief valve shipped loose and must be installed by contractor in field as shown.**
4. **A2 is Outlet height for PK12 Compacts.**

7.0 PARTS/TECHNICAL SUPPORT

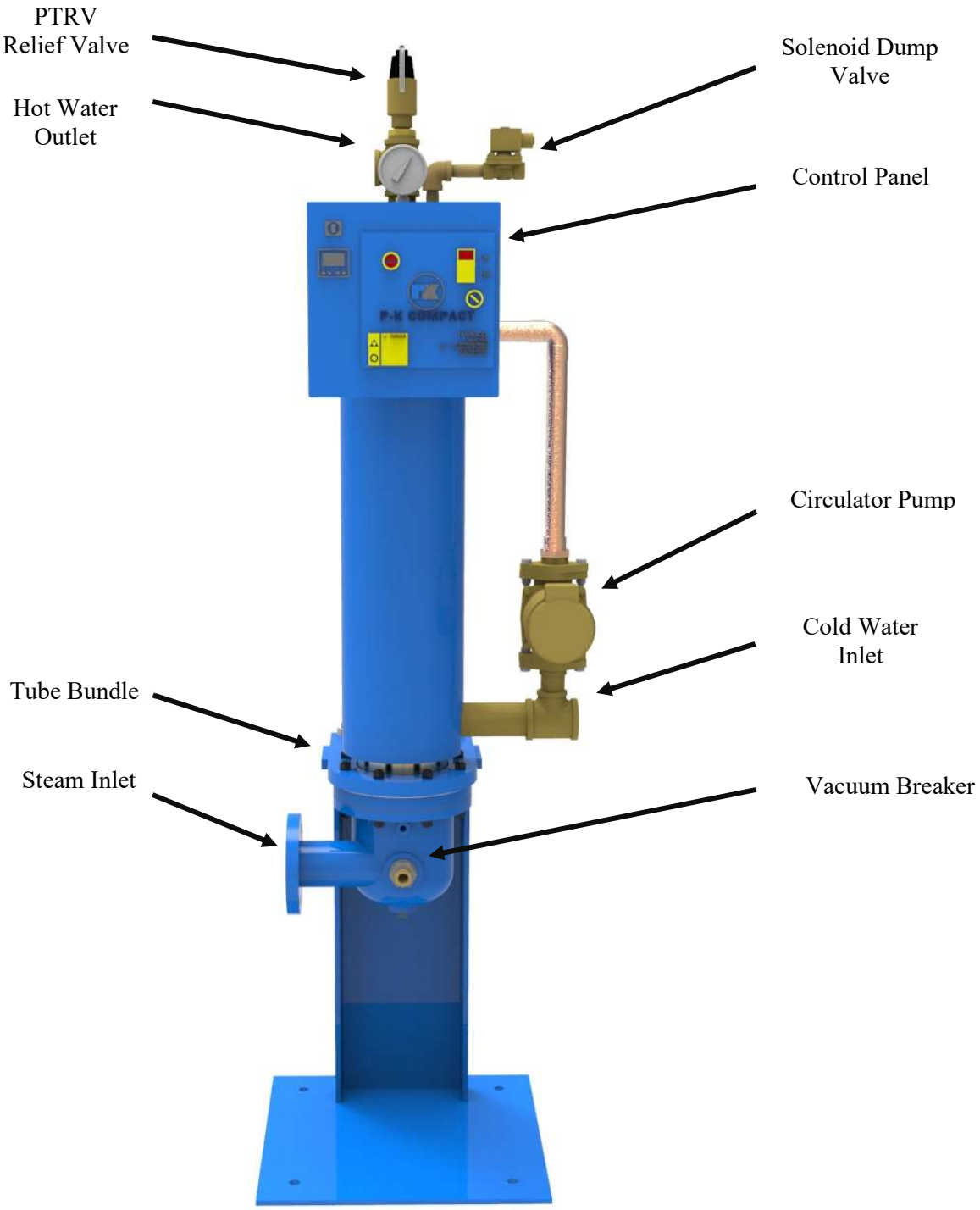
Spare parts and replacement parts can be ordered from your local representative. For assistance in determining part numbers, call your local rep or Patterson-Kelley at (877) 728-5351. Refer to the parts list shown on the assembly drawing provided with this manual. Factory direct replacement parts must be used to ensure that the water heater operates correctly. When ordering replacement parts please have the **Serial Number** of your P-K COMPACT® water heater available.

⚠ WARNING Use of Non-Factory-Authorized replacement parts are not recommended for this equipment. All control components are engineered for safety and are designed to work with each of the other components. Use of non-factory-authorized replacement parts could jeopardize the functionality of the safety features and the performance of the equipment.

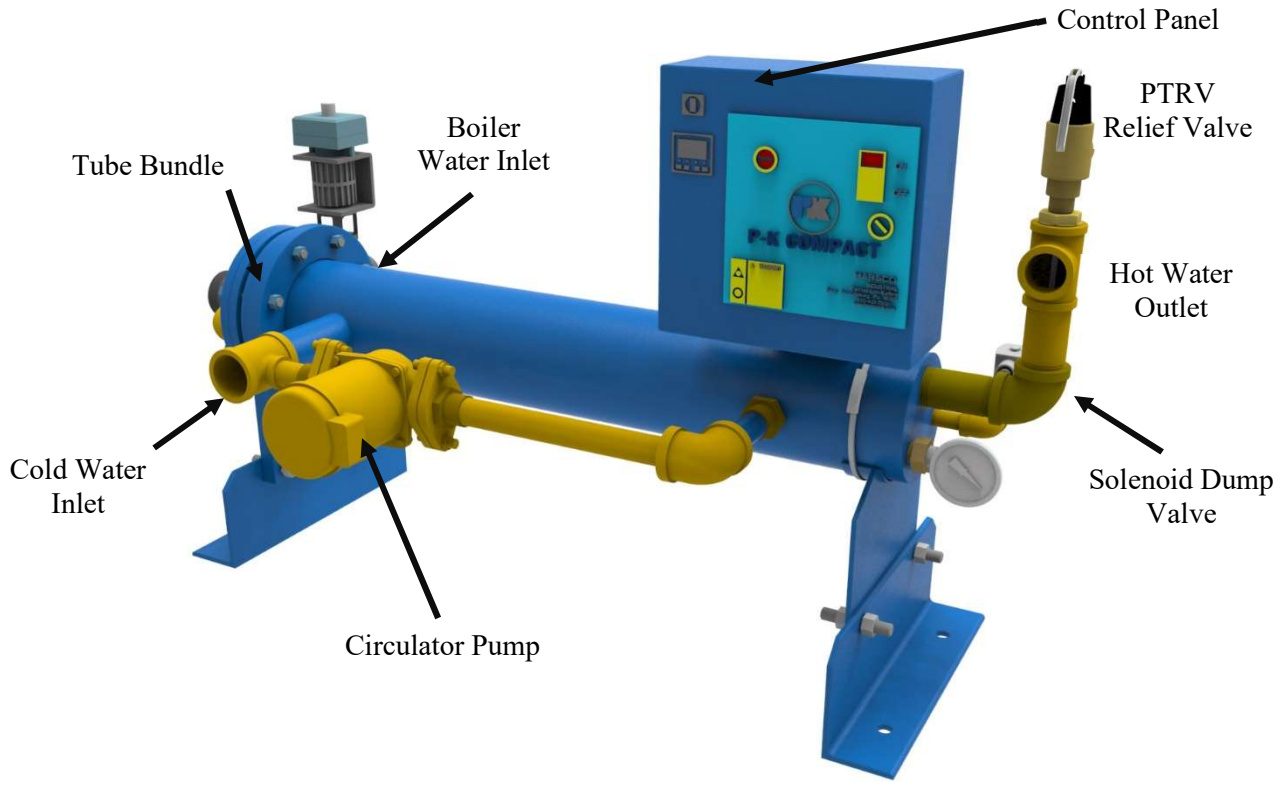
Technical information is also available at the above number or at the Patterson-Kelley website www.pattersonkelley.com.

7.1 SCHEMATIC DIAGRAMS

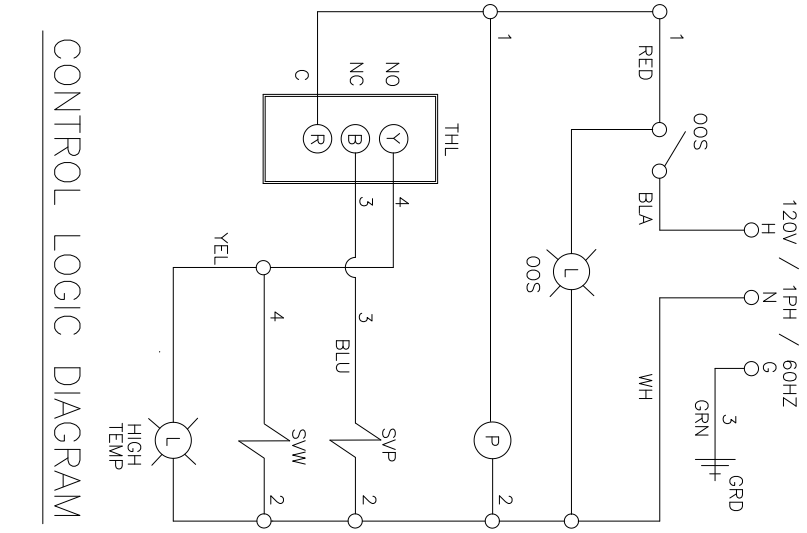
The image below is representative of a standard (vertical) steam-to-water Compact with no control valve. Detailed as-built drawings of the P-K COMPACT® water heaters can be supplied by your local Patterson-Kelley representative.

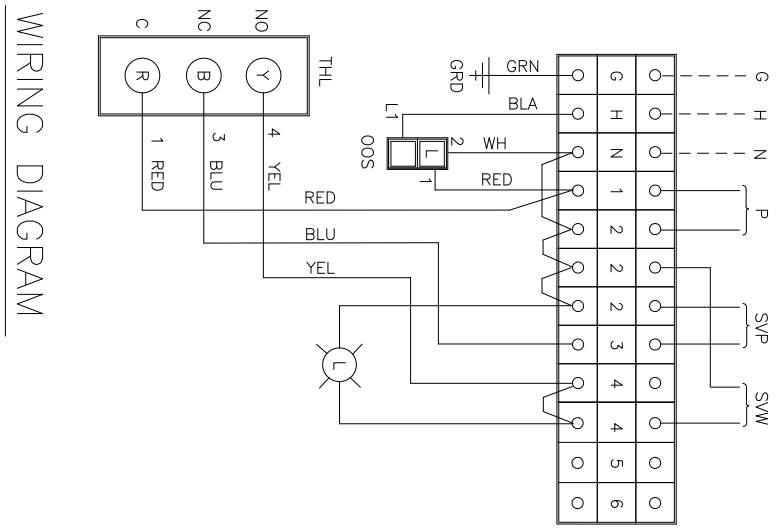


The image below is representative of a horizontal boiler water-to-water Compact with electric control valve. Detailed as-built drawings of the P-K COMPACT® water heaters can be supplied by your local Patterson-Kelley representative



7.1.1 Wiring Diagram for Pneumatic & Self-Contained Temperature Control





ABBREVIATIONS:

G.....GROUND
H.....POWER, HOT
N.....NEUTRAL
L.....LIGHT, HI-TEMP, RED
P.....PUMP
THL.....THERMOSTAT, HIGH LIMIT
SVP.....SOLENOID VALVE, PILOT
SVW.....SOLENOID VALVE, WATER
NC.....NORMALLY CLOSED
NO.....NORMALLLY OPEN
C.....COMMON
OOS.....ON-OFF SWITCH, LIGHTED

WIRING DIAGRAM

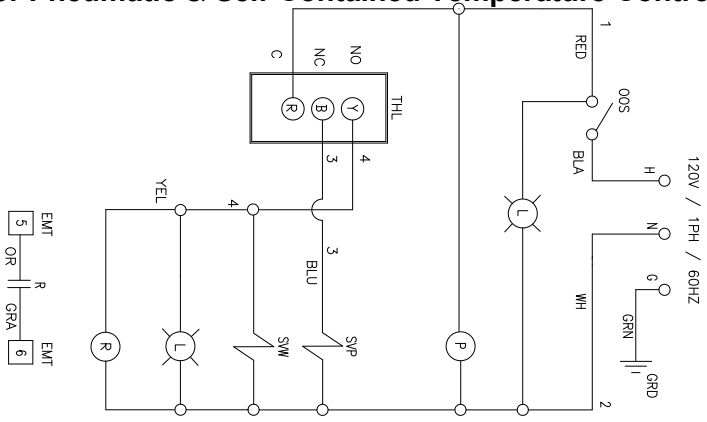
1.) DOUBLE SOLENOID SYSTEM
2.) SOLID LINES: FACTORY WIRING
3.) DOTTED LINES: FIELD WIRING

VERSION #1

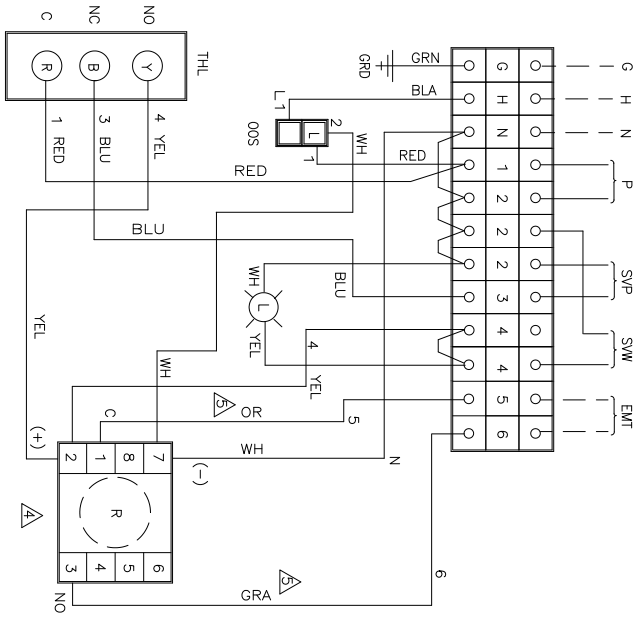
FOR MODULE SEE DWG. 1004901901-3

7.1.2 Wiring Schematic for Pneumatic & Self-Contained Temperature Control w/ Alarm Relay

CONTROL LOGIC DIAGRAM



WIRING DIAGRAM



ABBREVIATIONS:

G	GROUND
H	POWER, HOT
N	NEUTRAL
L	LIGHT, POWER ON, HI-TEMP.
P	PUMP
THL	THERMOSTAT, HIGH LIMIT
SVP	SOLENOID VALVE, PILOT
SVW	SOLENOID VALVE, WATER
R	RELAY
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
C	COMMON
OOS	ON-OFF SWITCH
EMT	ENGERY MANAGEMENT TERMINAL

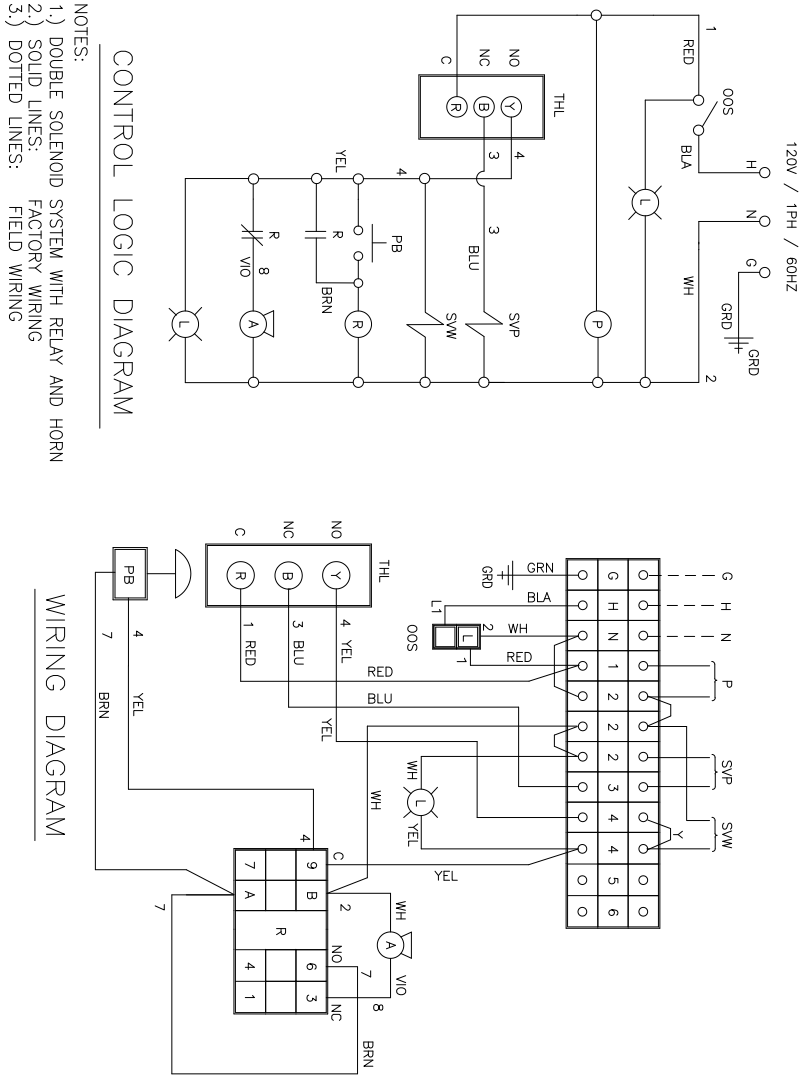
NOTES:

1.) DOUBLE SOLENOID SYSTEM WITH RELAY
2.) SOLID LINES: FACTORY WIRING
3.) DOTTED LINES: FIELD WIRING

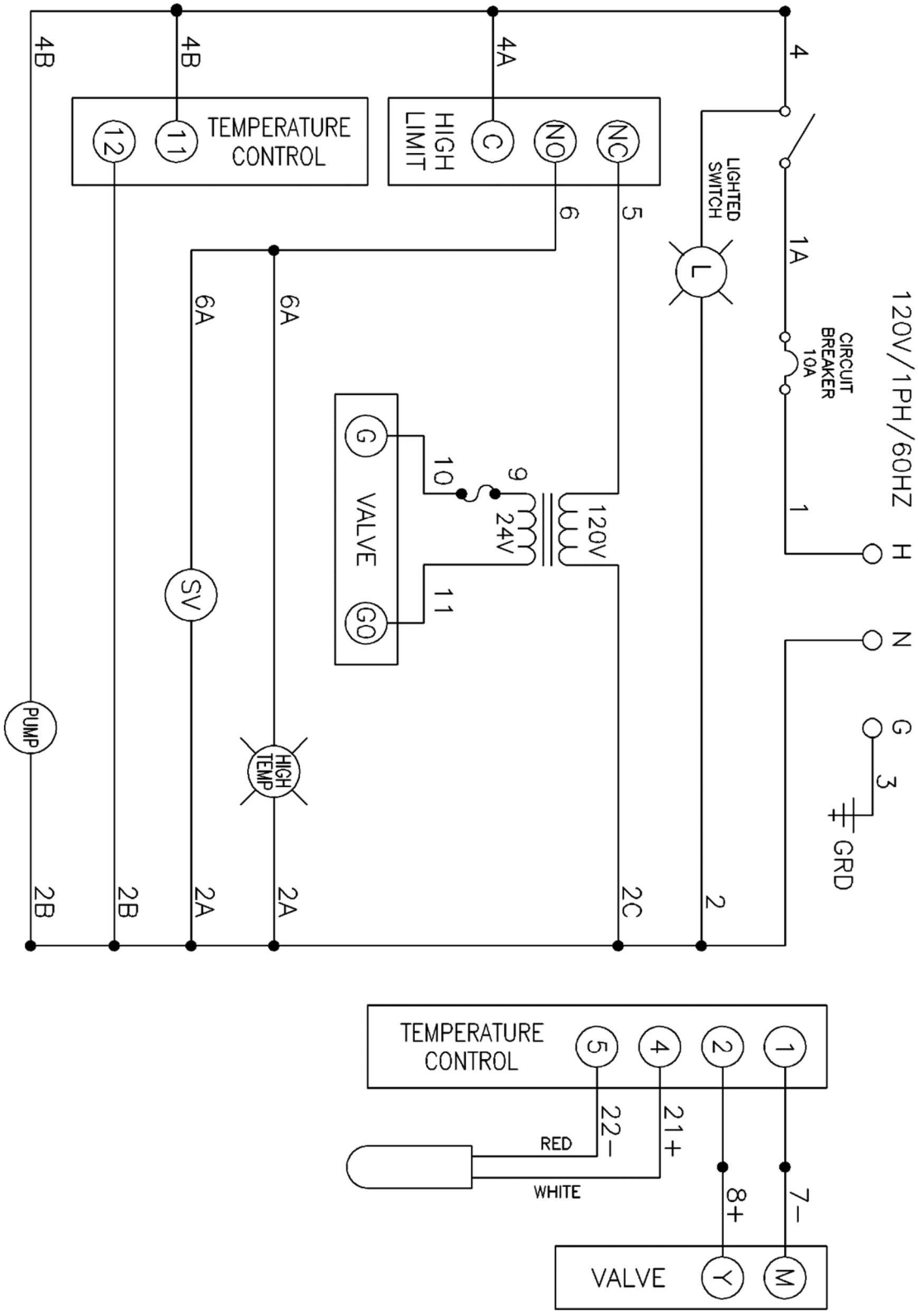
VERSION #2

FOR MODULE SEE DWG. C8651001020-5

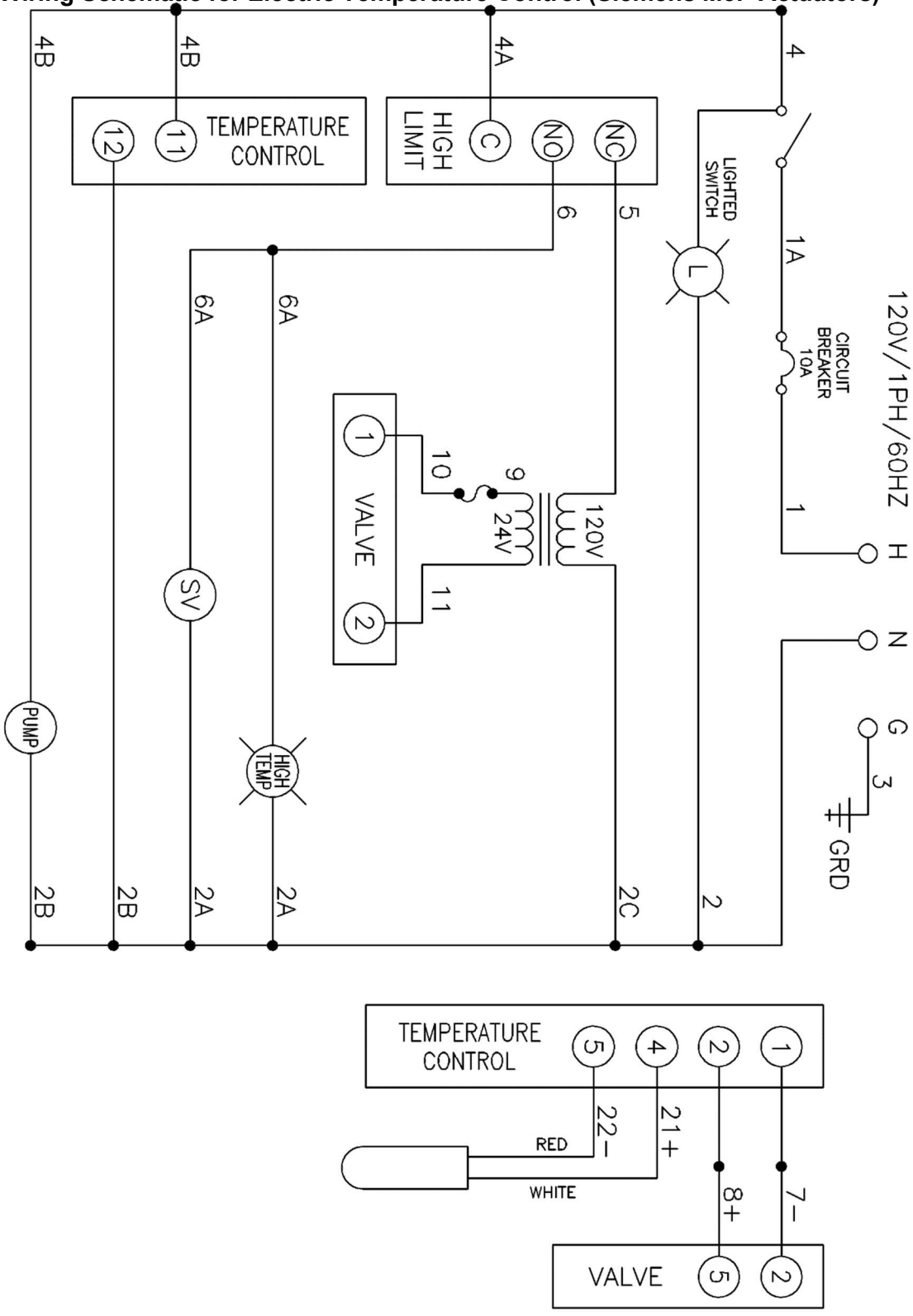
7.1.3 Wiring Schematic for Pneumatic & Self-Contained Temperature Controls w/ Alarm Relay & Local Alarm



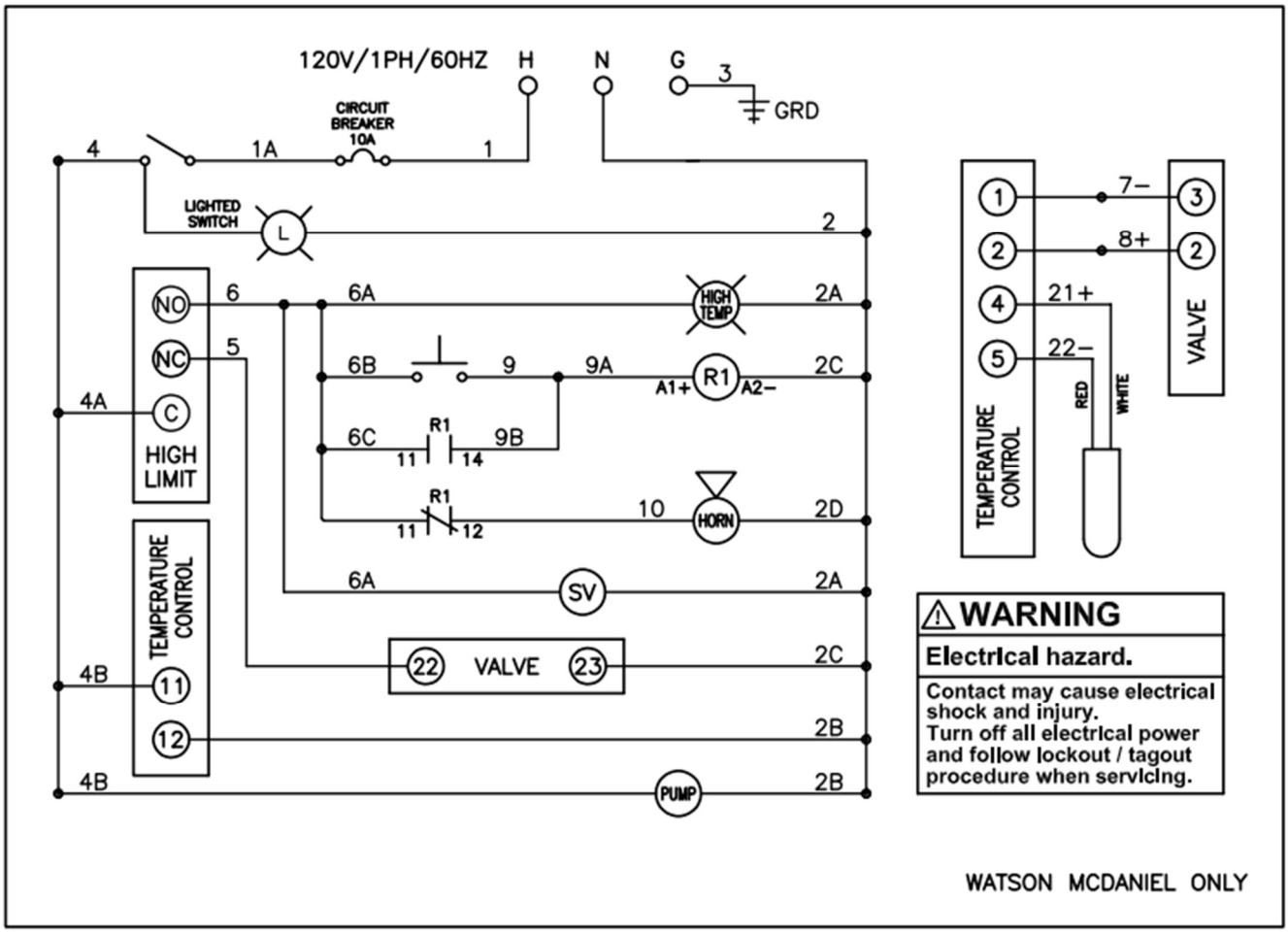
7.1.4 Wiring Schematic for Electric Temperature Control (Siemens MXG/MXF/MVF Actuators)



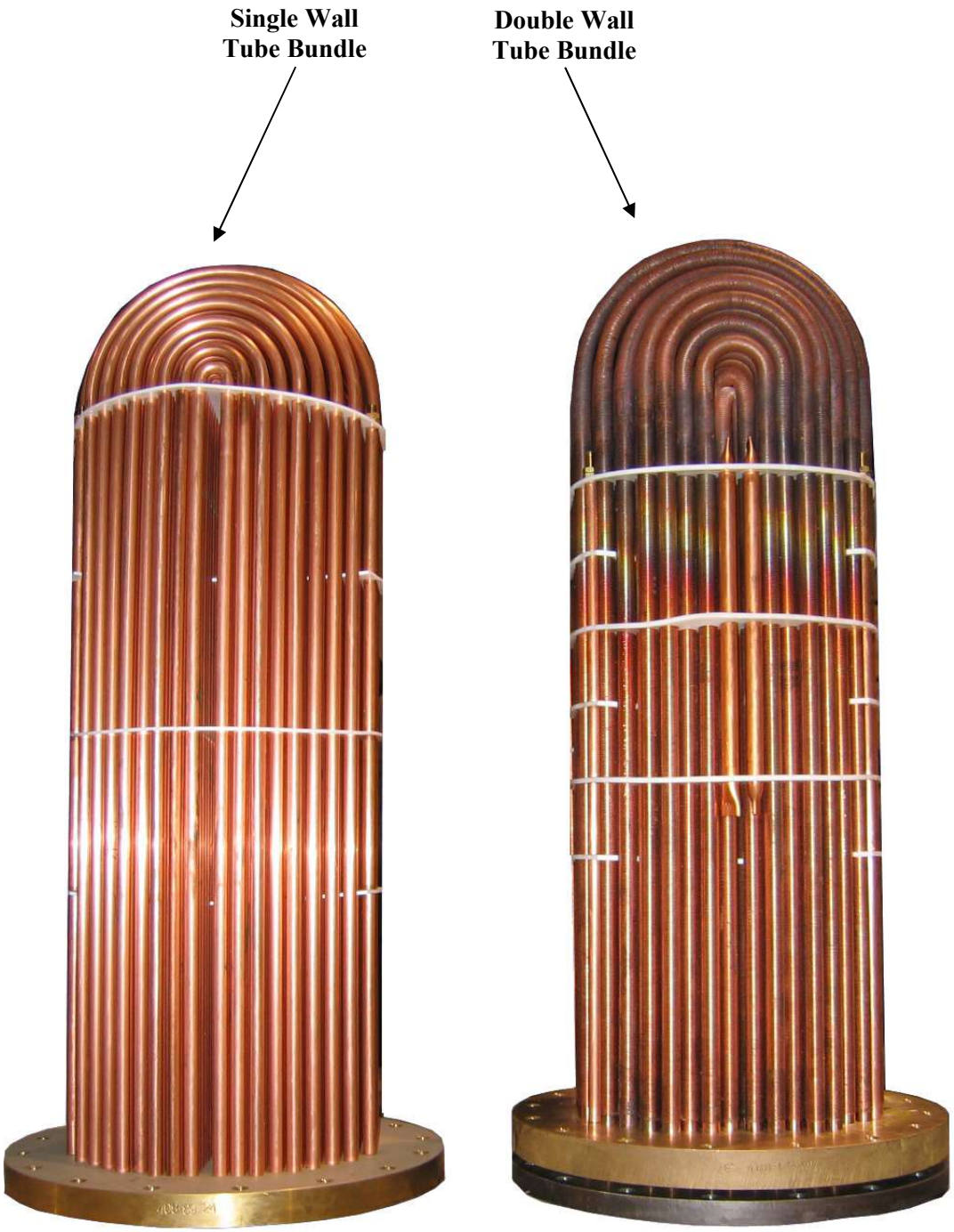
7.1.5 Wiring Schematic for Electric Temperature Control (Siemens M3P Actuators)



7.1.6 Wiring Schematic for Electric Temperature Control (Watson McDaniel Actuators)



7.1.7 Tube Bundle Types



8.0 P-K COMPACT® SPECIFIC LIMITED WARRANTY

Subject to the terms and conditions herein and the Terms and Conditions of Sale (as defined herein), Patterson-Kelley ("Seller") provides to the purchaser of the product ("Buyer") non-prorated warranties for the following components of the P-K COMPACT®, when operated in accordance with the conditions stated herein, against the indicated failures and for the indicated periods commencing on the date of shipment or, if a start-up report is furnished to Seller, on the start-up date shown on the report furnished to Seller (the "Warranty Period"), provided that startup is completed within six (6) months of shipment and the start-up report is furnished to Seller within thirty (30) days of startup (this "Specific Limited Warranty"):

- tube bundle assembly for 10 years against failure due to thermal shock or mechanical failure,
- pressure vessel for 20 years against leakage and
- Anticipator® temperature control (self-contained and pneumatic control) for 20 years against any failure.

The Exclusions and limitations of liability set forth in the Terms and Conditions of Sale (as defined herein) apply to this Specific Limited Warranty. Capitalized terms used but not defined herein have the meanings ascribed to them under Seller's terms and conditions of sale for the product, which can be found at http://pattersonkelley.com/warranty.php (the "Terms and Conditions of Sale"). This Specific Limited Warranty is transferrable to the owner that utilizes the product(s) purchased hereunder for its intended use at the original installation site (the "Original Owner"). This Specific Limited Warranty is non-transferable to anyone who subsequently receives or purchases products from the Original Owner. If the Original Owner did not purchase the product directly from Seller, the Original Owner should contact the reseller from whom it purchased the product for a copy of the Terms and Conditions of Sale attached to the Order Acknowledgement received by the original purchaser of the product from Seller.

I. REMEDY

Seller's obligations under this Specific Limited Warranty is limited to repairing or, if in Seller's judgment it seems more appropriate, to furnishing without charge (installation not included), FCA Seller's factory (Incoterms 2010), a similar part to replace any part which after examination shall, to Seller's own satisfaction be determined to have been defective at the time it was shipped. In the event that a replacement is provided by Seller, the defective item will become the property of Seller. Transportation to Seller's facility or other designated facility for repairs of any products or party alleged defective shall, in all events, be at Buyer's sole risk and cost. This warranty applies only if the original installer and Seller (Attention: Patterson-Kelley, 155 Burson Street, East Stroudsburg, PA 18301) receive, within the Warranty Period, an immediate written notice, providing a detailed description of all claimed defects, upon discovery of such defects together with proof of purchase (invoice or Order Acknowledgment) and a copy of the start-up report for the affected product. Seller may seek reimbursement of any costs incurred by Seller where the product is found to be in good working order, or when it has been determined that this Specific Limited Warranty does not apply as per the exclusions set forth below. The remedies available to Buyer set forth herein are exclusive remedies, and all other remedies, statutory or otherwise, including but not limited to the right of redhibition, are waived by Buyer. Buyer acknowledges that the exclusion of remedies is neither unreasonable nor unconscionable. Buyer shall indemnify and hold Seller harmless against, any claim due to any injury or death to any person or damage to any property resulting in whole or in part from any modification or alteration Buyer makes to any product sold hereunder.

II. EXCLUSIONS

To the full extent permitted by law, Seller shall have no liability for and the Warranties do not cover:
(A) any product which has been altered or repaired by other than Seller's personnel;
(B) deterioration or failure of any product due to
(i) abrasion, corrosion, erosion or fouling,
(ii) misuse,
(iii) modification not authorized by Seller in writing or
(iv) improper installation, lack of or improper maintenance or operation;
(C) equipment not furnished by Seller, either mounted or unmounted, or when contracted for by a party or parties other than Seller to be installed or handled;
(D) the suitability of any product for any particular application;
(E) the design or operation of owner's plant or equipment or of any facility or system of which any product may be made a part;
(F) any damage to the product due to abrasion, erosion, corrosion, deterioration, abnormal temperatures or the influence of foreign matter or energy;
(G) the performance of any product under conditions varying materially from those under which such product is usually tested under industry standards at the time of shipment;
(H) leakage or other malfunction caused by:

(i) defective installations in general and specifically, any installation which is made
(a) in violation of applicable state or local plumbing, housing or building codes or
(b) contrary to the written instructions furnished with the product,
(ii) adverse local conditions in general and, specifically, sediment or lime precipitation in the tubes, headers and/or shells or corrosive elements in the water, heating medium or atmosphere, or
(iii) misuse in general and, specifically, operation and maintenance contrary to the written instructions furnished with the unit, disconnection, alteration or addition of components or apparatus, not approved by Seller, operation with heating media, fuels or settings other than those set forth on the rating plate or accidental or exterior damage;
(I) production of noise or odors;
(J) discoloration or rusty water caused by piping, fittings, valves, pumps or other sources outside of the P-K COMPACT®;
(K) damage to surrounding area or property caused by leakage or malfunction;
(L) costs associated with the replacement and/or repair of the unit including: any freight, shipping or delivery charges, any removal, installation or reinstallation charges, any material and/or permits required for installation, reinstallation or repair, charges to return the P-K COMPACT® or components;
(M) INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, SUCH AS LOSS OF THE USE OF PRODUCTS, FACILITIES OR PRODUCTION, INCONVENIENCE, LOSS OF TIME OR LABOR EXPENSE INVOLVED IN REPAIRING OR REPLACING THE ALLEGED DEFECTIVE PRODUCT;
(N) any claim due to any injury or death to any person or damage to any property resulting in whole or in part from any modification or alteration Buyer makes to any product sold hereunder; and
(O) design defects where Seller has complied with Buyer's design specifications.

III. PROOF OF PURCHASE

Proof of purchase (invoice or Order Acknowledgement) and a copy of the start-up report for the affected product must be provided to Seller when requesting service under this Specific Limited Warranty.

IV. ORDER OF PRECEDENCE

The Standard Limited Warranty set forth in the Terms and Conditions of Sale, (b) this Specific Limited Warranty and (c) any applicable Extended Limited Warranty exclusively govern and control Seller's and Buyer's rights and obligations regarding the warranty of the products. In case of any inconsistency, conflict, or ambiguity between the Standard Limited Warranty, this Specific Limited Warranty and any applicable Extended Limited Warranty (collectively, the "Warranty Documents"), the documents shall govern in the following order: (w) any applicable Extended Limited Warranty; (x) this Specific Limited Warranty; (y) the Standard Limited Warranty and (z) other provisions in the Terms and Conditions of Sale. Information identified in one Warranty Document and not identified in another shall not be considered a conflict or inconsistency. No sales representative, agent, or employee of Seller or any reseller in the chain of sale of the product is authorized to make any modification, extension, or addition to this Specific Limited Warranty, unless agreed to in writing by Seller.

9.0 FIELD STARTUP INFORMATION

Installed Location

_____
_____
_____

Type of Building _____

Serial Number _____

Contractor/Installer _____
Contractor/Startup _____

Domestic Water Supply
Rating: _____ GPM supply
from _____ °F. to _____ °F

Hardness _____ GR or PPM (Select)

Heating Medium

Steam Line Pressure _____ P.S.I.G.
Or
Boiler Water _____ GPM supply
at _____ °F. to _____ °F

Submit to:

Patterson-Kelley
155 Burson Street
East Stroudsburg, PA 18301
Attention: Customer Service
Email: pkcboilersales@spx.com
Fax: (570) 476-7247