

INSTALLATION AND OPERATING INSTRUCTIONS

COLD WATER START & COLD WATER RUN



**For Hi Delta & MVB
Heaters & Boilers**

This manual should be maintained in legible condition and kept adjacent to the heater or in another safe place for future reference.

Raypak[®]
A Rheem[®] Company

GENERAL SAFETY

To meet commercial hot water use needs, the high limit safety control on this water heater is adjustable up to 210°F. However, water temperatures over 125°F can cause instant severe burns or death from scalds. When supplying general purpose hot water, the recommended initial setting for the temperature control is 125°F.

Safety and energy conservation are factors to be considered when setting the water temperature on the thermostat. The most energy-efficient operation will result when the temperature setting is the lowest that satisfies the needs of the application.

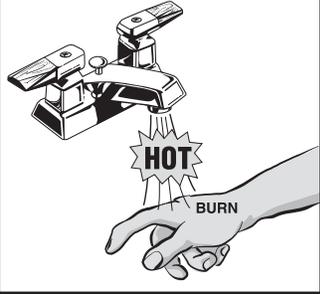
Water temperature over 125°F can cause instant severe burns or death from scalds. Children, disabled and elderly are at highest risk of being scalded.

- Feel water before bathing or showering.
- Temperature limiting valves are available.

NOTE: When this water heater is supplying general purpose hot water for use by individuals, a thermostatically controlled mixing valve for reducing point of use water temperature is recommended to reduce the risk of scald injury. Contact a licensed plumber or the local plumbing authority for further information.

Maximum water temperatures occur just after the heater's burner has shut off. To determine the water temperature being delivered, turn on a hot water faucet and place a thermometer in the hot water stream and read the thermometer.


DANGER



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

Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, see manual.

Time/Temperature Relationships in Scalds

The following chart details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

<i>Water Temp.</i>	<i>Time to Produce Serious Burn</i>
120°F	More than 5 minutes
125°F	1-1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1-1/2 seconds
155°F	About 1 second

Table courtesy of The Shriners Burn Institute

Table A: Time to Produce Serious Burn

COLD WATER START

Before arriving at the job site to begin the installation, it's important to first inspect the system and determine what materials you will need. Some parts are included with the controller while others you will need to provide.

- 1 Control Box
- 1 Temperature Sensor
- 1 Valve assembly with actuator (Shipped separately)
- Wiring and mounting hardware (Provided by installer)

INSTALLATION

Check the Power Source

CAUTION: Do not use for swimming pool applications

WARNING: Using a multi-meter, check the following voltages at the circuit breaker panel prior to connecting any equipment. Make sure proper polarity is followed and house ground is proven.

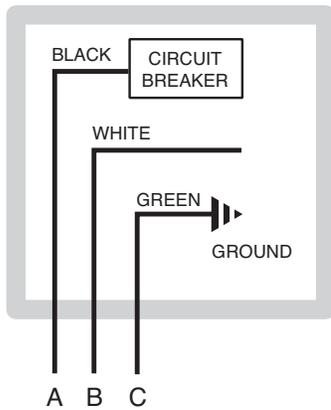


Fig. 1: Wiring Connections

Check the power source:

AC = 108 VAC Minimum, 132 VAC MAX

AB = 108 VAC Minimum, 132 VAC MAX

BC = <1 VAC Maximum

Mounting the Control Box

The control box should be mounted on the side of the heater to which the system piping and valve assembly are to be attached. The controller should be mounted

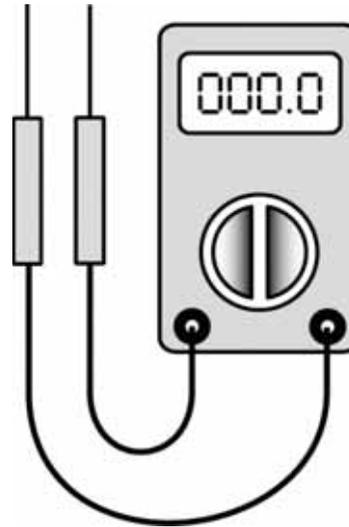


Fig. 2: Multi-meter

so as to provide maximum support by using the mounting holes provided on the base of the controller to the side center brace on the heater. You will need to drill mounting holes and holes through the heater side panel for the routing of wiring and the sensor. A template is supplied for field-installed kits to locate the control box properly.

Attaching the Temperature Sensor

Avoid routing wiring on or near other electrical wires, conduit, motors, spark igniters or other sources of high, intermittent voltage or current. The sensor should be placed in the dry well on the inlet header. Ensure it is installed using thermopaste (field supplied) and it is held firmly at the bottom of the well.

Connecting the Valve Assembly

Connect valve assembly "T CONNECTION " into the piping with the actuator input wiring facing the heater side panel, as shown below. Route wiring to the control thru the bottom panel knockouts to TB2. Refer to the wiring diagram provided on the inside of control cover assembly.

NOTE: Four knockouts are located on the bottom of the control for ease of installation.

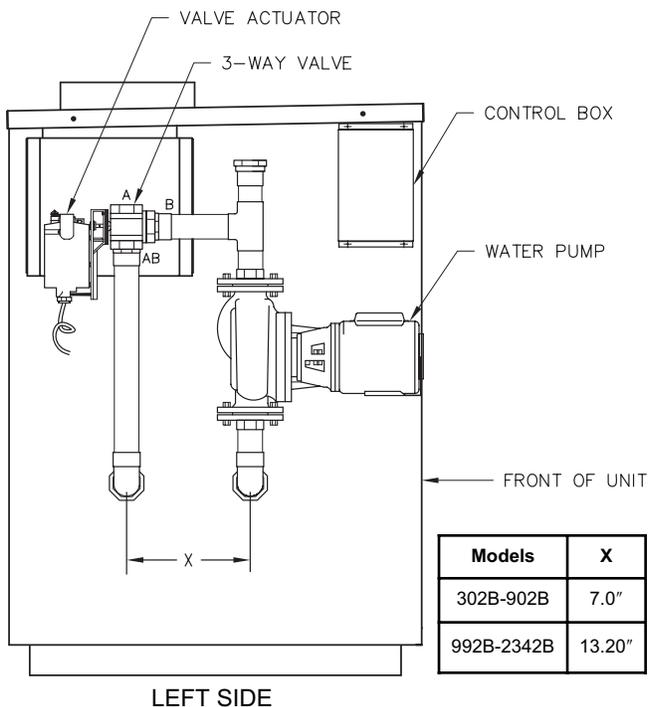


Fig. 3: Component Locations — Hi Delta

Connecting Power to the Controller

Supply power from the 120 VAC power input from the heater to the controller power inputs Terminal Block (TB1). This is accomplished by connecting wiring from the control box to the heater TB1 board 120 VAC power input connections. Refer to wiring diagrams.

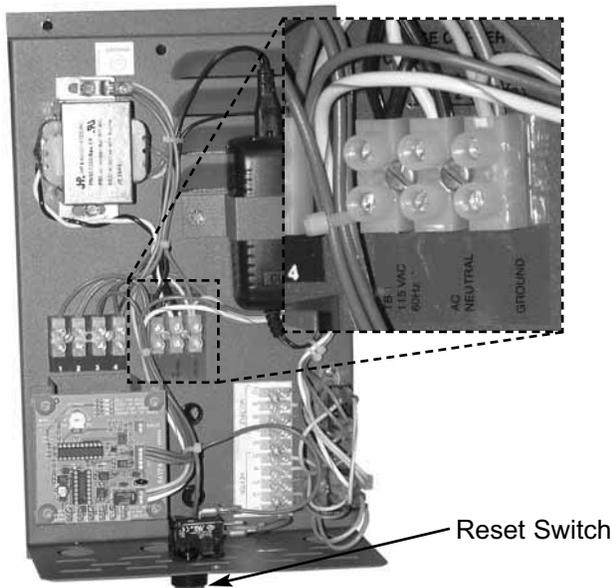


Fig. 4: Location of TB1 in Control Box

NOTE: If a “DIP” switch is provided on the control PCB, verify that the switch settings are correct: 1 = OFF, 2 = ON, 3 = OFF.

OPERATION

Verify the following upon a CALL FOR HEAT signal from the heater:

1. CALL FOR HEAT LED on PCB illuminates GREEN.
2. START UP MODE LED on PCB illuminates YELLOW. Before 7 minutes it should go out if boiler inlet temperature is approaching the set point temperature.

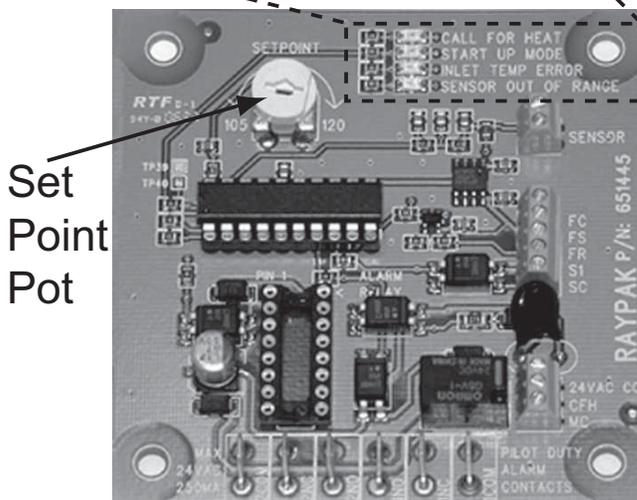


Fig. 5: Control PCB

3. The “ACTUATOR” should be in the fully open position or move to the fully open position if not already there. (Actuator at the fully CCW position)
4. Before 7 minutes time has elapsed if the control is operating properly the “START UP MODE” LED should go out. The inlet water temperature should be stable at a temperature between 105° F and 120° F (Normally set to 110° F) corresponding to the Set Point Pot setting on the PCB. The actuator should have stopped moving.

NOTE: The minimum return water temperature to the heater to prevent condensate is 105°F on standard heaters and 120°F on 87% Efficiency heaters. Ensure that during operation the Set Point Pot is adjusted properly.

Cold Start Sequence of Operation

- 1) 120VAC to heater sends 120VAC to Cold Start control on terminal block 1.
- 2) 120/24VAC transformer and 120VAC-12VDC converter are powered.
- 3) 120/24VAC transformer outputs 24VAC to pin 2 of terminal block 2
- 4) 24VAC leaves pin 2 of terminal block 2 and goes to the modulating three way valve on the 20-30VAC lead, and to the NO contacts of the SPST relay located in the cold start control panel.
- 5) 120VAC-12VDC converter outputs 12VDC to pin 3 of terminal block 2.
- 6) The 12VDC signal leaves pin 2 of terminal block 2 and goes to the common terminal of the reset switch, located on the bottom of the cold start control panel.
- 7) The 12VDC signal crosses over the reset switch and goes to Pin FS on cold start circuit board.
- 8) Cold start control remains on standby until a Call for heat occurs at heater.
- 9) TRIG terminal of Economaster connection on heater CPW board outputs 24VAC to terminal 4 of terminal block 3 located in Cold Start controller.
- 10) Terminal 4 of TB 3 sends 24VAC to the coil of the SPST relay located in the cold start control panel.
- 11) The SPST relay coil is energized and closes the contacts allowing 24VAC to energize the CFH pin on the cold start circuit board.
 - a) A two second delay occurs from the CFH signal waiting to send power from terminal MC of the cold start circuit board.
- 12) J9 terminal on the heater CPW board (interlock connection) outputs a 24 VAC signal to terminal 2 of terminal block 3 located in the cold start controller.
- 13) 24 VAC is sent from terminal 2 of terminal block 3 to the NO contacts of the DPST relay located in the cold start control panel.
- 14) After the two second delay on the cold start circuit board, pin MC outputs a 24 VAC signal to the coil of the DPST relay located in the cold start control panel.
- 15) The DPST relay coil energizes and closes the NO contacts.

- 16) Once the NO contacts of the DPST close, the heater 24 VAC is sent back to the heater to complete the Economaster circuit (pin 3 of terminal block 3) and the interlock circuit (pin 1 of terminal block 3) allowing the heater to fire.
- 17) Pin FR on the TVC board outputs 10VDC to the modulating three way valve actuator to drive it fully open for two-minutes waiting for the heater to reach full fire.
- 18) After the two-minute delay the 10VDC output signal from pin FR reduces to approximately 8VDC at the inverter thus slowing the pump to approximately 50 Hz.
- 19) The output signal continues to vary depending on the heater inlet temperature.

The heater will lockout and shut down if the set point on the inlet temperature is not achieved within seven-minutes from a call for heat.

The DIP switches on the 3-way valve actuator must be set as indicated in the Fig. 6.

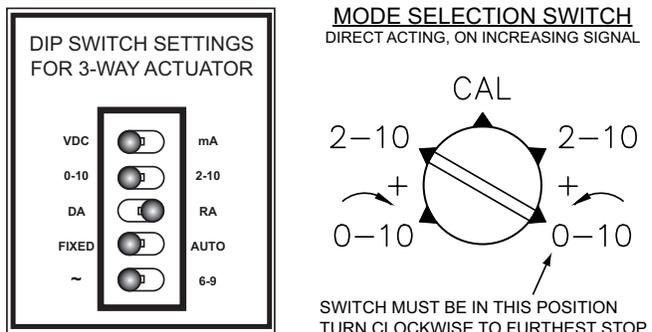


Fig. 6: Set Dip Switch Settings — Delta Actuator

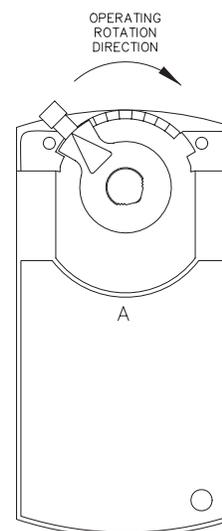


Fig. 7: Delta Actuator — Actuator Shown in Full System Flow Position

TROUBLESHOOTING

Check your power source using a Volt-Ohm meter; check the following voltages at TB1 terminal block:

TB1-1 to TB1-2 = 108 VAC Minimum, 132 VAC Maximum

TB1-1 to TB1-3 = 108 VAC Minimum, 132 VAC Maximum

TB1-2 to TB1-3 = Must be less than .6 VAC

IF CALL FOR HEAT LED does not illuminate when the heater has a CFH signal, check for 24VAC at the heater CPW Board (J17-TRIG) output. If voltage is present, check wiring using the wiring diagram. If voltage is not present, the problem exists in the heater.

IF VALVE DOES NOT MOVE: Check for voltage out at TB2-1: Should be a 1VDC to 10VDC output to the actuator valve. If no voltage is present, check for voltage at TB2-3, there should be a 12VDC signal. If the 12VDC signal is not present, verify that the converter is wired correctly using the wiring diagram.

IF SENSOR OUT OF RANGE LED is illuminated: The set point temperature has not been reached within the 7 minute time period.

- Push the Reset Switch (see Fig. 4) or remove power and watch for proper operation.
- Check pump sizing and valve/piping sizing and correct as necessary.
- Replace sensor.
- Check wiring using wiring diagram.

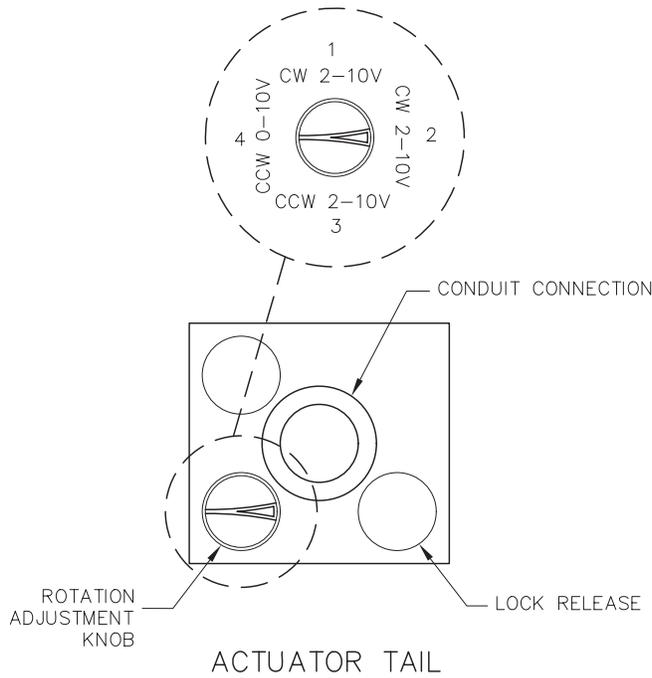


Fig. 8: Elodrive Actuator — Rotation Knob Setting

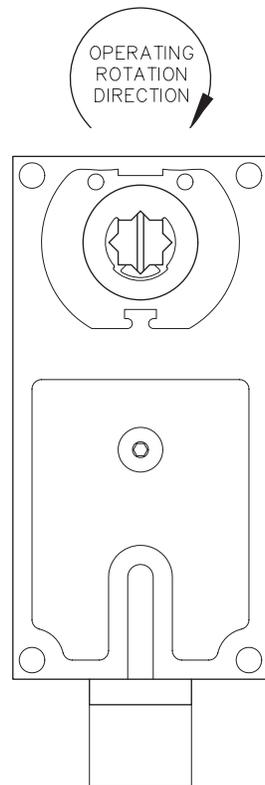
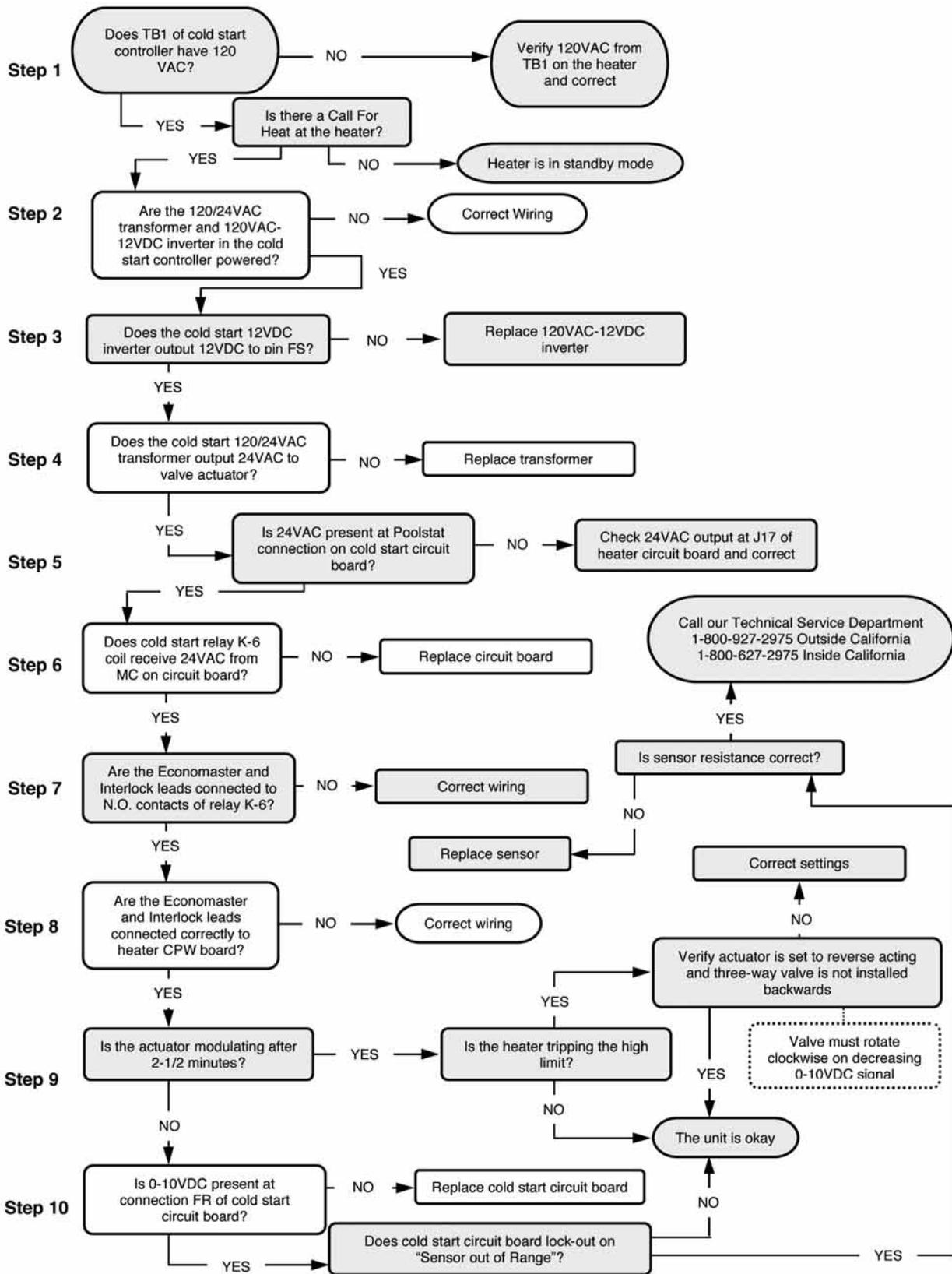


Fig. 9: Elodrive Actuator — Actuator Shown in Full System Flow Position

NOTE: Elodrive actuator is Nema 4 rated.

Cold Water Start Troubleshooting Guide

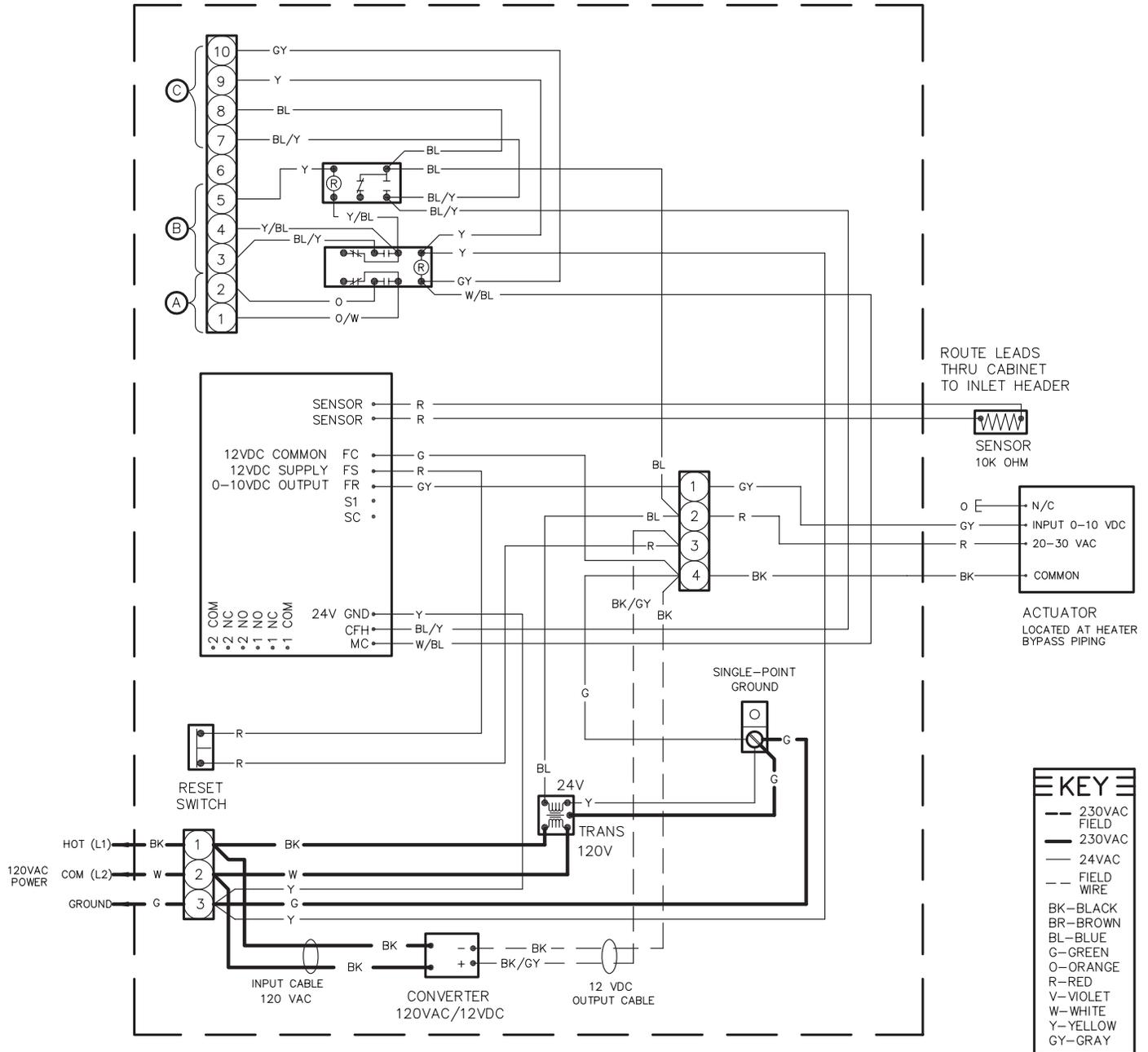


Wiring Diagram

	HI DELTA	MVB	RAYTHERM
(A) {	1 O/W INTERLOCK J9	INTERLOCK 9	FLOW SWITCH
2	0 INTERLOCK J9	INTERLOCK 10	IGNITION MODULE
(B) {	3 BL/Y TP4 ECONOMASTER	CWR/CWS 7	TP4 ECONOMASTER
4	Y/BL J17/TRIG	CWR/CWS 8	FROM TH
5	Y J17 / 24VR	Y/GY (ALARM)	TRANSFORMER COMMON
(C) {	7		
8			
9			
10			

← MULTI-BOILER CONTROL →

COLD START CONTROL ASSEMBLY



901797 REV. 2

COLD WATER RUN

Purpose

The Cold Water Run system utilizes a variable-speed pump to inject the proper amount of water from the main system loop into the boiler to maintain the optimum inlet temperature. This approach allows the full capacity of the boiler to be utilized to meet the system load, while at the same time continuously maintaining the optimum inlet water temperature to prevent condensation.

Typical Cold Water Run Applications

- Swimming pools.
- Snow melting.
- Low temperature radiant panel.
- Water source heat pumps.
- Any system with steady state return water temperature below 105°F.

CWR vs. CWS

- Cold water start is for transient cold water operation.
- Cold water run is for continuous operation below 105°F system return temperature.
- Cold water start maintains design flow rate at system design temperature but reduces boiler flow rate during heavy by-pass operation.
- Cold water run maintains constant design flow rate in the boiler.

INSTALLATION

Before arriving at the job site to begin the installation, it's important to first inspect the system and determine what materials you will need. Some parts are included with the controller while others you will need to provide.

Installation Codes

Installations must be in accordance with local, state, provincial, and national codes, laws, regulations and ordinances. In the absence of local codes, installations must be in accordance with the latest editions of the:

- National Fuel Gas Code, ANSI Z223.1/NFPA 54
- National Electrical Code, ANSI/NFPA 70
- For Canada only: CAN/CGA B149.1 installation Code (B149.1) and CSA C22.1 C.E.C. Part 1 and Part 2

Mounting the Control Box

NOTE: The heater should not be located in an area where possible water leakage will result in damage to the area adjacent to the heater or to the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, with adequate drainage, be installed under the heater. The pan must not restrict combustion air flow.

The control box should be mounted on the side of the heater to which the system piping and pump assemblies are to be attached. The controller should be mounted so as to provide maximum support by using the mounting holes provided on the base of the controller to the side center brace on the heater. You will need to drill mounting holes and holes through the heater side panel for the routing of wiring and the sensor. A template is supplied for field-installed kits to locate the control box properly.

CAUTION: Remote mounted controller must be installed within 25 feet of the heater.

Indoor and Outdoor Installations

The cold water run control panel is rated for indoor use only. Do not mount or install the control panel in areas where dripping, flooding, rain, snow or spraying water may come in contact with the enclosure. If the injection pump is located outdoors, the optional outdoor cover must be installed according to the instructions in the following section. For outdoor installations mount the control panel indoors and route the wiring to the appropriate connection points. Wire length is not to exceed 25 feet in any one direction. Contact your local sales representative for further information.

Injection & Heater Pump Comparison — Hi Delta

Heater Model	Heater Pump			Injection Pump		Injection Pump	Heater Pump
	Flow	Temp. Rise	Press. Drop	Flow	Temp. Rise		
302	32	16	2	13	40	1911-¼ hp	112
402	34	20	2	17	40	1911-¼ hp	112
502	42	20	2.3	22	40	1911-¼ hp	1630 4.0
652	55	20	4.1	28	40	1911-¼ hp	1630 4.0
752	63	20	5.7	32	40	1911-¼ hp	1630 4.2
902	76	20	8.4	38	40	1911-¼ hp	1630 4.2
992	83	20	5.2	42	40	1911-¼ hp	1630 4.7
1262	107	20	9.6	54	40	1911-¼hp	1630 4.7
1532	120	22	12.4	62	42	1911-¼hp	1632 5.6
1802	120	25	13	68	45	1911-¼hp	1632 5.6
2002	132	26	19	74	46	1935-¾hp	1634 6.1
2072	132	27	19	75	47	1935-¾hp	1634 6.1
2342	132	30	21.4	80	50	1935-¾hp	1634 6.1

Table B: Injection and heater pump specifications

Check the Power Source

WARNING: Using a multi-meter, check the following voltages at the circuit breaker panel prior to connecting any equipment. Make sure proper polarity is followed and house ground is proven.

Check the power source:

AC = 108 VAC Minimum, 132 VAC MAX
 AB = 198 VAC Minimum, 250 VAC MAX
 BC = 108-132 VAC Maximum

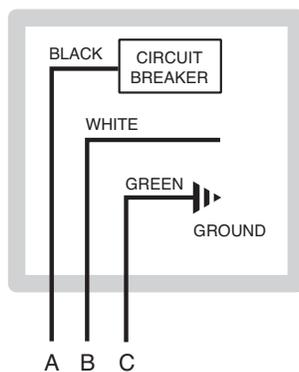


Fig. 10: Wiring Connections

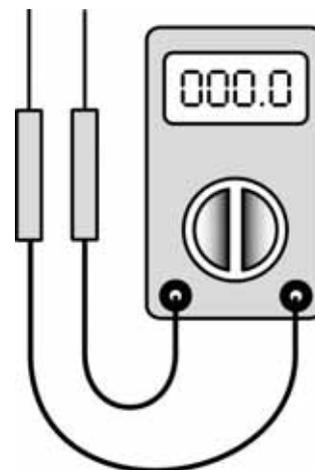


Fig. 11: Multi-meter

Injection Pump Cover Installation

Before Starting

- 1) Turn off power to the unit at the circuit breaker.
- 2) Turn off gas supply.
- 3) Shut off the water supply to the heater and, if necessary, drain water from the system.
- 4) Allow heater to cool down before attempting work.

In order to install the pump cover, you will need to rotate the pump body so that the electrical box is pointing downward, as outlined in the following steps:

1. Loosen and remove the eight (8) 9/16" wrench bolts holding the pump body in place. See Fig. 12.

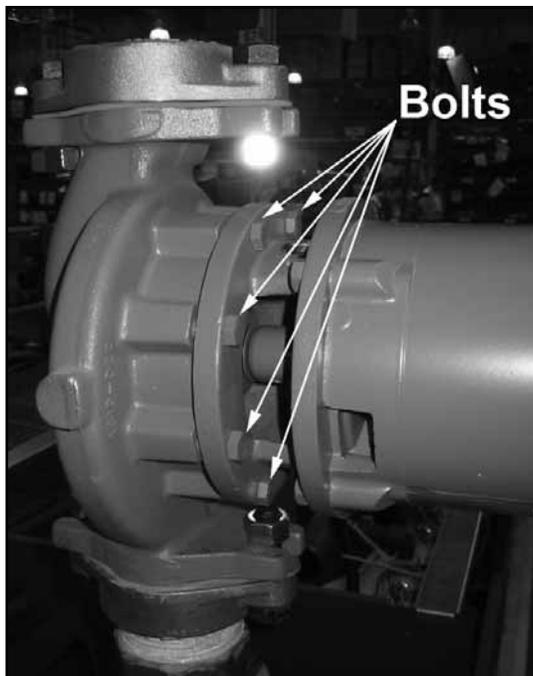


Fig. 12: Remove the eight bolts holding the pump body in place

2. Remove the pump body then rotate it so that the electrical box is pointing downward, ensuring not to damage the seal. See Fig. 13, 14 and 15.



Fig. 13: Remove the pump body

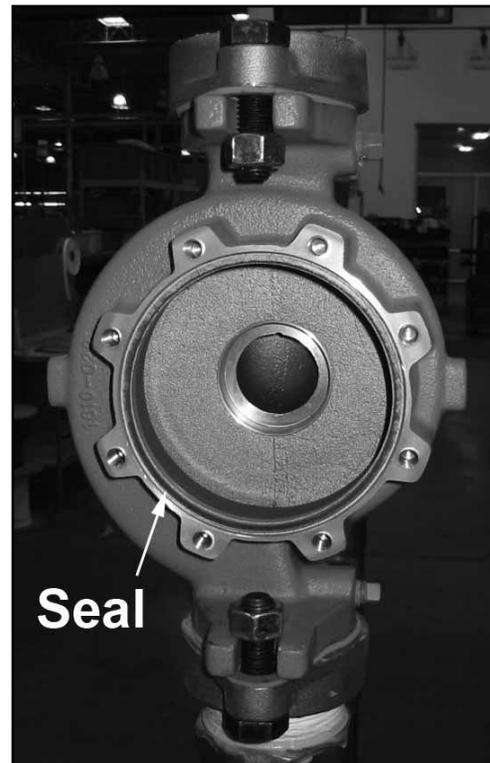


Fig. 14: Be sure not to damage the seal when removing or replacing the pump body

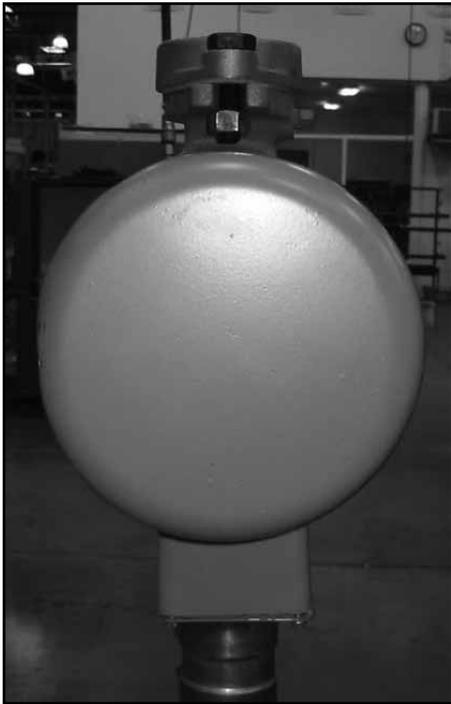


Fig 15: Reposition the pump body so that the electrical box points downward

3. Insert and tighten all eight (8) wrench bolts, securing the pump body in place.
4. You will now be able to install the pump cover. See Fig. 18 and 19.



Fig 17: Pump cover - angle view

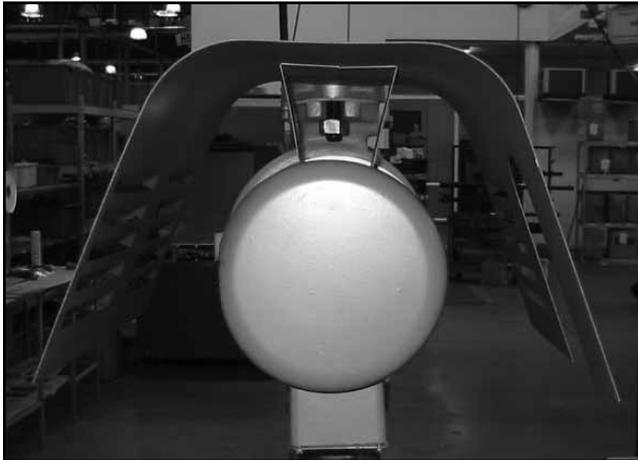
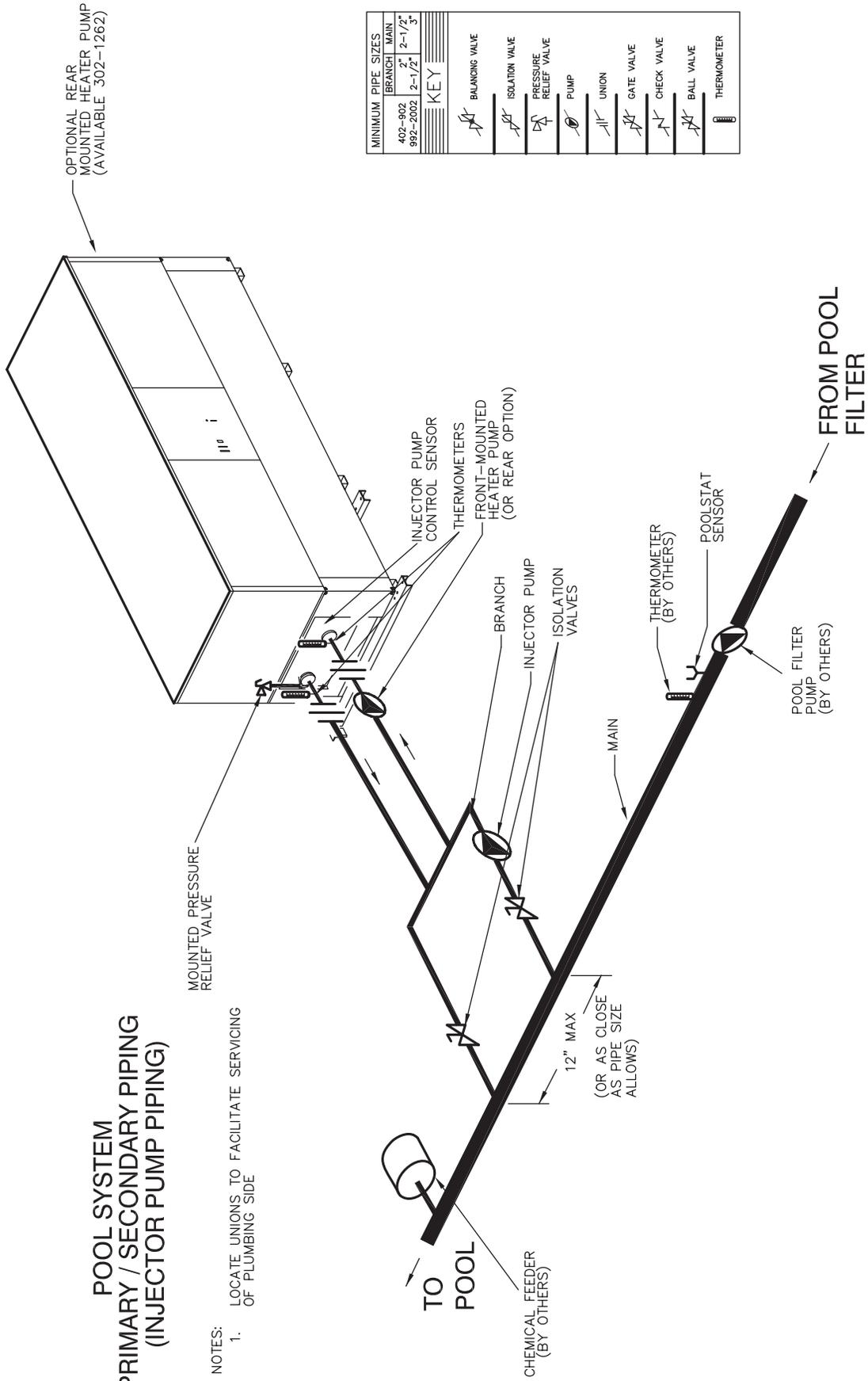


Fig. 16: Place the cover on the pump

Typical Boiler Piping (Hi Delta shown)



POOL SYSTEM PRIMARY / SECONDARY PIPING (INJECTOR PUMP PIPING)

- NOTES:
1. LOCATE UNIONS TO FACILITATE SERVICING OF PLUMBING SIDE

MINIMUM PIPE SIZES	
BRANCH	MAIN
402-902	2"
892-2002	2-1/2"
	3"

KEY	
	BALANCING VALVE
	ISOLATION VALVE
	PRESSURE RELIEF VALVE
	PUMP
	UNION
	GATE VALVE
	CHECK VALVE
	BALL VALVE
	THERMOMETER

START-UP PROCEDURE

- Run full system flow for two minutes.
- Initiate PID pump control to achieve target inlet temperature by slowing injector pump.
- Boiler ΔT will not increase during bypass operation.
- If target temperature is not achieved after seven minutes from “call for heat”, the system will shut down.

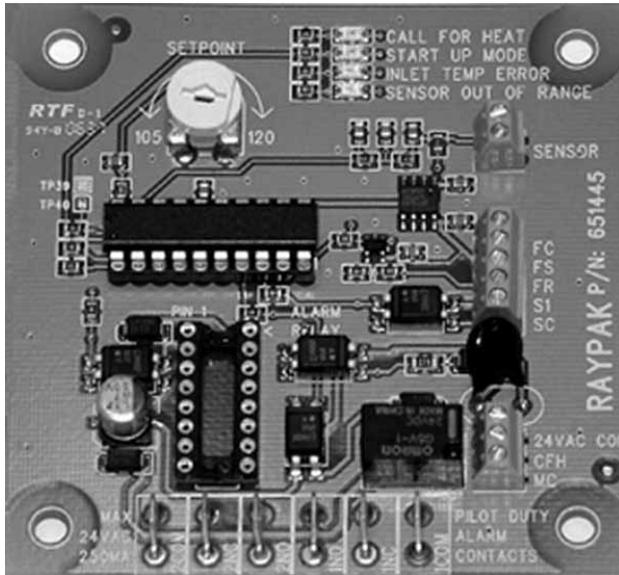


Fig. 18: Control Board

Sequence of Operation

- 1) Supply separate 220VAC, 1 \emptyset , 60 Hz power to Cold Run control.
- 2) Call for heat occurs at heater.
- 3) TRIG terminal of Economaster connection on heater CPW board outputs 24VAC to terminal 4 of terminal block 3 located in Cold Run controller.
- 4) Terminal 4 of TB 3 sends 24VAC to the coil of the SPST relay located in the cold run control panel.
- 5) The SPST relay coil is energized and closes the contacts allowing 24VAC from the Cold Run control transformer to be sent to the CFH terminal of the Cold Run circuit board.
 - a) A two second delay occurs from the CFH signal waiting to send power from terminal MC of the cold run circuit board.
- 6) J9 terminal on the heater CPW board (interlock connection) outputs a 24 VAC signal to terminal 2 of terminal block 3 located in the cold run controller.
- 7) 24 VAC is sent from terminal 2 of terminal block 3 to the NO contacts of the DPST relay located in

the cold run control panel.

- 8) After the two second delay on the cold run circuit board, pin MC outputs a 24 VAC signal to terminal AL0 of the Hitachi inverter.
- 9) The AL0 relay closes and outputs a 24 VAC signal to the coil of the DPST relay located in the cold run control panel.
- 10) The DPST relay coil energizes and closes the NO contacts.
- 11) Once the NO contacts of the DPST close, the heater 24 VAC is sent back to the heater to complete the Economaster circuit (pin 3 of terminal block 3) and the interlock circuit (pin 1 of terminal block 3) allowing the heater to fire.
- 12) Pin SC of the cold run circuit board sends 24VAC to Pin 1 (Forward) on Hitachi Inverter.
- 13) PCS terminal on Inverter outputs 12VDC signal to the common terminal of the reset switch located on the bottom of the cold run control panel.
- 14) The 12VDC signal crosses over the reset switch and goes to Pin FS on cold run circuit board.
- 15) 12VDC on pin FS is jumpered to pin S1 on the cold run circuit board.
- 16) Pin FR on the TVC board outputs 10VDC to the Inverter to drive injector pump at full speed two-minutes waiting for the heater to reach full fire.
- 17) After the two-minute delay the 10VDC output signal from pin FR reduces to approximately 8VDC at the inverter thus slowing the pump to approximately 50 Hz.
- 18) The output signal continues to vary depending on the heater inlet temperature.

The heater will lockout and shut down if the set point on the inlet temperature is not achieved within seven-minutes from a call for heat.

The DIP switches on the Hitachi Inverter must be set as indicated on Fig. 19 below.

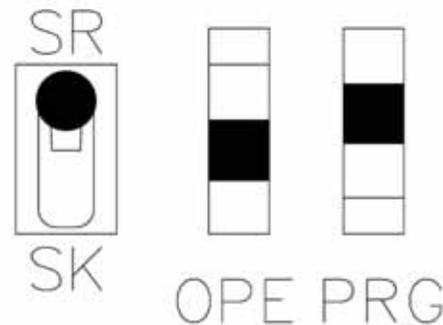


Fig. 19: DIP Switch Settings

Wiring Diagram

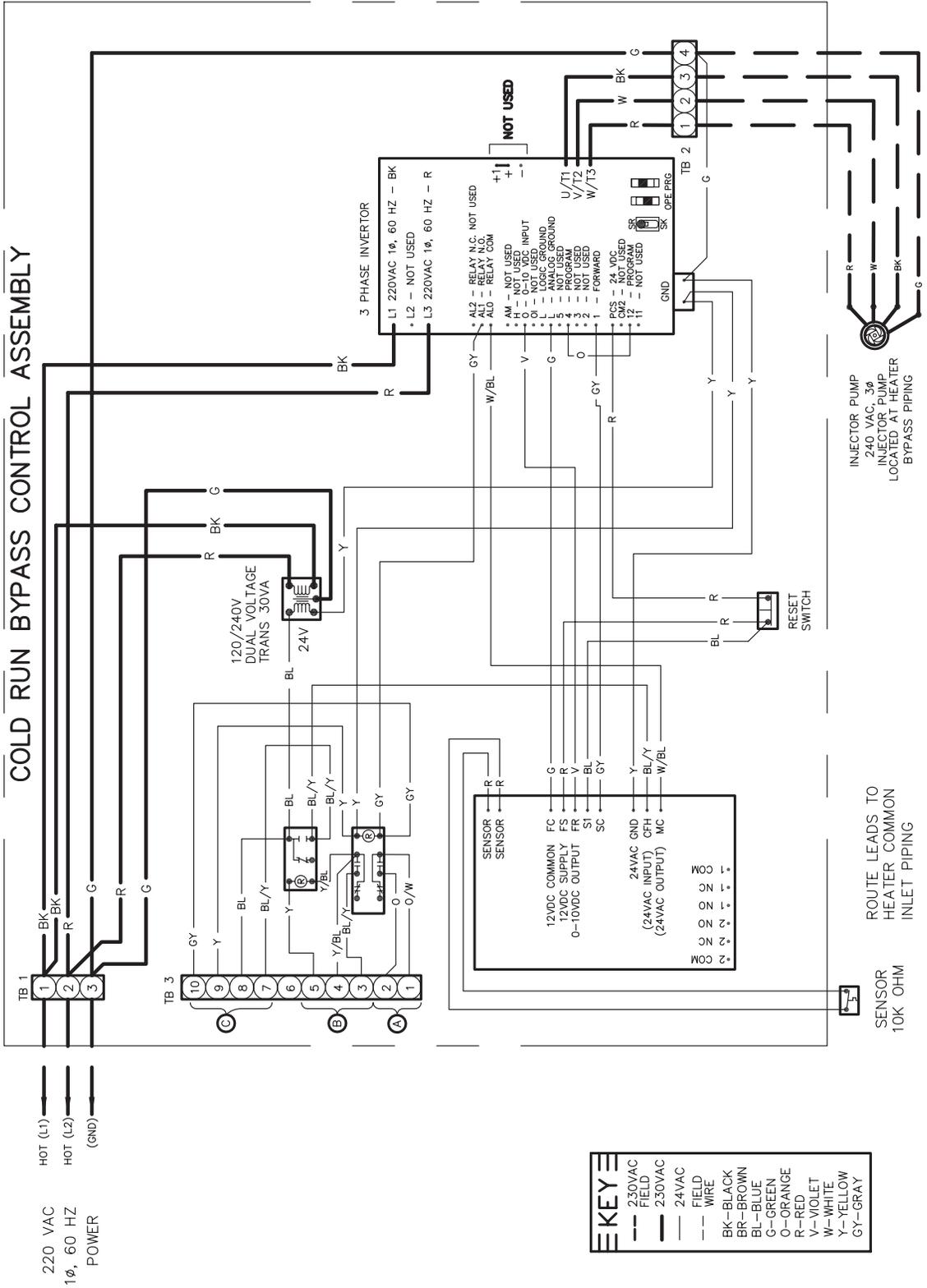
HI DELTA
 1 O/W INTERLOCK J9
 2 O INTERLOCK J9
 3 BL/Y TP4 ECONOMASTER
 4 Y/BL J17/TRIG
 5 Y J17/ 24VR

MVB
 INTERLOCK 9
 INTERLOCK 10
 CWR/CWS 8
 CWR/CWS 7
 Y/GY (ALARM)

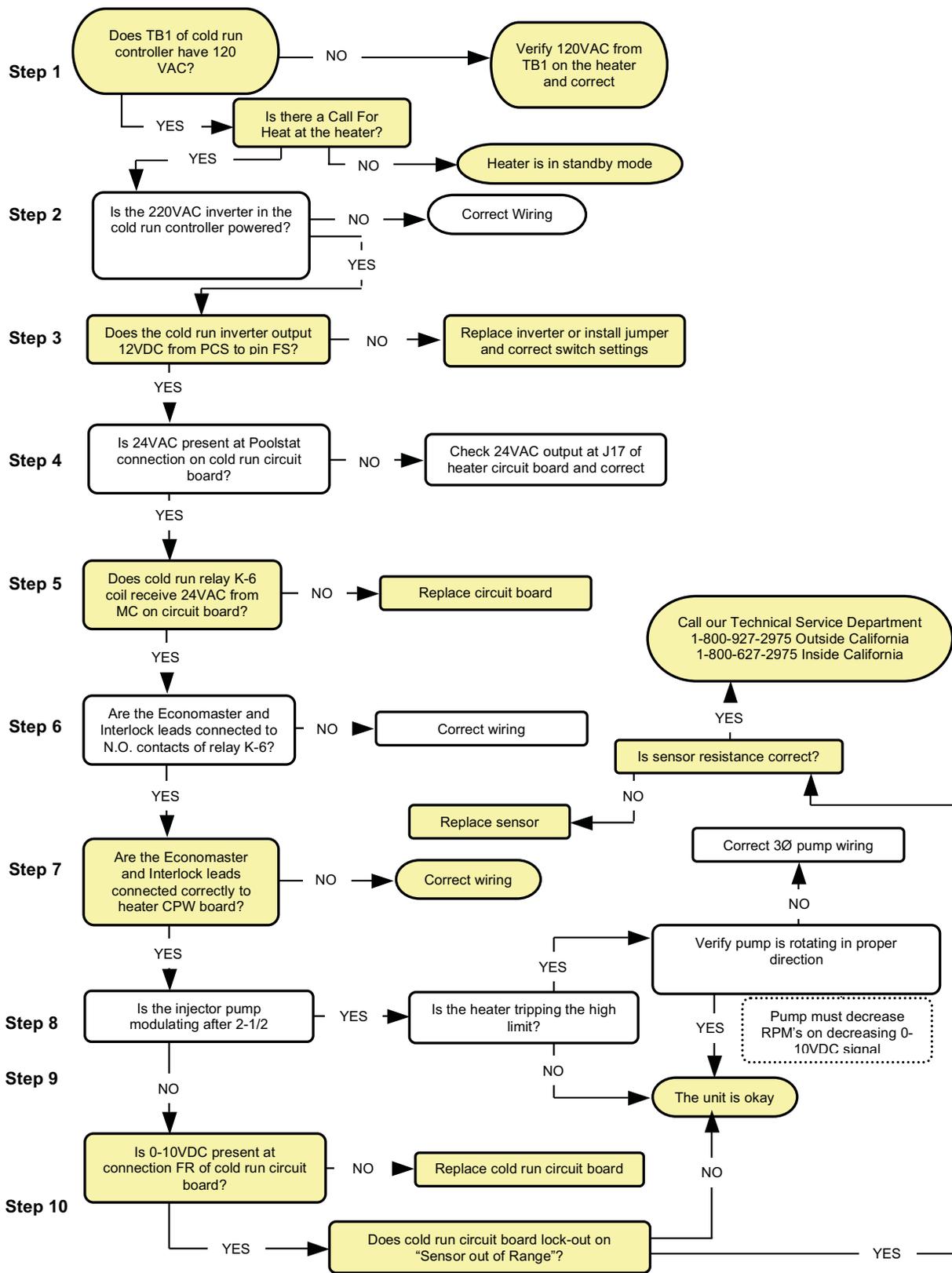
RAYTHERM
 FLOW SWITCH
 IGNITION MODULE
 FROM TH
 TP4 ECONOMASTER
 TRANSFORMER COMMON

MULTI-BOILER CONTROL

COLD RUN BYPASS CONTROL ASSEMBLY

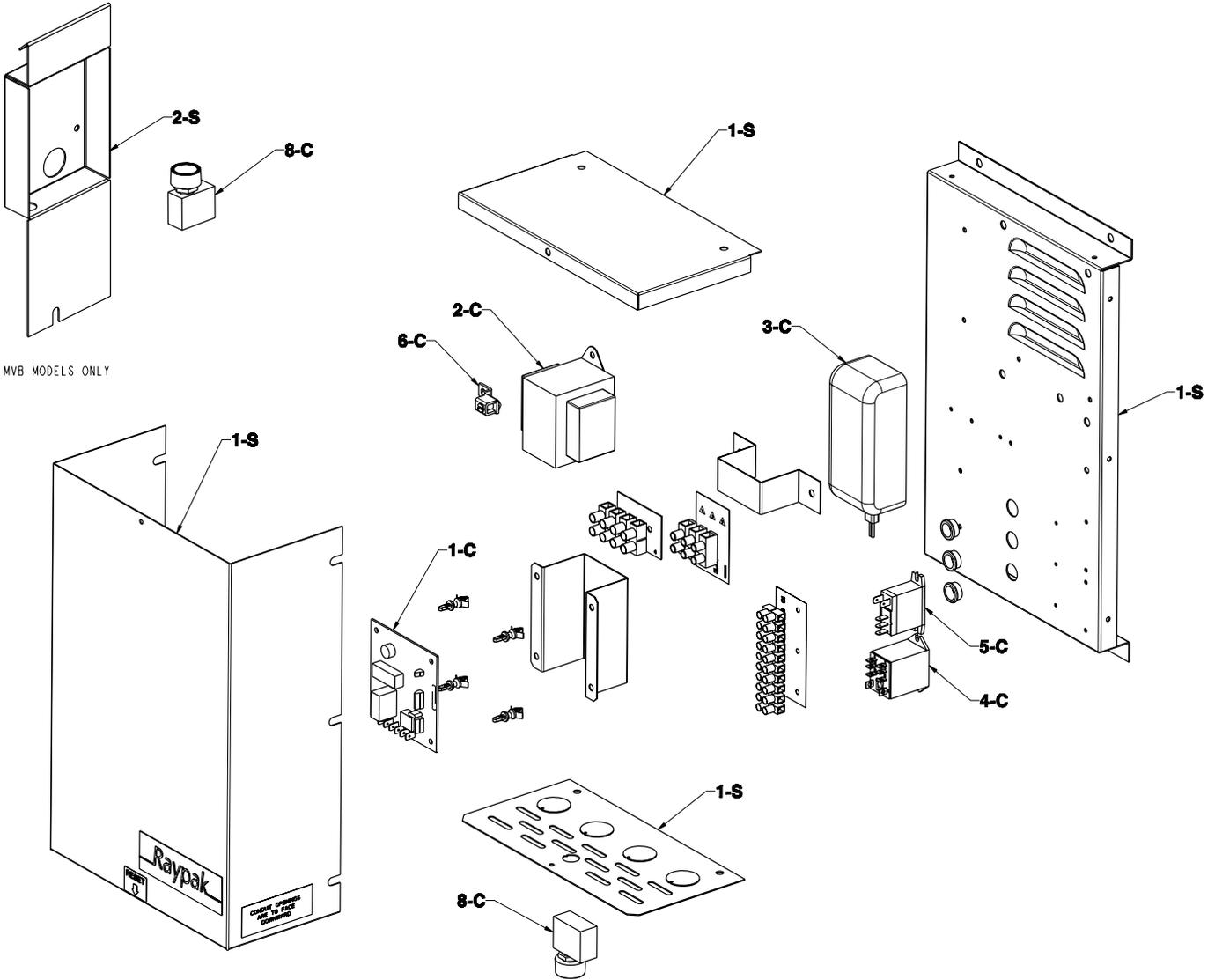


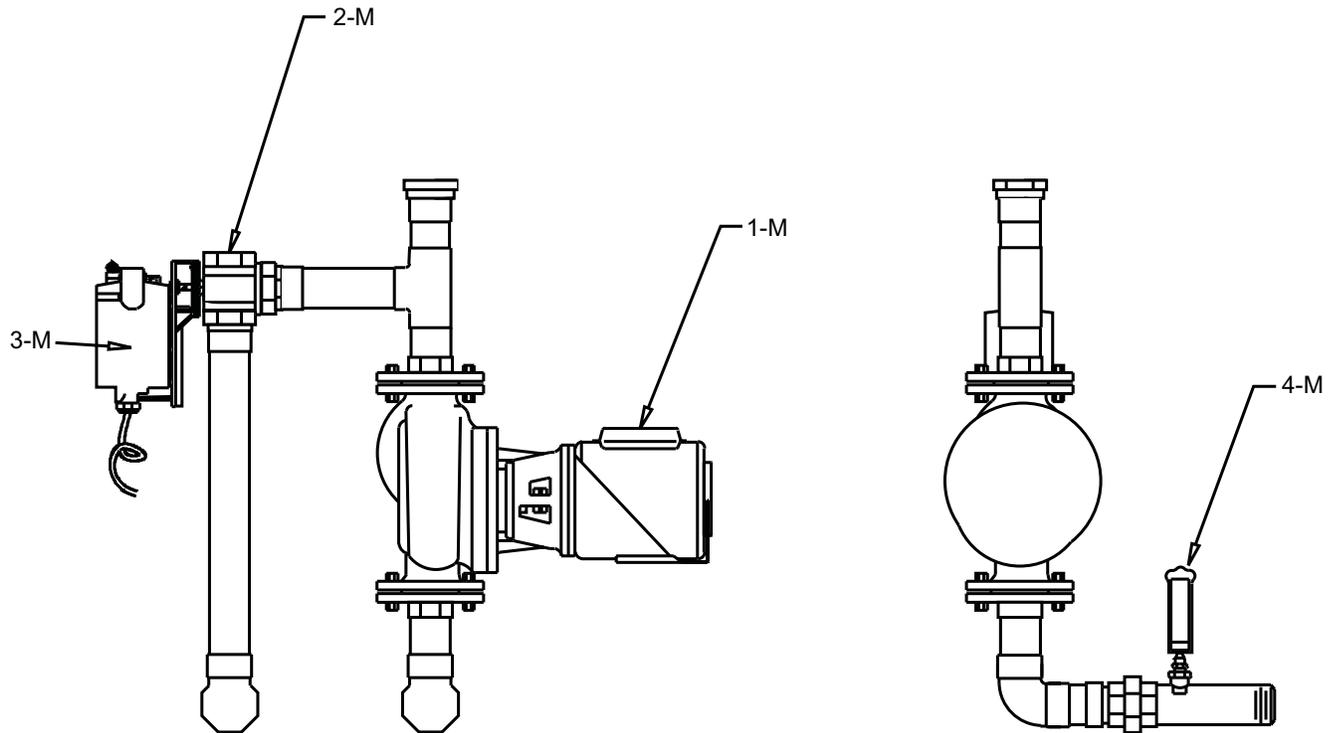
Cold Water Run Troubleshooting Guide



ILLUSTRATED PARTS LISTS

Cold Water Start

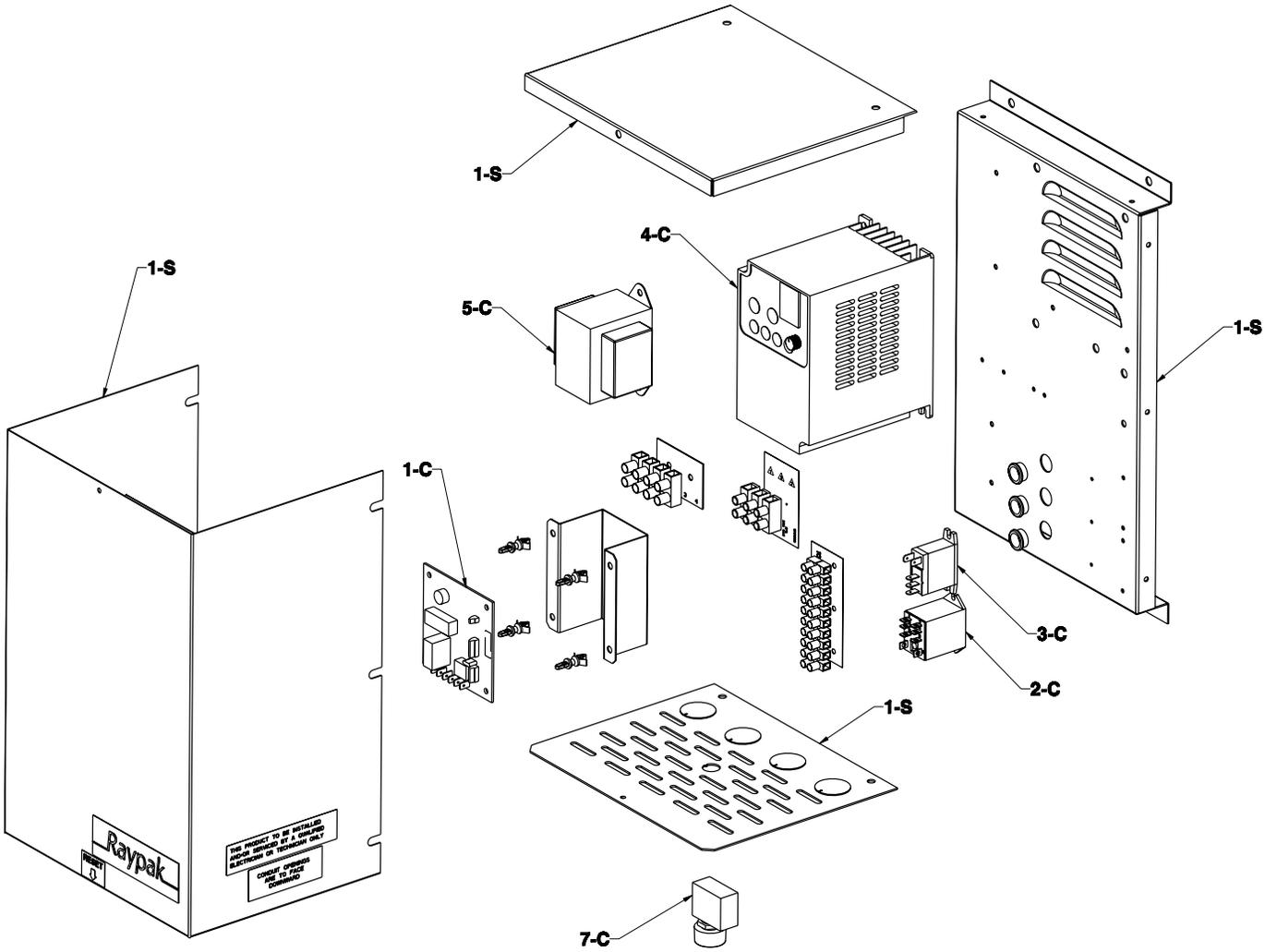


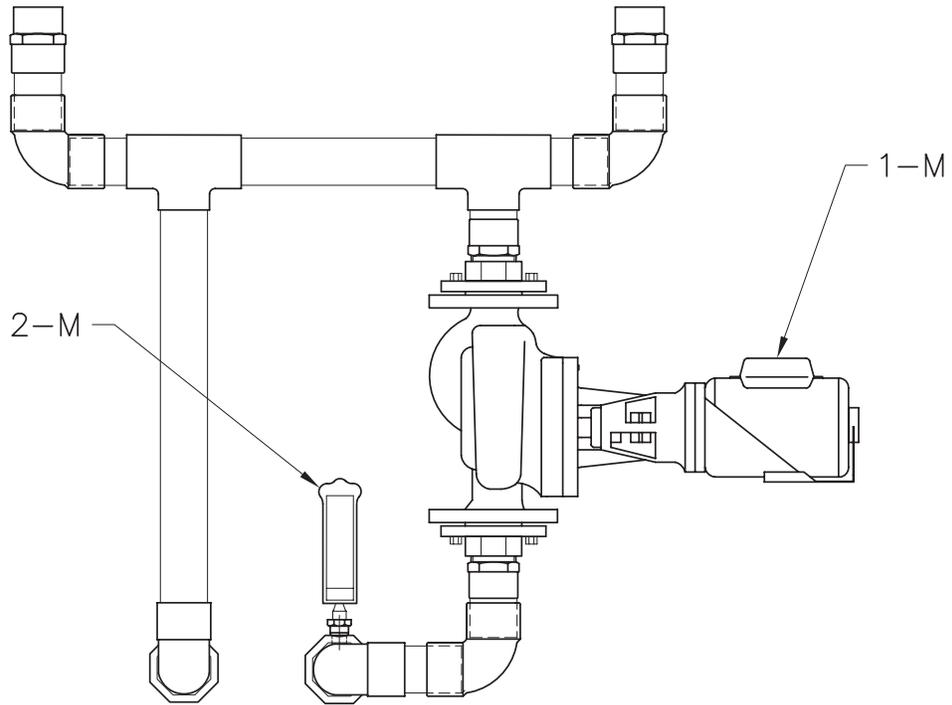


CALL OUT	DESCRIPTION	HI DELTA	MVB
1-C	PC BOARD ASSY-CONTROL	011717F	011717F
2-C	TRANSFORMER	011718F	011718F
3-C	POWER SUPPLY 120VAC/12VDC	011719F	011719F
4-C	RELAY-DPDT 24V	011720F	011720F
5-C	RELAY-SPDT 24V	009039F	009039F
6-C	GROUND LUG	007155F	007155F
7-C	TEMP SENSOR 10K (NOT SHOWN)	010787F	010787F
8-C	RESET SWITCH	005641F	005641F
1-M	PUMP-WATER BR 2" FLANGE, 1/4 HP	007226F	007226F
	PUMP-WATER CI 2" FLANGE, 1/4 HP	007232F	007232F
	PUMP-WATER BR 2" FLANGE, 1/2 HP	N/A	007347F
	PUMP-WATER CI 2" FLANGE, 1/2 HP	N/A	007353F
	PUMP-WATER BR 2-1/2" FLANGE, 3/4 HP	007348F	007348F
	PUMP-WATER CI 2-1/2" FLANGE, 3/4 HP	007354F	007354F
	PUMP-WATER BR 2-1/2" FLANGE, 1 HP	007348F	007348F
	PUMP-WATER CI 2-1/2" FLANGE, 1 HP	007354F	007354F
	PUMP-WATER BR 2-1/2" FLANGE, 1.5 HP	N/A	007937F
	PUMP-WATER CI 2-1/2" FLANGE, 1.5 HP	N/A	007938F
2-M	3-WAY VALVE 2 NPT 24 Cv	011939F	011939F
	3-WAY VALVE 2 NPT 38 Cv	011721F	011721F
	3-WAY VALVE 2 NPT 57 Cv	011722F	011722F
	3-WAY VALVE 2-1/2 NPT 74 Cv	011723F	011723F
	3-WAY VALVE 2-1/2 NPT 100 Cv	011724F	011724F
3-M	ACTUATOR	011834F	011834F
4-M	THERMOMETER-VERTICAL	000919	000919
1-S	CONTROL BOX SHEET METAL	011716F	011716F
2-S	CONTROL BOX COVER	N/A	011978F

NOTE: Sizing is specific to this application.

Cold Water Run





CALL OUT	DESCRIPTION	HI DELTA	MVB
1-C	PC BOARD ASSY-CONTROL	011717F	011717F
2-C	RELAY-DPDT 24VAC	011720F	011720F
3-C	RELAY-SPDT 24VAC	009039F	009039F
4-C	INVERTER-1/2 HP	011835F	011835F
	INVERTER-1 HP	011836F	011836F
5-C	TRANSFORMER-115/230 VAC	011718F	011718F
6-C	TEMPERATURE SENSOR 10K (NOT SHOWN)	010787F	010787F
7-C	ALARM RESET SWITCH	005641F	005641F
1-M	PUMP-WATER BR 2" FLANGE, 1/4 HP	007226F	007226F
	PUMP-WATER CI 2" FLANGE, 1/4 HP	007232F	007232F
	PUMP-WATER BR 2-1/2" FLANGE, 3/4 HP	007348F	007348F
	PUMP-WATER CI 2-1/2" FLANGE, 3/4 HP	007354F	007354F
	PUMP-WATER BR 2-1/2" FLANGE, 1 HP	007351F	007351F
	PUMP-WATER CI 2-1/2" FLANGE, 1 HP	007357F	007357F
2-M	THERMOMETER-VERTICAL	000919	000919
3-M	INJECTOR PUMP, BR 302B-902B (NOT SHOWN)	951414	N/A
	INJECTOR PUMP, CI 302B-902B (NOT SHOWN)	951415	N/A
	INJECTOR PUMP, BR 992B-1802B (NOT SHOWN)	951394	N/A
	INJECTOR PUMP, CI 992B-1802B (NOT SHOWN)	951413	N/A
	INJECTOR PUMP, BR 2002B-2342B (NOT SHOWN)	951411	N/A
	INJECTOR PUMP, CI 2002B-2342B (NOT SHOWN)	951416	N/A
1-S	CONTROL BOX SHEET METAL	011716F	011716F
2-S	CONTROL BOX COVER	N/A	011978F

NOTE: Sizing is specific to this application.



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Raypak, Inc., 2151 Eastman Avenue, Oxnard, CA 93030 (805) 278-5300 Fax (805) 278-5468
Raypak Canada Limited, 2805 Slough St., Mississauga, Ontario, Canada L4T 1G2 (905) 677-7999 Fax (905) 677-8036
Litho in U.S.A.