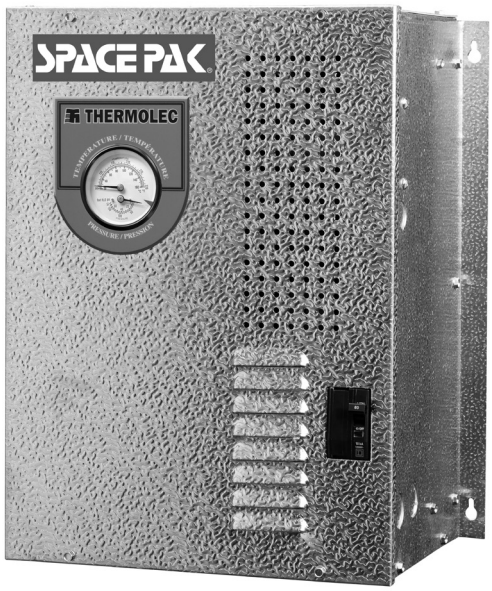
SEB2-0626

SPACE PAK®

MODELS EB20, EB36, EB60 ELECTRIC BOILER INSTALLATION, OPERATION, MAINTENANCE MANUAL

Model Number Clarification:

EB20	B-6TMB
EB36	B-11TMB
EB60	B-18UFFB



IN UNITED STATES: 260 NORTH ELM ST. WESTFIELD, MA 01085 (800) 465-8558
IN CANADA: 7555 TRANMERE DRIVE, MISSISSAUGA, ONTARIO, L5S 1L4 (905) 670-5888

A MESTEK COMPANY

SECTION 1: INTRODUCTION

Water Treatment and Quality

The EB Series electric boilers are intended to be used primarily for a boost or backup heat source in systems employing SpacePak Solstice Air to Water Heat Pumps. These systems are capable of cooling as well as heating, and they include plumbing located outside of conditioned space. So the use of Ethylene Glycol or Propylene Glycol freeze protection is mandatory. (Refer to the Solstice Heat Pump manual for the proper concentration in your region)

Therefore it is expected that glycol will be used in the EB Electric Boiler also, as it is completely compatible with concentrations up to 50%. In any case, the water in the boiler must be clean, chlorine free, free of sediment and at a minimum receive a corrosion inhibitor and buffering agent to ensure neutral pH (7.0 ±1) and all components in the plumbing system must include an oxygen barrier.

It is ultimately the responsibility of the installing contractor to ensure the entire system is protected from any freezing event that may occur. SpacePak will not warrantee damage caused by freezing water, such as but not limited to cracked heat exchangers, burst pipes or fittings, nor any material or consequential loss due to resulting leaks or moisture exposure.

Product development and continuous improvement are at SpacePak's core. As such, there may be changes or modifications to products, without notice. In addition, the information and specifications presented in this document are provided as is, without guarantee or warranty of any kind, expressed or implied. For the most up-to-date information regarding our products, you may contact our Customer Service group at custservice@spacepak.com.

Important

These instructions should be used as a general guide only. Electrical Code and local utility requirements must be followed and take precedence over these instructions.

SpacePak electric boilers by Thermolec are manufactured with quality components for maximum life, durability and minimum service. To ensure a satisfactory installation it is imperative that you read these instructions carefully before installing and operating the heating system. Failure to do so may result in breach of warranty.

Unpacking

Inspect the unit and check whether there are missing parts.

Report any damage or claims to the carrier immediately.

Location and Dimensions

These boilers are designed for wall mounting. Please see Table 1 for overall dimensions.Table 1 also gives the minimum clearances to combustible material as well as recommended distances for ease of service (e.g. replacement of tubular elements).

The boiler room should be well ventilated as to maintain the temperature below 77°F (25°C).

The unit must be mounted level on a vertical wall with the outlet fitting on the left side of the unit.

Model Number Clarification:

EB20	B-6TMB
EB36	B-11TMB
EB60	B-18UFFB

Figure 1

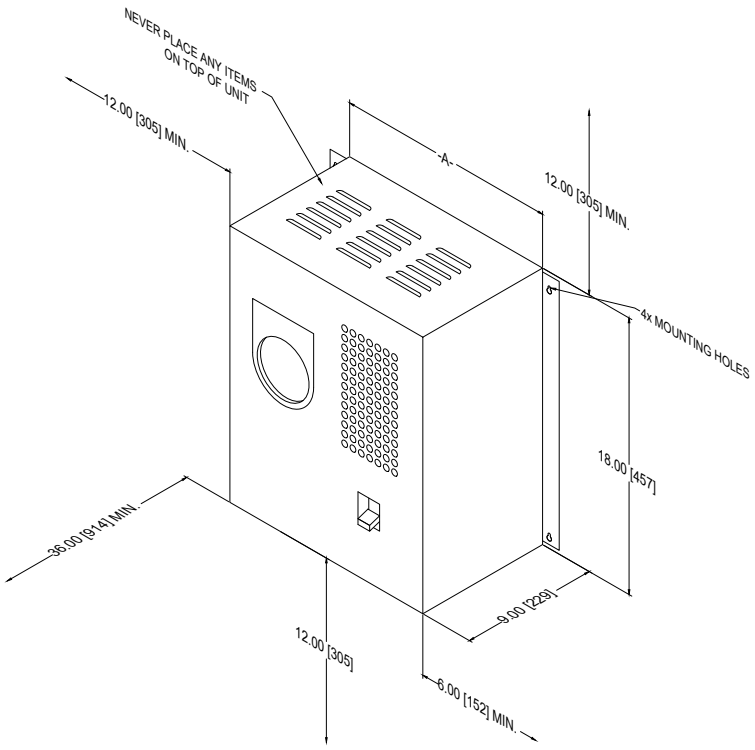


Figure 2

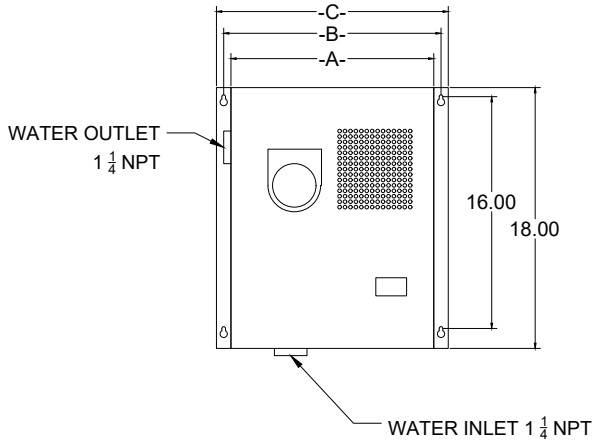


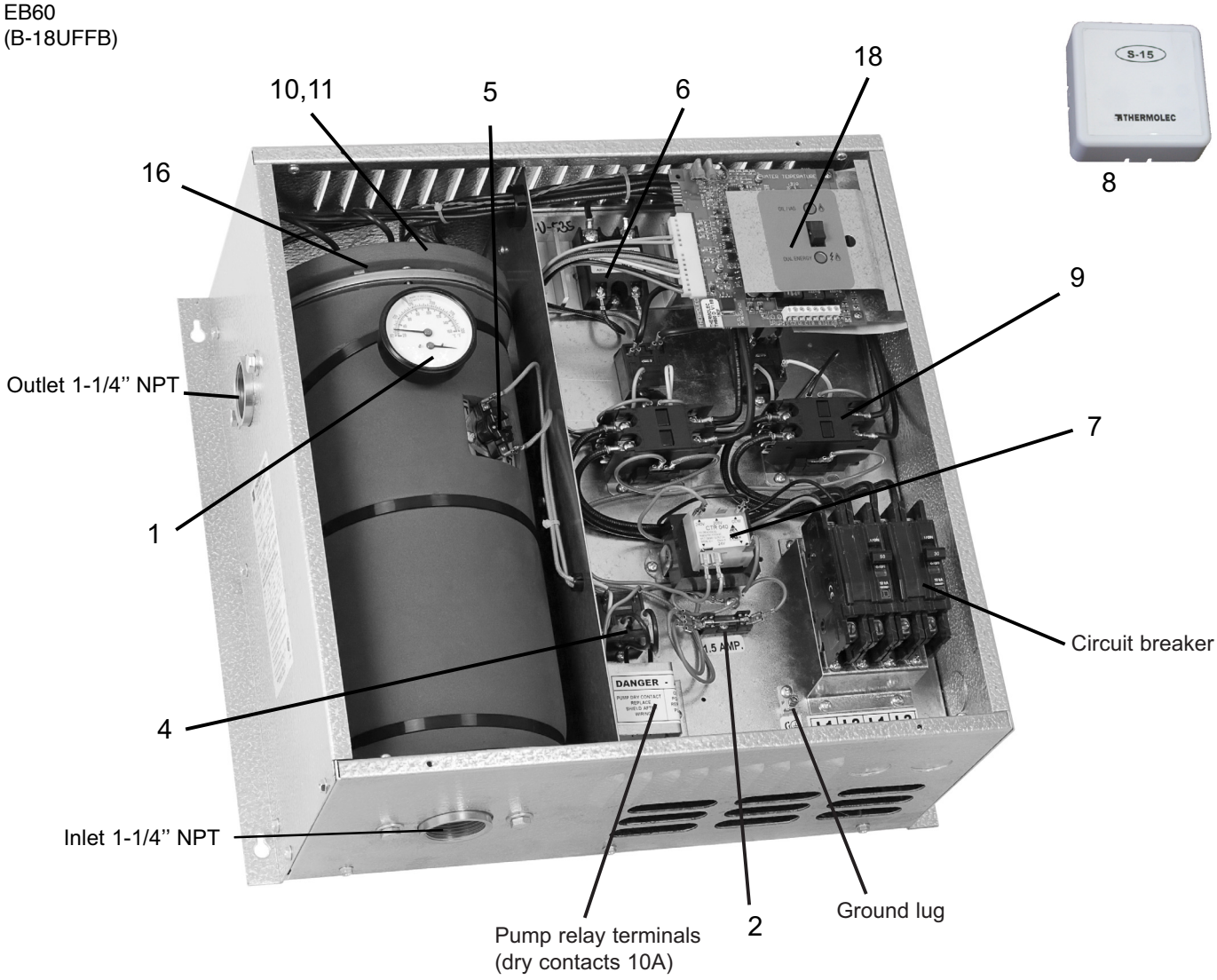
Table 1

Model	Dimensions (in [mm])		
	A	B	C
EB20 (B-6TMB)	13 [330]	14 [356]	15 [381]
EB36 (B-11TMB)	13 [330]	14 [356]	15 [381]
AC-EB60 (B-18UFFB)	18 [457]	19 [483]	20 [508]

Components

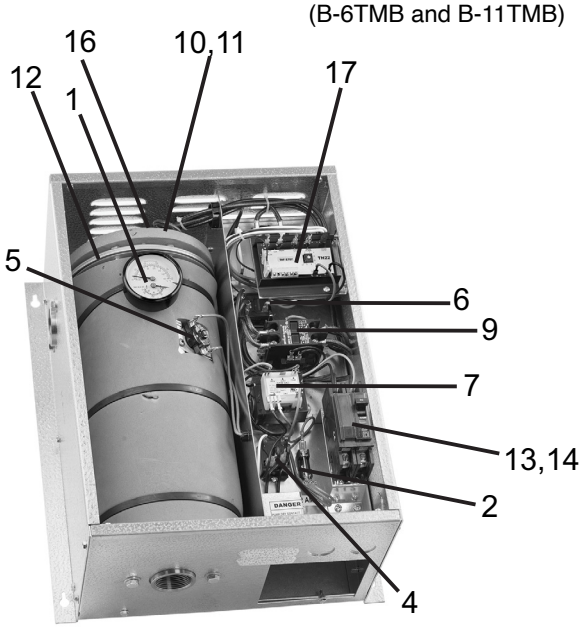
Figure 3

EB60
(B-18UFFB)



No.	Item	SP P/N	QTY per Unit		
			EB20 (B-6TMB)	EB36 (B-11TMB)	EB60 (B-18UFFB)
1	T & P Gage	45W41-WG1733-01	1	1	1
2	Fuse, 2A	45W41-WG1733-02	1	1	1
3	Pressure Relief Valve	45W41-WG1733-03	1	1	1
4	Relay, Pump/Element	45W41-WG1733-04	2	2	4
5	Thermal Limit, 200°F	45W41-WG1733-05	1	1	1
6	SSR Relay, 50A	45W41-WG1733-06	1	1	1
7	Transformer, 30 VA	45W41-WG1733-07	1	1	1
8	OD Temp Sensor	45W41-WG1733-08	1	1	1
9	B/U Contactor	45W41-WG1733-09	1	1	2
10	Element, 3.0 kW	45W41-WG1733-10	2	2	1
11	Element, 5.0 kW	45W41-WG1733-11	0	1	3
12	Tank Gasket, SST	45W41-WG1733-12	1	1	1
13	Circuit Breaker, 40A	45W41-WG1733-13	1	0	0
14	Circuit Breaker, 50A	45W41-WG1733-14	0	1	1
15	Circuit Breaker, 60A	45W41-WG1733-15	0	0	1
16	Tank Temp. Sensor Kit	45W41-WG1733-16	1	1	1
17	Controller	45W41-WG1733-17	1	1	0
18	TH600D Board Kit	45W41-WG1733-18	0	0	1

EB20 and EB36
(B-6TMB and B-11TMB)



Specifications

Table 2

Model	EB20 (B-6TMB)	EB36 (B-11TMB)	EB60 (B-18UFFB)
kW	6	11	18
BTU/h	20,472	37,532	61,416
Total Amps	25	45.8	75
Breaker Size	1 x 40A	1 x 60A	1 x 60A
			1 x 50A

NOTE: Always select the wire size according to the local, state, and federal electrical codes.

Table 3

Capacity and Amp Draw at Voltage												
	208V			220V			230V			240V		
Model	BTU/ hr	kW	A	BTU/ hr	kW	A	BTU/ hr	kW	A	BTU/ hr	kW	A
EB20	15354	4.5	21.6	17060	5	22.7	18766	5.5	23.9	20472	6	25
EB36	28320	8.3	39.9	31732	9.3	42.3	34461	10.1	43.9	37532	11	45.8
EB60	46062	13.5	64.9	51521	15.1	68.6	56639	16.6	72.2	61416	18	75

Water Circulation and Plumbing

The system is designed to operate with a maximum output temperature of 190°F (87.8°C) or lower and a temperature rise across the unit of 20°F (11°C) or lower. Although the boiler can produce temperatures up to 190°F (87.7°C), boiler setpoint should not exceed system's design, installation, and material limitations. Please refer to Table 4 for the minimum flow rate versus the capacity of the boiler.

Table 4

Minimum Hydronic Flow Rate						
Propylene Glycol Percentage						
Model	0	10	20	30	40	50
EB-20	2.0(7.6)	2.1(7.9)	2.1(7.9)	2.3(8.7)	2.4(9.1)	2.5(9.5)
EB-36	3.7(14)	3.8(14.4)	3.9(14.8)	4.1(15.5)	4.3(16.3)	4.5(17)
EB-60	6.1(23.1)	6.3(23.8)	6.4(24.2)	6.8(25.7)	7.1(26.9)	7.4(28)

Gallons per minute(Liters per minute)

Because of the nature of resistive heating elements, there is no capacity de-rate associated with the glycol content in the water flow. However, as the amount of glycol is increased, the carrying capacity of the water is reduced, so the minimum flow rate must be increased to avoid exceeding the maximum temperature rise of 20°F(11°C).

In order to ensure an adequate flow rate:

Pressure loss (referred as "Head") caused by water friction in the system should not exceed the capacity of the pump.

Please refer to Table 5 to find the copper pipe diameter (type L) recommended to accommodate the water flow found in Table 4.

Elbows and valves will greatly add to the head loss in the system. An appropriate water flow rate must be maintained to avoid tripping of the temperature limiter. Pipes with diameters larger than specified in Table 5 will not help to increase water flow.

Head loss through the boiler tank is negligable and should not affect calculations of flow rates.

Table 5

Maximum Flow Rate @ 15 psi (104 kPa)	
Maximum Flow Rate US Gallons / Min (liters / min)	Pipe Diameter (Type L Copper)
4.3 (16.3)	3/4"
10.1 (38.2)	1"
17.3 (65.5)	1-1/4"

The installation must have a drain valve, an expansion tank, maintenance valves and an automatic pressure reducing fill valve set at 15 PSI (104 kPA). A "T" fitting (1-1/4" NPT) must be installed at the supply outlet of the unit. This "T" must be equipped with a reducing bushing 1-1/4" to 3/4" NPT, facing upwards, to accept a 3/4" NPT pressure relief valve. This safety valve must be installed vertically. Except for the pressure relief valve, the above plumbing supplies are not supplied with the unit. Please refer to Figures 11, 12, 13 and 14 of this manual.

To ensure safe and reliable operation, the Electric Boiler loop must employ a flow prove device to ensure continued flow of water delivered through the heat exchanger. This must be in the form of a Normally Open switch that closes when the minimum flow has been achieved, and is connected between the two FS terminals inside the boiler.

The automatic pressure relief valve supplied with the boiler is required to prevent dangerous pressure build-ups in the system in case of system malfunction and may under certain conditions vent hot water. Do not install the system where water could damage rugs, furniture, etc. When piping the relief valve to a drain, check with local authority for recommended method of installation. Do not open or tamper with the relief valve. If operated frequently or used to drain or flush the system, the valve could fail to seat properly and thus leak.

NOTICE **This safety valve is mandatory and must be installed as shown in Figures 11, 12, 13 and 14 of this manual. The omission of the safety valve installation will create a very serious safety hazard and will void all warranties.**

Automatic air vents should be installed at the highest point of the installation and above the level of the boiler tank, ideally on all radiator units for best results or at points where air could possibly be trapped in the system.

⚠ CAUTION **Make sure the system has been properly vented before starting the unit.**

Depending on water conditions, determine wether water additives are necessary.

SECTION 2: MECHANICAL INSTALLATION

Mounting brackets are located on the sides of the boiler. Depending on the size of the unit, four or six holes are provided. The unit may be attached directly to a combustible surface.

Use a circulator pump of appropriate capacity for the intended application. The pump should be placed as close as possible to the boiler. Ensure that the water direction is correct. An arrow indicating the circulation direction is generally visible on the pump casing.

Install inlet and outlet piping.

Install air vents, valves, the pressure relief valve supplied with the unit, expansion tank, etc.

When everything is finished, install the temperature / pressure gauge.

SECTION 3: ELECTRICAL INSTALLATION

Disconnect all power sources before opening the main panel and working within.

Read the nameplate and other markings carefully and wire strictly in accordance with the wiring diagram.

Wires and protective equipment must be sized according to the applicable Electrical Code.

Use only wires suitable for minimum 167°F (75°C).

Install the Boiler outdoor temperature sensor only in applications where the Boiler is installed in a “Stand Alone” application. When boiler is used in conjunction with SpacePak ATW units and SSIC their controls will operate the outdoor temperature management when applicable. Install the outdoor sensor on an exterior North wall and connect it with 18/2 wire to terminals”OT / OT” on the electronic board (TH-22 in the EB20 & EB36, TH600 in the EB60)

On the electronic aquastat (marked “WATER TEMPERATURE”), select the maximum water temperature required (1-10) by the type of installation. Please see Table 6 for the temperature obtained according to the knob position. The minimum water temperature is reset automatically by the outdoor sensor. Please see the variation graph in Figure 5.

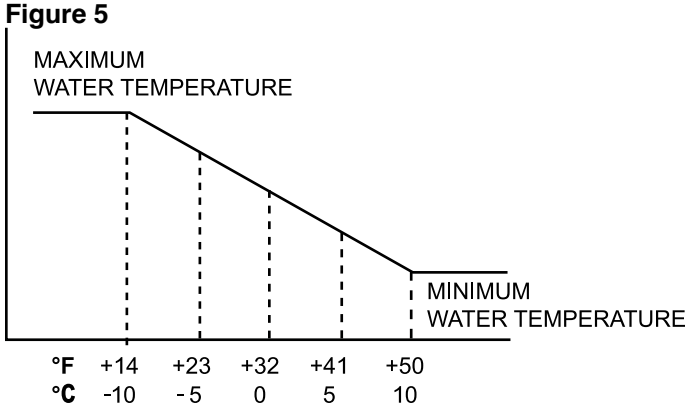
Table 6

Water Temperature controlled by Electronic Aquastat											
Set-point		10	9	8	7	6	5	4	3	2	1
Maximum temperature	**°F**	190	178	167	153	137	122	113	107	102	97
	°C	88	81	75	67	58	50	45	42	39	36
Minimum temperature	**°F**	118	118	118	113	104	100	93	88	84	82
	°C	48	48	48	45	40	38	34	31	29	28

Figure 4

Electronic Aquastat

Figure 5



If used, the outdoor sensor will:

- **a)** Maintain the selected maximum water temperature when the outdoor temperature is at +14°F (-10°C) or colder.
- **b)** Automatically and proportionally compensate by varying the water temperature between the maximum and minimum when the outdoor temperature is between +14°F (-10°C) and +50°F (10°C).
- **c)** Maintain the minimum water temperature when the outdoor temperature is between +50°F (10°C) and +68°F (20°C).
- **d)** Prevent boiler operation above +68°F (20°C).
- **e)** The outdoor sensor CANNOT be used in conjunction with a heat pump.

NOTICE **If you choose not to use the outdoor sensor, don’t connect it to the “OT / OT” terminals nor jumper these terminals. You will not use this feature and the water will simply be maintained at the maximum selected temperature.**

Connect the heat pump aux out or SSIC boiler connections to **“C”** and **“W1”** terminals on the electronic board. If neither of these components are utilized, power stealing thermostats require an isolation relay (not included).

Circulating Pump Control. The “P / P” terminals are connected to dry contacts of a relay (capacity up to 1 HP) and are used to start the pump. This relay is switched ON with the first heating step and OFF after the last one. A separate 120V / 1Ø service must be provided from the electrical panel to the boiler for the pump. For Electric Boiler only systems, refer to the wiring diagram. For Electric Boiler with fossil fuel backup, see the diagram labeled ‘PUMP WIRING WITH FOSSIL FUEL BACK-UP BOILER’ as the pump must also run when another source of heat is selected. Follow the extra steps dedicated to EB60 installation in the start-up sequence.

The installation is now ready for start-up procedure and testing.

Start-up Procedure and Test Sequence

Do not energize electrical elements prior to purging system and verifying proper water circulation
Double check the following carefully:

All wiring and plumbing is complete.

Pipes have been cleaned, the system has been flushed and filled again.

Without powering the entire unit, install a jumper between the "P / P" terminals (using proper gauge of wire) and switch the pump breaker ON as to let the pump run alone. Verify that the pump is running freely and check for leaks. During this test, a lot of bubbles will travel through the system and air will be eliminated by the automatic vents. You can accelerate the process by purging the radiators manually. Shut off the pump breaker at the panel, then remove the jumper between the "P / P" terminals.

The pressure in the system has been stabilized at approximately 15 PSI (104 kPA).

The entire system is now almost free of air.

Switch the boiler breaker ON at the main panel.

Once a call is made to the boiler, the system should start.

Make sure the pump starts running as soon as the system starts.

Heating stages will be switched ON in sequence at 30 second intervals, confirmed by green lights on the left hand side of the PC board on the TH600 or by red lights on the TH22.

Wait for two minutes and measure the current drawn by the boiler and compare it with the one shown on the nameplate.

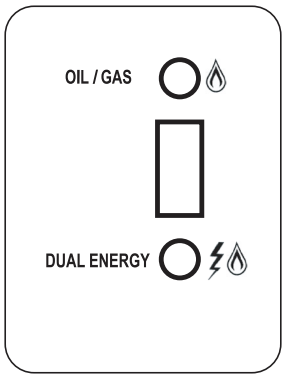
When the required maximum water temperature selected on the aquastat (0-10) or controlled by the outdoor sensor is reached, the electronic controller will modulate the boiler capacity to maintain the water temperature, as long as the demand for heating is not satisfied. The bottom green light flashes continuously on the TH600 or one of the red lights on the TH22 to indicate that the boiler is maintaining the setpoint. When the room thermostat is satisfied, the heating stages will come OFF in sequence at 5 second intervals.

The boiler is now ready and functional.

Test Sequence for EB60 Boiler System

An EB60 boiler is supplied with a three-position mode selector switch. This mode selector switch MUST be kept on Dual-Energy mode.

Figure 6



Your boiler is now ready and functional.

Installation examples

Figure 11 shows a SpacePak EB series boiler installed with a Solstice Heat Pump and single Buffer Tank, in a Heating only or Heat/Cool application.

Figures 12 and 13 show a SpacePak EB series boiler installed with one or more Solstice Heat Pumps, with two Buffer Tanks, in a Heating and Cooling application.

Figure 14 shows a SpacePak EB series boiler in a standalone configuration or with other unspecified equipment. It is the responsibility of the installer to ensure that all equipment is compatible and all requirements are met.

Position and Electric Values of Heating Elements

Standard values of the heating elements used in the EB Series boilers are 3 kW and 5kW, when rated at 240V. Please refer to the following sketches and tables to find the position and test value in ohms of each element. Please ensure you disconnect the element wires completely before you make the resistance reading.

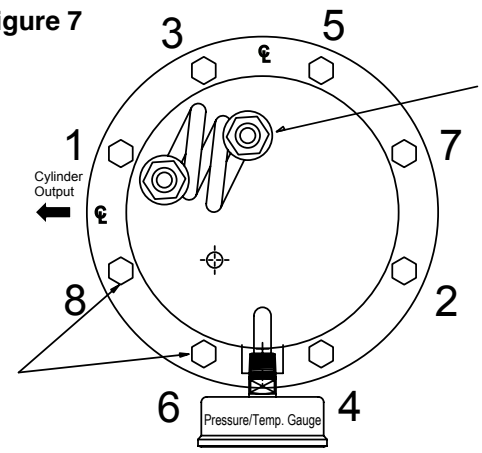
Replacement of Heating Elements

Heating elements nuts and cover bolts have been factory torqued with a calibrated tool. Please make sure you have a torque driver and the proper sockets handy before you open the boiler tank.

Elements nuts should be torqued at:
130 inch-pound (in-lbs) [14.7 N-m] or equivalent
When torquing the element nuts, always use an open-end backup wrench on the hex inside the tank to prevent twisting of the element.

Cover hex bolts should be torqued at:
70 inch-pound (in-lbs) [7.9 N-m] or equivalent Please make sure to tighten all nuts by hand first, then tighten them as per Figure 8 and finally apply the proper torque with the torque wrench. Resist the feeling that the bolts could get torqued more (even if possible) because that action would crush the silicone gasket to the point where it would eventually lose all its resiliency and sealing properties. Keep in mind that an equal torque is far more important.

Figure 7



Torque Element Nuts at 130 inch-lbs / 14.7 N-m

Torque Cover Bolts at 70 inch-lbs / 7.9 N-m

Figure 8

Two Element Configuration

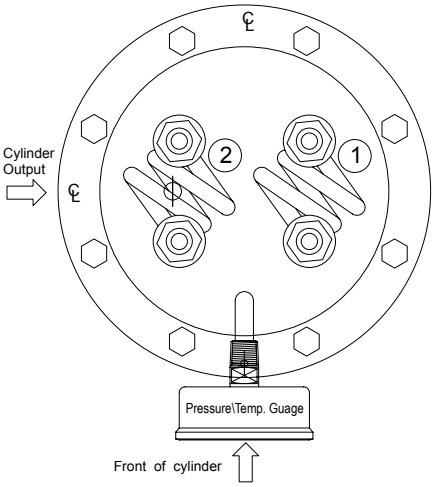


Figure 9

Three Element Configuration

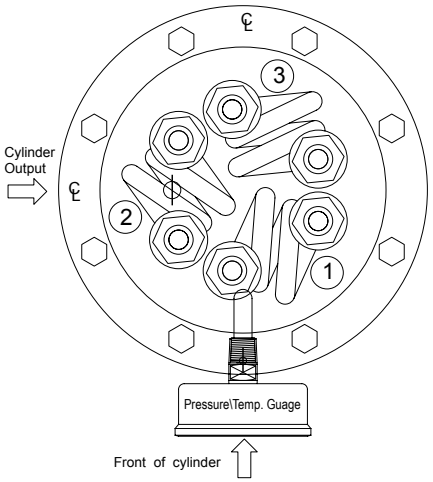


Figure 10

Four Element Configuration

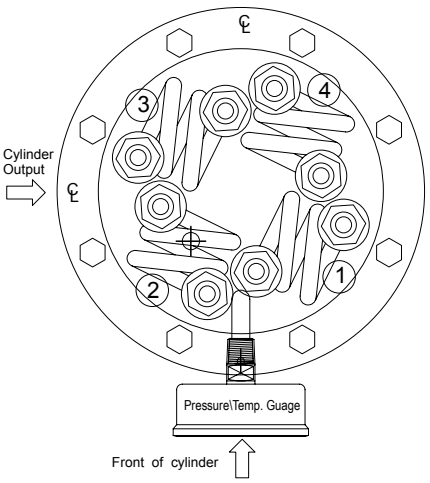


Table 7

Heating Element Identification and Location													
		Position 1			Position 2			Position 3			Position 4		
Model	Figure	Watts	Ohms	P/N	Watts	Ohms	P/N	Watts	Ohms	P/N	Watts	Ohms	P/N
AC-EB20	1	3000	19.2	45W41-WG1733-10	3000	19.2	45W41-WG1733-10						
AC-EB36	2	3000	19.2	45W41-WG1733-10	3000	19.2	45W41-WG1733-10	5000	11.5	45W41-WG1733-11			
AC-EB60	3	5000	11.5	45W41-WG1733-11	5000	11.5	45W41-WG1733-11	5000	11.5	45W41-WG1733-11	3000	19.2	45W41-WG1733-10

Note: For proper temperature reading and overtemp protection, as wall as future element identification, it is important that elements are replaced in the same locations as shown below.

Figure 11

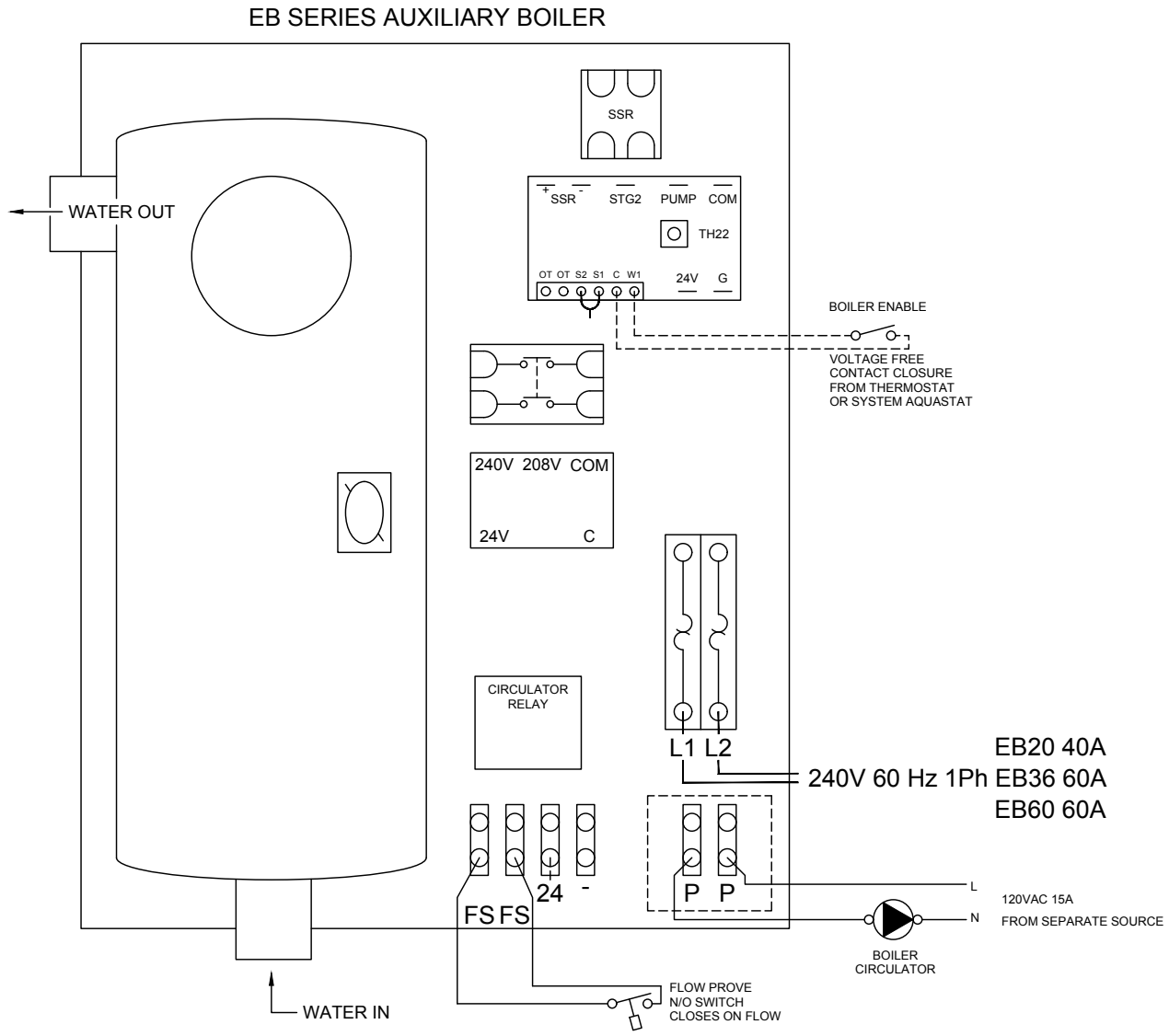


Figure 12

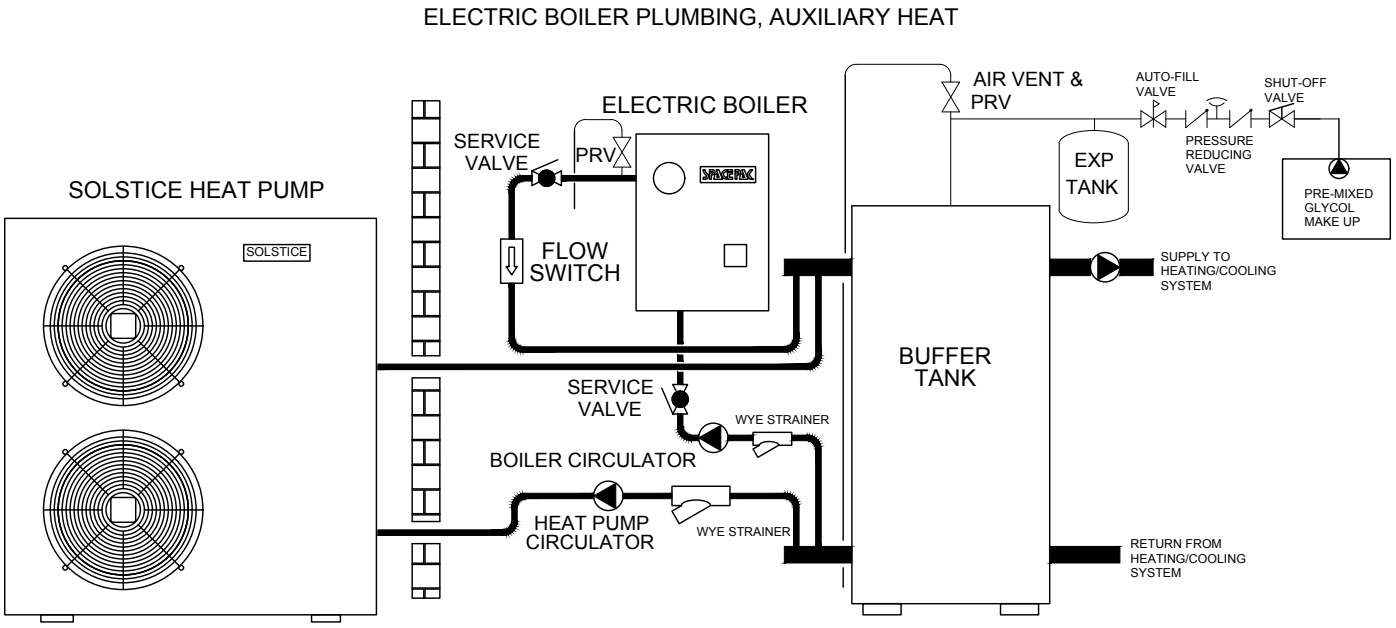


Figure 13

ELECTRIC BOILER PLUMBING, TWO TANK

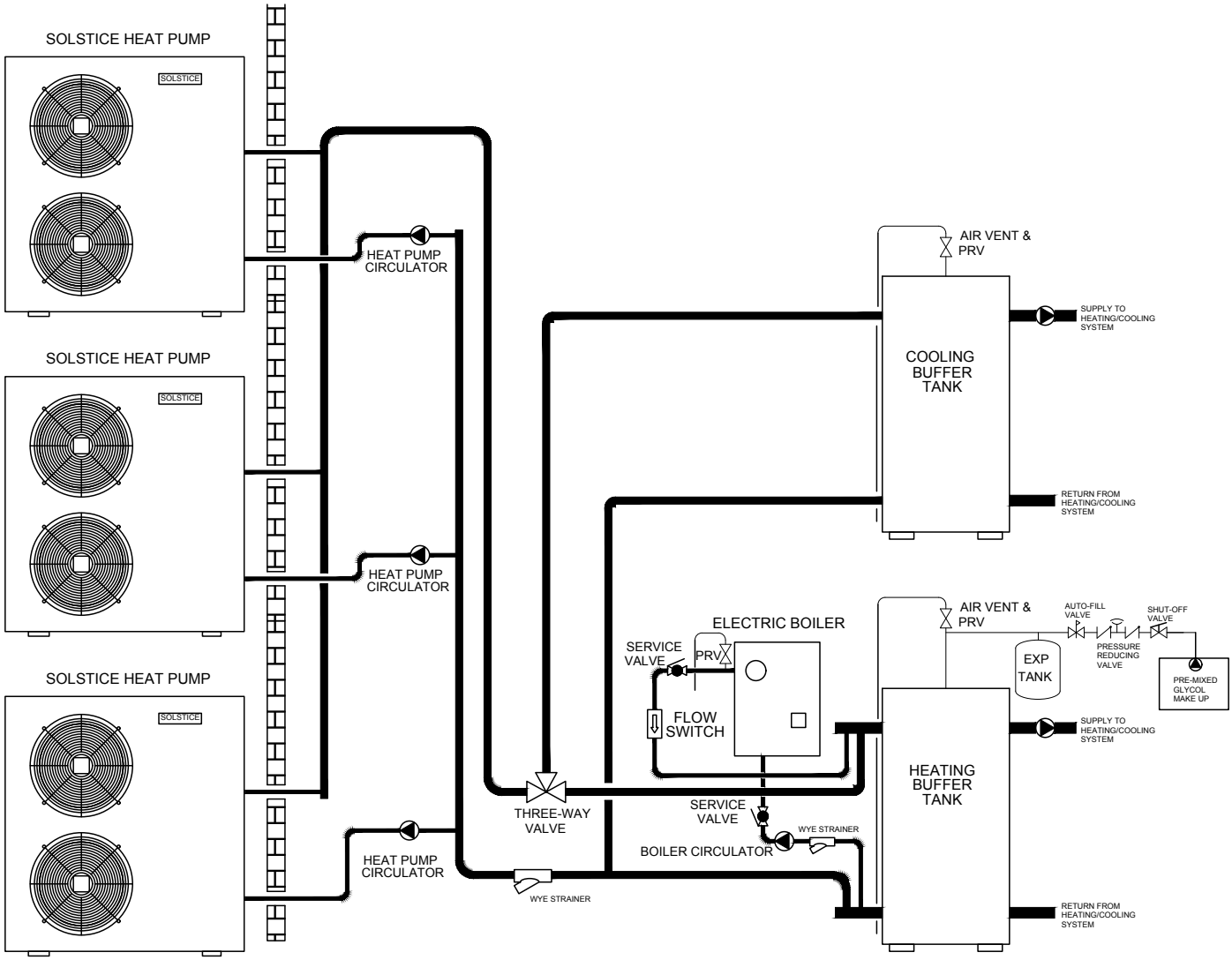
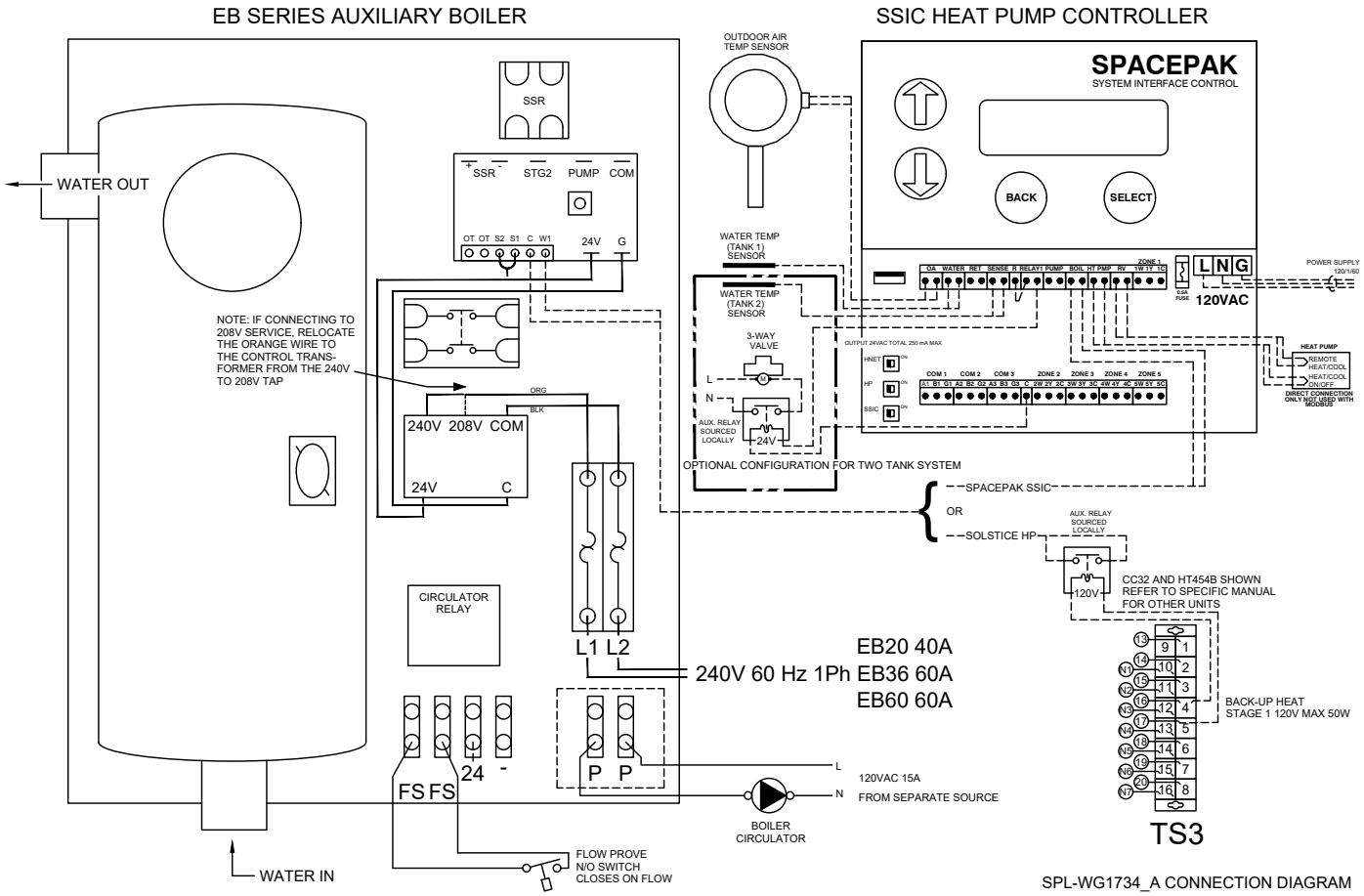


Figure 14



SPL-WG1734_A CONNECTION DIAGRAM

SECTION 4: TROUBLESHOOTING GUIDE

Call for heat and boiler doesn't start, no lights on circuit board. Try the following:

1. Confirm that the boiler is connected to 240/1 power, main panel breakers are ON, breakers supplying boiler in panel are ON.
2. Boiler circuit breakers are ON.
3. Check line side of transformer for 240 volts. If yes, continue. If no, check for 240VAC at circuit breaker.
4. Check low voltage side of transformer for 24 VAC. If yes, continue. If no, change transformer.
5. Check for 24 VAC from fuse to circuit board. If yes, continue. If no, change fuse.
6. If outdoor sensor is attached to OT/OT on boiler circuit board, is outdoor temperature below 68°F (20°C)? If outdoor temperature is 68°F (20°C) or more, disconnect one leg of wires to OT/OT. Do not jumper OT/OT.
7. Confirm that load management control contact is wired to S1/S2 terminals on boiler circuit board and load management contact is closed, or jumper S1/S2. Boiler will not start if S1/S2 is open.
8. Confirm that thermostat or zone valve end switch is wired to C/W1 terminals on boiler circuit board and that boiler is getting a good call for heat, or jumper C/W1.
9. Turn OFF circuit breakers at boiler. On upper left corner of circuit board are two red wires connected to supply water sensor on boiler tank. Carefully disconnect red wire connections from board. Turn ON circuit breakers. If boiler starts, turn OFF circuit breakers and replace supply water sensor. If boiler doesn't start, replace circuit board.

Call for heat, circuit board lights come on but no heat or insufficient heat. Try the following:

1. Check amp draw at boiler circuit breakers. If amp draw is less than rating on boiler label, continue to next step. If amp draw is correct, turn OFF circuit breakers and check pump operation, confirm system design, heat loss, boiler sizing, system water level, etc.
2. Check back-up contactor. Set meter to volts AC and measure for voltage on power wires out of contactor going to elements/relays. If 240VAC, go to next step. If not 240VAC, check for 24VAC

at coil of back-up contactor. If no 24VAC, check for 24VAC across high limit sensor on tank. If 24VAC, reset manual high limit or, if auto high limit, change high limit. If no 24VAC, check wiring at high limit.

3. Check for 24V DC from circuit board to coil of element relays - smaller two screws on solid state relay, terminals labeled coil on DC relays. Make sure + probe on meter to + terminal on SSR and – to –. If no DC voltage to relays, check wiring harness connection to circuit board. If DC voltage at relay, set meter to volts AC and check contact side of relay. If solid state relay, put probes on SSR L1 and T1 – larger two screws on SSR. If DC relays, put probes on terminals labeled contacts. If 0 voltage, relay contact is closed, go to step 4. If 240VAC at relay contact, it is failed open, change relay.
4. Turn OFF circuit breakers. Check for continuity at boiler elements. If no continuity, change element.

Call for heat, boiler starts and back-up contactor is noisy. Try the following:

1. Check for 24VAC out of transformer to contactor. If less than 24VAC, change transformer. If 24VAC, contactor is defective or contacts are dirty. Continue.
2. Turn OFF boiler circuit breakers. Disconnect wires to contactor, remove contactor from boiler, remove two screws from bottom metal plate on contactor, carefully remove coil and magnetic core, carefully clean surface of magnetic contacts with emery cloth. Reassemble and reinstall contactor. Remove all debris, metal shavings, etc. from inside of boiler cabinet. Restart boiler. If contactor noise continues, replace contactor.

Call for heat, boiler starts but pump doesn't run. Try the following:

1. Check for 120VAC from main electrical panel to pump. Pump must get power from the panel.
2. Route 120VAC from panel to pump through boiler. Run line leg of 120VAC through PP terminal on boiler. When boiler starts, relay connected to PP will close and start pump.
3. If pump is powered from panel and run through PP as described above and pump does not start when boiler starts, check for continuity on contact side of PP relay. If not closed, replace PP relay.

Call for heat, boiler starts, call for heat ends (no lights on board) and boiler continues to heat. Try the following:

1. Confirm that the call for heat has ended, disconnect wires to C/W1.
2. Check for amp draw at each element circuit. If there is amp draw, check for 240V AC on contact side of element relay. If there is 0 voltage, relay has failed closed, change relay.
3. Check for amp draw and if some amp draw but less than full rated amp draw: Set meter to ohms and check element drawing amps. If element reads less than rated ohms, change element. If element reads proper ohms, change relay.

Call for heat and boiler tank is "noisy". Hissing, percolating or knocking noise from tank:

1. Most common cause of boiler tank noise is improper flow. Refer to Table 5 for proper GPM based on kW size of boiler.
2. If proper GPM flow rate through boiler, noise can be caused by sediment build-up on elements. Check for build-up on outside surface of elements.

SPACE PAK®

Electric Boiler Limited Warranty

1. The parts are warranted for a period of two (2) years to the original owner of the System. If any parts should prove defective due to improper workmanship and/or material for a period of two (2) years from the date of installation, SpacePak will replace any defective part without charge for that part. Replacement parts are warranted for the remainder of the original 2-year warranty period. Parts used as replacement may be of like kind and quality and may be new or remanufactured. Defective parts must be available for SpacePak in exchange for the replacement parts and become the property of SpacePak.

2. The heating elements and housing are warranted for a period of ten (10) years to the original owner of the System. If the heating elements or housing should prove defective due to improper workmanship and/or material for a period of ten (10) years from the date of installation, SpacePak will replace the defective heating elements or housing without charge for the heating element or housing. Replacement heating elements and housing are warranted for the remainder of the original 10-year warranty period. Heating elements or housing used for replacement may be of like kind and quality and may be new or remanufactured. Defective heating elements or housing must be made available to SpacePak in exchange for the replacement heating elements or housing and become the property of SpacePak.

IMPORTANT NOTICE

PRODUCT REGISTRATION & EXTENDED WARRANTY

Extended Warranty Requirements

- Project/Equipment Registration
- Active SpacePak Certified Contractor Status at Time of Installation

To visit the **Product Registration Page**, click or scan the QR code.

Are You Certified?

Check our **Contractor Locator** map to find out.

Benefits of Becoming a SpacePak Certified Contractor:

- Local Leads
- Listed on SpacePak Website
- Sales & Marketing Support
- Pre-Sale Application Support & Load Calculations
- Extended Warranty

SpacePak Offers Factory Authorized Training for Certification On:

- Small Duct High Velocity Equipment
- Air-to-Water Heat Pump & Hydronic Equipment

Available Training Certification - Methods Include:

- Online Webinar Training
- Local Field Training
- Corporate Headquarter Factory Training

For All Training Inquiries, Contact Your Local Spacepak Manufacturers Representative:

https://www.spacepak.com/RepLocator