
SYSTEM BYPASS CIRCULATOR KIT PART NUMBER 107795-01 INSTRUCTIONS

General

These instructions cover installation, operation and troubleshooting of system bypass circulator kit part No. 107795-01 to protect the boiler from sustained flue product condensation.

The system bypass circulator kit includes the following components:

- Bypass Circulator Assembly (consists of Taco 007-VSF5-4IFC circulator with factory mounted Internal Flow Check (IFC) valve @ circulator body outlet port and PCB adaptor with labeled jumper wire installed @ PCB enclosure - 1 pc
- Circulator Flange Gasket - 2 pcs
- Return water temperature sensor S3 with 30" long leads - 1 pc
- Nylon cable tie, 14.2" long - 1 pc
- Nylon cable tie, 18" long - 2 pcs
- Black nipple 1-1/4" NPT x 2" lg., SCH40 - 3 pcs
- Black nipple 1-1/4" NPT x 3" lg., SCH40 - 2 pcs
- Black nipple 1-1/4" NPT x 7" lg., SCH40 - 1 pc
- Black 1-1/4" NPT Tee - 2 pcs
- Black 1-1/4" NPT Union - 2 pcs
- Circulator Hardware Kit, 1-1/4" NPT - 1 pc
This Kit includes (2) 1-1/4" NPT circulator flanges; (4) bolts and (4) nuts
- Closed cell black rubber foam pipe insulation; 2" ID, 1/2" thick, 6" lg. - 1 pc
- Bypass circulator wiring harness - 1 pc
- Instructions p/n 107797-01 - 1 pc

Taco Cartridge Circulator (007-VSF5-4IFC) is a microprocessor-based Variable Speed - Setpoint circulator designed to raise water temperature entering boiler above flue gas condensing range by mixing return water with hotter supply water to protect the boiler against sustained flue gas condensation.

Taco 007-VSF5-4IFC variable speed circulator control adjusts the speed output of the circulator to keep a setpoint temperature target at the boiler return water temperature sensor (S3) whenever a space heat demand is present (the circulator does not react to domestic hot water heat demand). The control adjusts the speed towards zero as long as the boiler return water temperature is above the setpoint target.

Application

1. Maximum operating pressure: 125 psi (862 kPa)
2. Maximum water temperature not to exceed nameplate rating of 230° F (110 °C)
3. The circulator applicable for closed loop systems only.
4. The circulator applicable for indoor use only.

NOTICE

Not for use in swimming pool or spa areas.

CAUTION

When installing electrical connections, do not apply mechanical loads to the capacitor box: otherwise, retaining screws may be pulled out the housing, making circulator unusable. Personal injury may result.

WARNING

In the event the retaining screws have been pulled out of the housing, NEVER attempt to reattach an electrical box that's broken away from the motor housing. Use of any other screw may short out the stator windings, creating a risk of electrical shock and personal injury.

CAUTION

1. The addition of petroleum based fluids or certain chemical additives to systems utilizing TACO equipment void the warranty.
2. Use supply wires suitable for 90°C.

ATTENTION: Employeur des fils d'alimentation adéquates pour 90°C.

Installations at higher elevations over 5,000 feet must have higher fill pressure of 20 psi minimum to prevent pump cavitation and flashing. Premature failure and personal injury may result. Adjust expansion tank pressure to equal fill pressure. A larger size expansion tank may be required.

WARNING

To avoid electrical shock, disconnect the power supply to the circulator and the main electrical unit. Failure to do so may cause personal injury or death.

Prior to attempting any service on this boiler, read, understand and follow all instructions as outlined in these instructions. Also, follow the Installation, Operating and Service Instructions for Gas-Fired Hot Water Boiler provided with the boiler and also available on the manufacturer's website. Failure to do so may cause personal injury or death. Only an experienced, skilled and knowledgeable installer or service agency shall perform installation.

Explosion Hazard; Electrical Shock Hazard; Burn Hazard. This boiler uses flammable gas, high voltage electricity, moving parts and very hot water under high pressure. Assure that all gas and electric power supplies are off and that the water temperature is cool before attempting any disassembly or service. Failure to do so may cause personal injury or death.

Respiratory Hazard. Boiler materials of construction contain alumina, silica, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the appliance.

Recommended System Piping and Near-boiler Piping

In order to properly accomplish this boiler protection, the following piping details should be considered - see Figure 1 "Bypass Circulator Mounting" for recommended near-boiler piping.

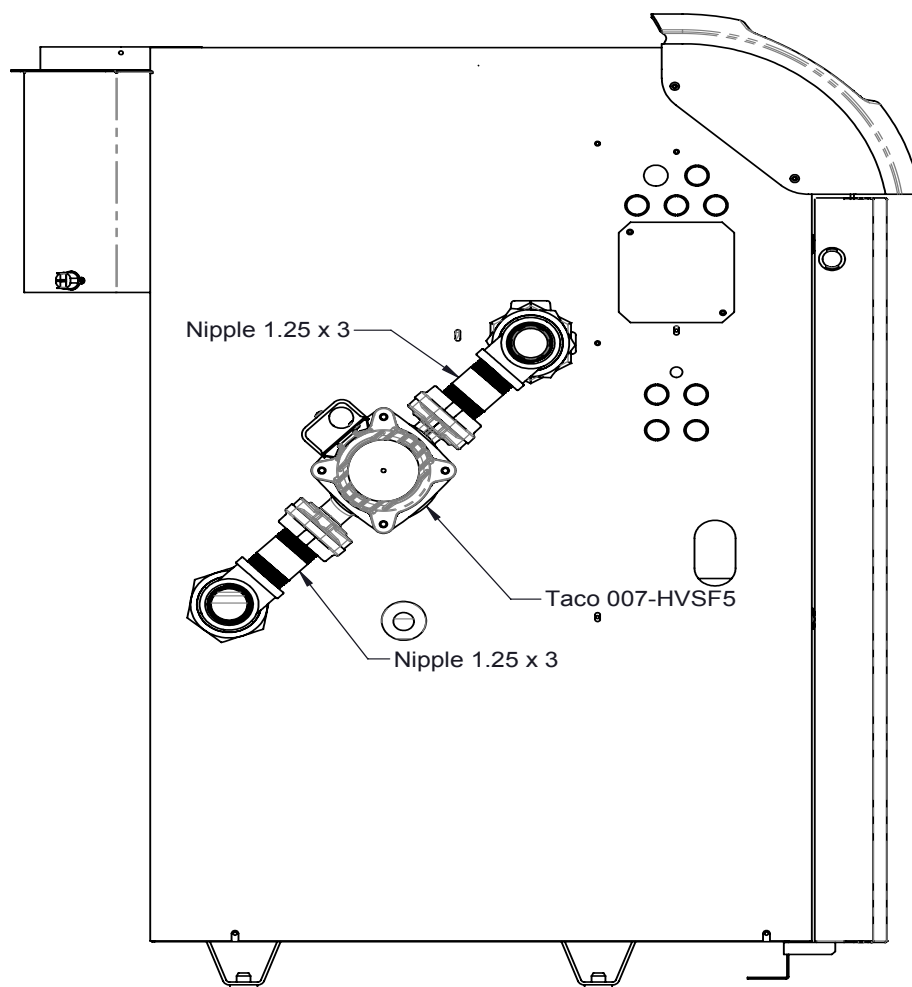
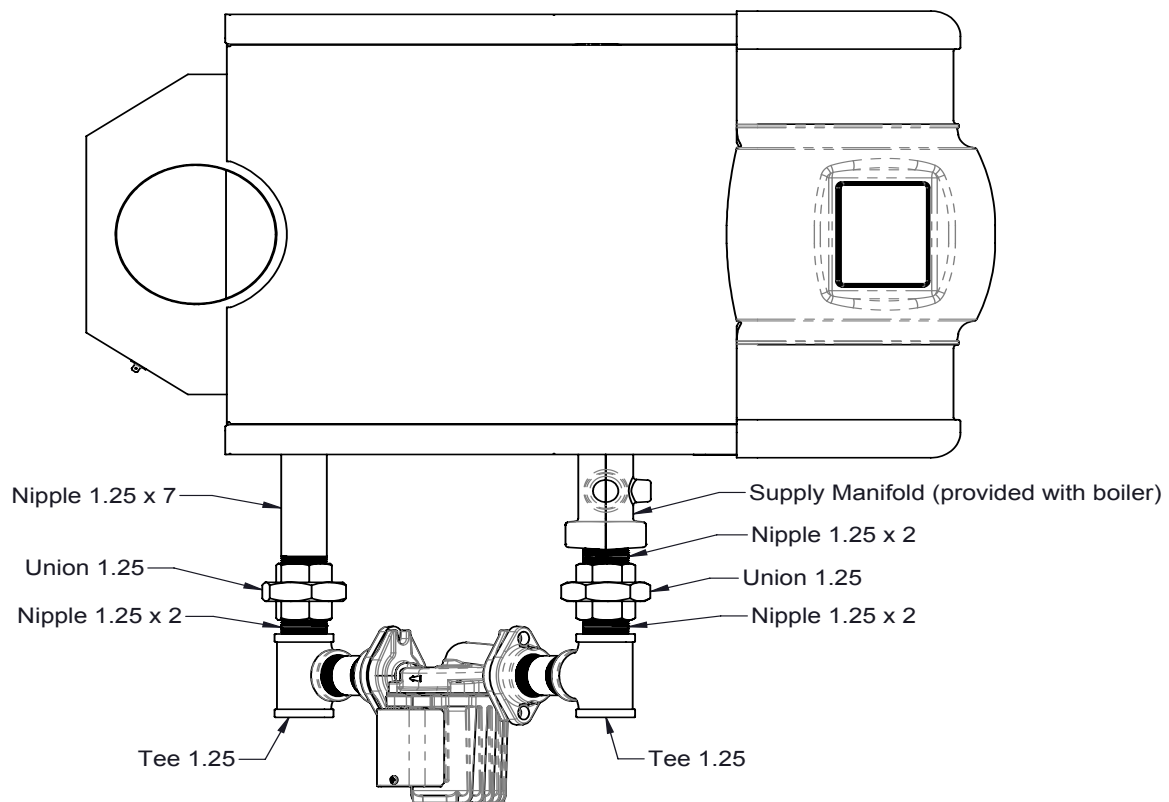


Figure 1 "Bypass Circulator Mounting"

Bypass Circulator Field Setup

Mount bypass circulator and near-boiler piping onto boiler (see Figure 1 “Bypass Circulator Mounting” for details).

For **a new system** assemble near-boiler piping with bypass circulator as follows:

1. Disconnect boiler power supply
2. Shut off boiler gas supply (if already connected).
3. Apply pipe sealant to all threads.
4. Install 1-1/4” x 7” long black nipple into boiler return tapping.
5. Mount 1-1/4” union onto 1-1/4” x 7” long black nipple.
6. Install 1-1/4” x 2” long black nipple into open end of the union.
7. Mount 1-1/4” black tee onto 1-1/4” x 2” long black nipple and adjust to tee side outlet is facing boiler supply piping.
8. Install 1-1/4” x 3” long black nipple into return tee side outlet.
9. Mount circulator flange (part of Circulator Hardware Kit) onto 1-1/4” x 3” long black nipple and orient so the flange bolt holes are parallel to 1-1/4” x 7” return nipple.
10. Install round flange gasket into bypass circulator assembly outlet (Internal Flow Check IFC valve is factory mounted into circulator outlet port.)
11. Install the circulator body outlet onto circulator flange making sure IFC is positioned inside of the flange opening and secure the circulator to the flange with bolts and nuts.
12. Install water supply manifold into boiler supply tapping.
13. Orient the manifold with safety relief valve port on the top.
14. Install 1-1/4” x 2” long black nipple into open end of water supply manifold.
15. Mount 1-1/4” union onto 1-1/4” x 2” long black nipple.
16. Install 1-1/4” 2” long black nipple into open end of the union.
17. Mount 1-1/4” black tee onto 1-1/4” x 2” long black nipple and adjust to tee side outlet is facing circulator inlet flange.
18. Install 1-1/4” x 3” long black nipple into tee side outlet.
19. Mount circulator flange (part of Circulator Hardware Kit) onto 1-1/4” x 3” long black nipple and orient so the flange bolt holes are parallel to installed circulator inlet flange holes.
20. Install round flange gasket into bypass circulator assembly inlet.
21. Align bypass circulator inlet with circulator flange off supply tee, then, secure with bolts and nuts.
22. Proceed with safety relief valve, temperature/pressure gauge and drain valve installation as described on boiler Installation, Operating and Service Instructions, Section “Connection Boiler Water Piping”.

For **an existing system upgrade** assemble near-boiler piping with bypass circulator as follows:

1. Disconnect boiler power supply.
2. Shut off gas supply.
3. Disconnect existing heating system return piping from boiler return tapping.
4. Disconnect existing heating system supply piping from boiler water manifold supply tapping.
5. Proceed with Steps 3 thru 22 as outlined above (new system assembly section).

• Potentiometer

• Dip Switches

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Secure S3 sensor to boiler return pipe with provided 14.2” long nylon cable tie. See Figure 3



Figure 3 “Return Water Temperature S3 Strapped To Boiler Return Pipe Nipple

Apply pipe insulation over strapped sensor and secure in place with provided 18” long nylon cable ties. See Figure 4.



Figure 4 “Insulated Return Water Temperature S3

Wiring and Sensor Connection to PCB Board

WARNING

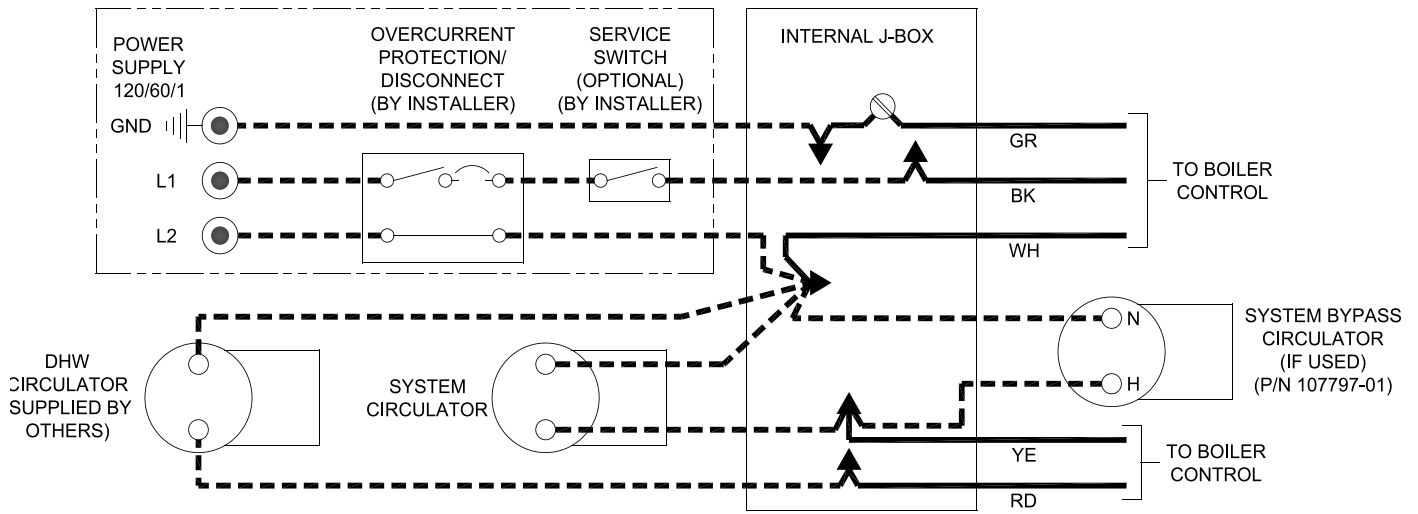
Wiring connections must be made in accordance with all applicable electrical codes. To prevent electrical shock, disconnect electric power to system at main fuse or circuit breaker box until installation is complete. When a service switch is installed, more than one disconnect switch may be required to deenergize this device for servicing. Failure to do so can cause severe personal injury or death. Positively assure that no voltage is present. Lock electrical boxes to prevent someone from inadvertently restoring power before the heating system is safe to operate.

Never defeat or jump out safety devices. Protect each boiler circuit with properly sized over-current protective device. Make electrical connections carefully according to boiler's wiring diagram and instructions.

Refer to Internal Wiring diagrams in this instruction - see Figure 5 “Wiring Diagram” and Figure 6 “Wiring Schematic”.

Proceed with bypass circulator harness and S3 sensor connections as follows:

1. Locate the wiring box on the left side of the boiler and open the cover.
2. Install factory provided bypass circulator wiring harness line voltage wires through the knockout of bypass circulator enclosure. See Figure 7 “Bypass Circulator PCB Connections”. Ensure that no power is present during this process.
3. Connect the live (hot) wire to the H terminal and the neutral wire to the N terminal on the PC Board.
4. Connect harness ground wire to ground green screw at circulator PCB enclosure.
5. Run the other end of bypass circulator wiring harness line voltage wires through the boiler wiring box cover knockout and attach to the marked **system circulator** connections, typically yellow (hot) and white (neutral).
6. Secure the connections with wire nuts.
7. Attach green ground wire to boiler ground wires, then, secure with wire nut.
8. Mount return water temperature sensor S3, to return piping and insulate. See Figure 3 and 4.
9. Connect two blue wire leads from Return Water Temperature S3 sensor to external PCB black adaptor terminals marked **S3** and **COM**. The sensor wire leads may be reversed. See Figure 7 “Bypass Circulator PCB Board Connections”.



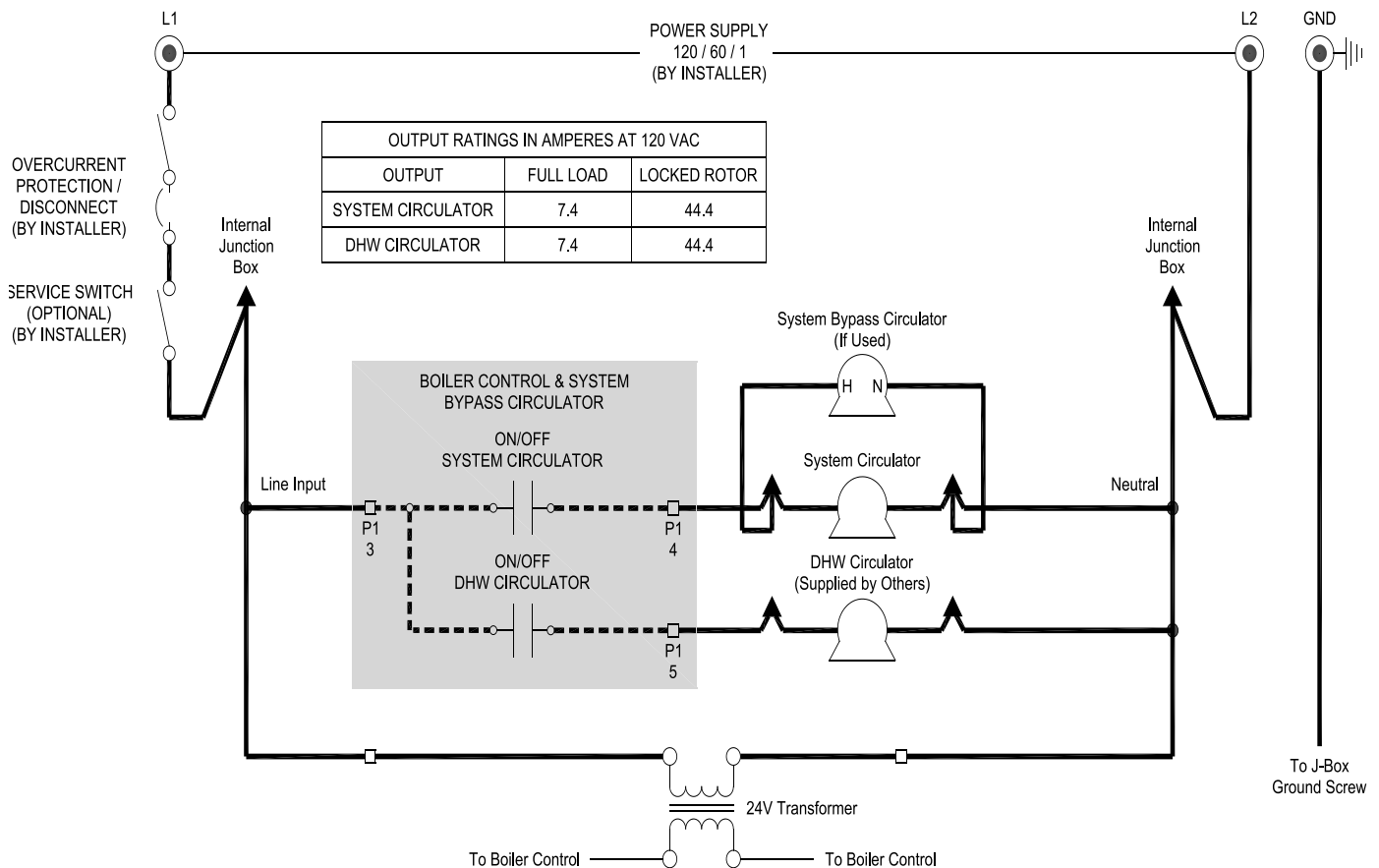
WIRE TYPE LEGEND

— LINE VOLTAGE FACTORY WIRING SIZE 14 AWG TYPE TW OR TEW/AWM WIRE
 - - - - - LINE VOLTAGE FIELD WIRING

WIRE CODE

BK - BLACK
 GR - GREEN
 RD - RED
 WH - WHITE
 YE - YELLOW

Figure 5 Wiring Diagram



LADDER DIAGRAM LEGEND

- - - - - 120 VAC, PCB Internal Traces
 — 120 VAC Wiring
 ▲ Wire Nut
 □ Molex Connection

Figure 6 Wiring Schematic

CAUTION

Do not apply power to sensor terminals as this will damage the PCB Board and can cause severe personal injury. The wiring terminals for the sensors may be removed for ease of installation. Do not run the wires parallel to telephone or power cables. If the sensor wires are located in an area with strong sources of electromagnetic interference (EMI), shielded cable or twisted pair should be used or the wires can be run in a grounded metal conduit. If using shielded cable, the shield wire should be connected to the COM terminal on the OC Board and not to earth ground.

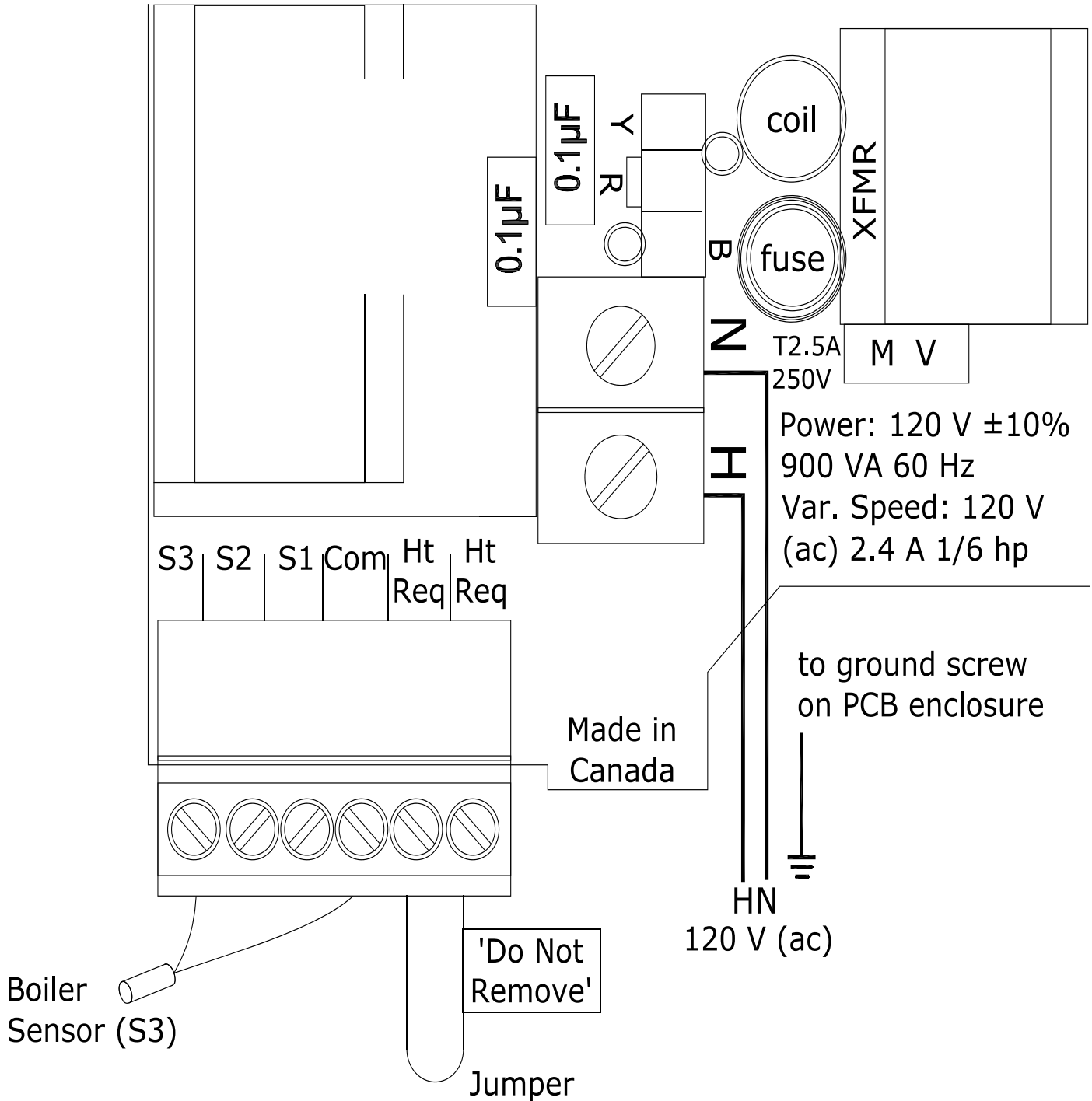


Figure 7 Bypass Circulator PCB Board Connections

Sequence of Operation

- Upon space heating call for heat the 007-VSF5-4IFC circulator is powered up, the green PWR LED turns on and stays solid.
- The heat request signal is provided by connecting the 24 V wiring from the thermostat to the “T-T” terminals on the boiler Control or Option Control Panel as applicable. HEAT REQ LED turns on and stays solid. The heat request (HT Req) terminals on the bypass circulator PCB are factory jumpered. **Do not remove the jumper.**
- Once a space heat request is present sensor S3 provides return water temperature feedback to circulator control. Providing return water temperature value is below set point target the 007-VSF5-4IFC operates to reach a limiting setpoint of 120°F. % OUT LED lights on and stays solid (100% speed).
- The 007-VSF5-4IFC circulator mixes colder return water with hotter supply water to raise water temperature entering the boiler following return water temperature S3 sensor feedback to the circulator control. The circulator control adjusts the variable speed output towards zero speed as long as the temperature measured at sensor S3 is above the limiting setpoint of 120°F. % OUT LED starts flashing as 007-VSF5-4IFC starts to reduce speed when approaching the set point target temperature and decreases speed towards zero once the set point target is reached. At this point % OUT LED light turns off.
- When space heating call for heat ends, the circulator shuts down.

System Start-up

1. The system must be filled with water before operating the circulator. The bearings are water lubricated and should not be allowed to operate dry. Filling the system will result in immediate lubrication of the bearings. It is always good practice to flush a new system of foreign matter before starting the circulator.
2. Operate the circulator for 5 minutes immediately after filling system to purge remaining air from the bearing chamber. This is especially important when installing the circulator during the off-season.

Troubleshooting

As in any troubleshooting procedure, it is important to isolate a problem as much as possible before proceeding. The error messages greatly simplify troubleshooting of the 00-VS (see table Multi-Status LED for details). When the 007-VSF5-4IFC flashes an error message, identify the fault and follow standard testing procedures to confirm the problem. If a wiring fault is suspected, return to the wiring section on this brochure and carefully check all external wiring and wiring connections.

For safety and protection from permanent damage to the microprocessor, the 007-VSF5-4IFC PCB includes a 2.5 A 250 V (ac) field replaceable fuse.

Table 2 - Multi-Status LEDs

| LED | LED Status | 007-VSF5 Status |
|-----------------------------|---------------|---|
| PWR | Solid | Power On |
| HEAT REQ | Solid | Heat Request |
| % OUT | Flash (Solid) | Variable Speed Output (100% Speed) |
| RED OUT | Solid | Reduced Output (Boiler Protection activated) |
| HEAT REQ and RED OUT | Flash | Boiler Sensor S3 Fault. 007-VSF5-4IFC does not provide boiler protection. |
| POWER, HEAT REQ and RED OUT | Flash | No sensor connected, or incompatible mode and sensor combination. 007-VSF5-4IFC does not provide boiler protection. |

Testing the Sensors

Tools required for sensor testing:

- A good quality test meter capable of measuring up to 5,000 k Ω (1k Ω = 1000 Ω) To measure the sensor resistance.
- A good quality digital thermometer to measure the actual temperature.

To test for a defective sensor:

1. Measure the resistance directly at the sensor location.
2. Measure the temperature using the thermometer.
3. Measure the resistance of the sensor at the 007-VSF5-4IFC.
4. The wires from the sensor must not be connected to the PCB while this test is performed. The wiring terminals (terminal adaptor) are easily removed by pulling them from the PCB.
5. Using the Table 2 estimate the temperature measured by the sensor. The sensor and thermometer reading should be close.
6. If the test meter reads a very high resistance, there may be a broken wire, a poor wiring connection or a defective sensor.
7. If the resistance is very low, the wiring may be shorted, there may be moisture in the sensor or the sensor may be defective.

| Temperature | | Resistance | Temperature | | Resistance | Temperature | | Resistance | Temperature | | Resistance |
|-------------|-----|------------|-------------|----|------------|-------------|----|------------|-------------|----|------------|
| °F | °C | Ω | °F | °C | Ω | °F | °C | Ω | °F | °C | Ω |
| -30 | -34 | 234,196 | 30 | -1 | 34,558 | 90 | 32 | 7,334 | 150 | 66 | 2,045 |
| -20 | -29 | 165,180 | 40 | 4 | 26,099 | 100 | 38 | 5,828 | 160 | 71 | 1,689 |
| -10 | -23 | 118,018 | 50 | 10 | 19,900 | 110 | 43 | 4,665 | 170 | 77 | 1,403 |
| 0 | -18 | 85,362 | 60 | 16 | 15,311 | 120 | 49 | 3,760 | 180 | 82 | 1,172 |
| 10 | -12 | 62,465 | 70 | 21 | 11,883 | 130 | 54 | 3,050 | 190 | 88 | 983 |
| 20 | -7 | 46,218 | 80 | 27 | 9,299 | 140 | 60 | 2,490 | 200 | 93 | 829 |

Service Parts

Contact US Boiler Co. Customer Service @ (717) 481-8400 if Bypass Circulator Assembly (P/N 107798-01) needs to be replaced.