Service Manual for NEOTHERM®

Modulating Boiler
Model NTH
Sizes 080–285 MBTU/h

Water Heater
Model NTV
Sizes 150–285 MBTU/h

Every reference
that you'll need,
to service the
Residential
NEOTHERM

LAARS®
Heating Systems Company
A subsidiary of BRADFORD WHITE® Corporation

How to Use This Manual

How to Use the Troubleshooting Information

This manual is divided into five main sections:

Section A - Troubleshooting Instructions

Section B - Troubleshooting Procedures

Section C - Combustion

Section D - NeoTherm Control System

Appendix

Start the troubleshooting process using the charts in Section A. The instructions in Section A will lead you to more detailed procedures in Section B.

Section C covers possible combustion problems and the combustion setup procedure.

For details on the User Interface used on your unit, see Section D.

If the unit presents a Hold or Lockout message, you can get more information from the listing in the Appendix.

Contact Laars Technical Support if you can't diagnose the problem using the information in this manual:

LAARS Product Support

Phone: (800) 900-9276
(603) 335-6300

Fax: (800) 335-3355

Finding Information in this PDF File

This manual includes a lot of detailed information, but none of this is very useful to you unless you can find it. We'd like to help you to find the information you need, quickly and easily.

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Table of Contents -
The Table of Contents is located at the beginning of the manual. (The bookmark for Contents will take you there.) Use this to identify the section of the manual you want to read, then use the Bookmarks to jump to that section. (You can also scroll through the PDF file to get to the section you want.)

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Safety Notes

Please read this section before beginning any troubleshooting procedures.

⚠ DANGER

If the information in this manual is not followed exactly, a fire or explosion may result, causing loss of life, personal injury, or property damage.

Necessary Training -

This product must be installed and serviced by a professional service technician, qualified and/or licensed in hot water boiler and heater installation and maintenance. Any changes to safety-related configuration parameters must only be done by qualified and/or licensed burner/boiler operators and mechanics.

Carbon Monoxide Hazard -

Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause death, serious injury, or property damage. Improper installation and/or operation will void the warranty.

Fire or Explosion Hazard -

Improper configuration can cause fuel buildup and explosion. Improper user operation may result in death, severe physical injury, or property damage. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

What to Do If You Smell Gas -

If any odor of gas is detected, or if the gas burner does not appear to be functioning in a normal manner, ***close the main gas shutoff valve***. The inlet gas pressure to the appliance must not exceed 13” w.c. (3.2 kPa).

- Do not try to light any appliance.
- Do not touch any electrical switch. Do not shut off the power switch. Do not use any phone in your building.
- Immediately call your gas supplier from a nearby phone. Follow the gas supplier’s instructions.
- If you cannot reach your gas supplier, call the fire department, your heating contractor, gas company, or factory representative.

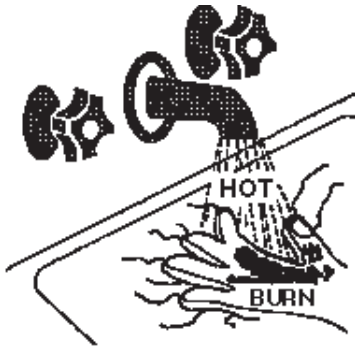
Electrical Shock Hazard

Electrical shock can cause severe injury, death or property damage. Only a professional technician, trained in electrical safety, should work on this unit. Whenever the troubleshooting procedures make this possible, turn off the power to the unit before working inside the cabinet. The only exceptions would be when it is necessary to test the voltages between the points listed in this manual. 120V AC is present in this unit behind the metal cover marked with the safety label. Be especially careful when working on the unit if this cover has been removed. Always replace the cover when the service procedure is complete. Before making any changes, disconnect the power supply to prevent electrical shock or damage to the equipment. It may be necessary to turn off more than one power supply disconnect.

All electrical wiring is to be done in accordance with local codes, or in the absence of local codes, with: 1) The National Electrical Code ANSI/NFPA No. 70 - latest Edition, or 2) CSA STD. C22.1 “Canadian Electrical Code - Part 1.” This appliance must be electrically grounded in accordance with these codes.

Hot Water -

This unit can produce water which is hotter than 125°F (52°C). This can cause severe burns instantly or death from scalding. Always shut off the system and allow it to cool for one hour before opening any pipe connections that may contain hot water.



Children, disabled and elderly person are at the highest risk of being scalded. See the Installation and Operating manual for instructions before setting the temperature at the NeoTherm unit.

For NTV units - Adjust the outlet control (limit) or use temperature limiting valves to obtain a maximum water temperature of 125°F (52°C). Instruct all users to feel the water temperature before getting into the bath or shower.

The NeoTherm unit is protected against over-pressurization. A pressure relief valve is included with each NeoTherm unit.

Installation Codes -

All installations must be made in accordance with 1) American National Standard Z223.1/NFPA54-Latest Edition “National Fuel Gas Code” or 2) CSA B149.1 “Natural Gas and Propane Installation Code” and with the requirement of the local utility or other authorities having jurisdiction. Such applicable requirements take precedence over the general instructions contained in this manual.

Table of Contents

Section A - Troubleshooting - Start Here

Section B - Troubleshooting Procedures

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Section C - Possible Combustion Problems

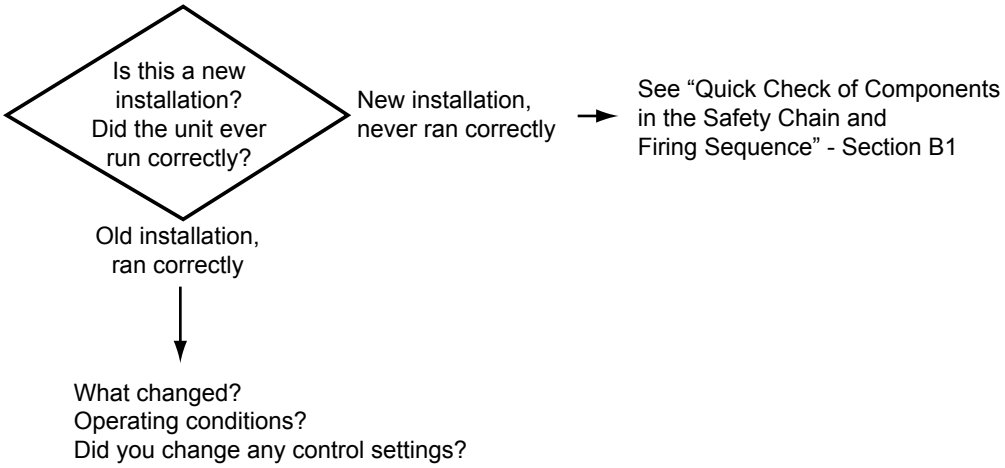
Table of Contents (continued)

Section D - Using the NeoTherm Control System

Appendix

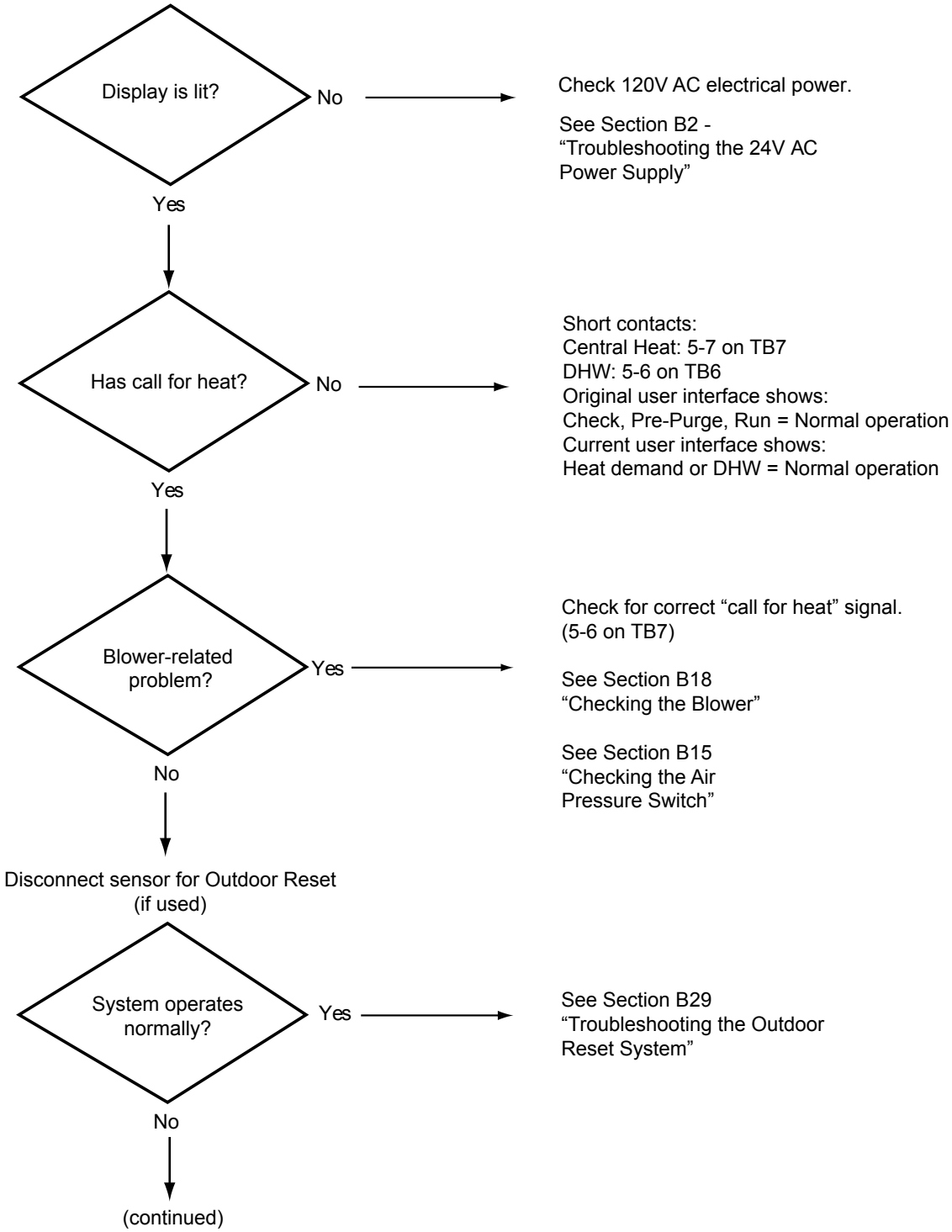
Troubleshooting - Start Here

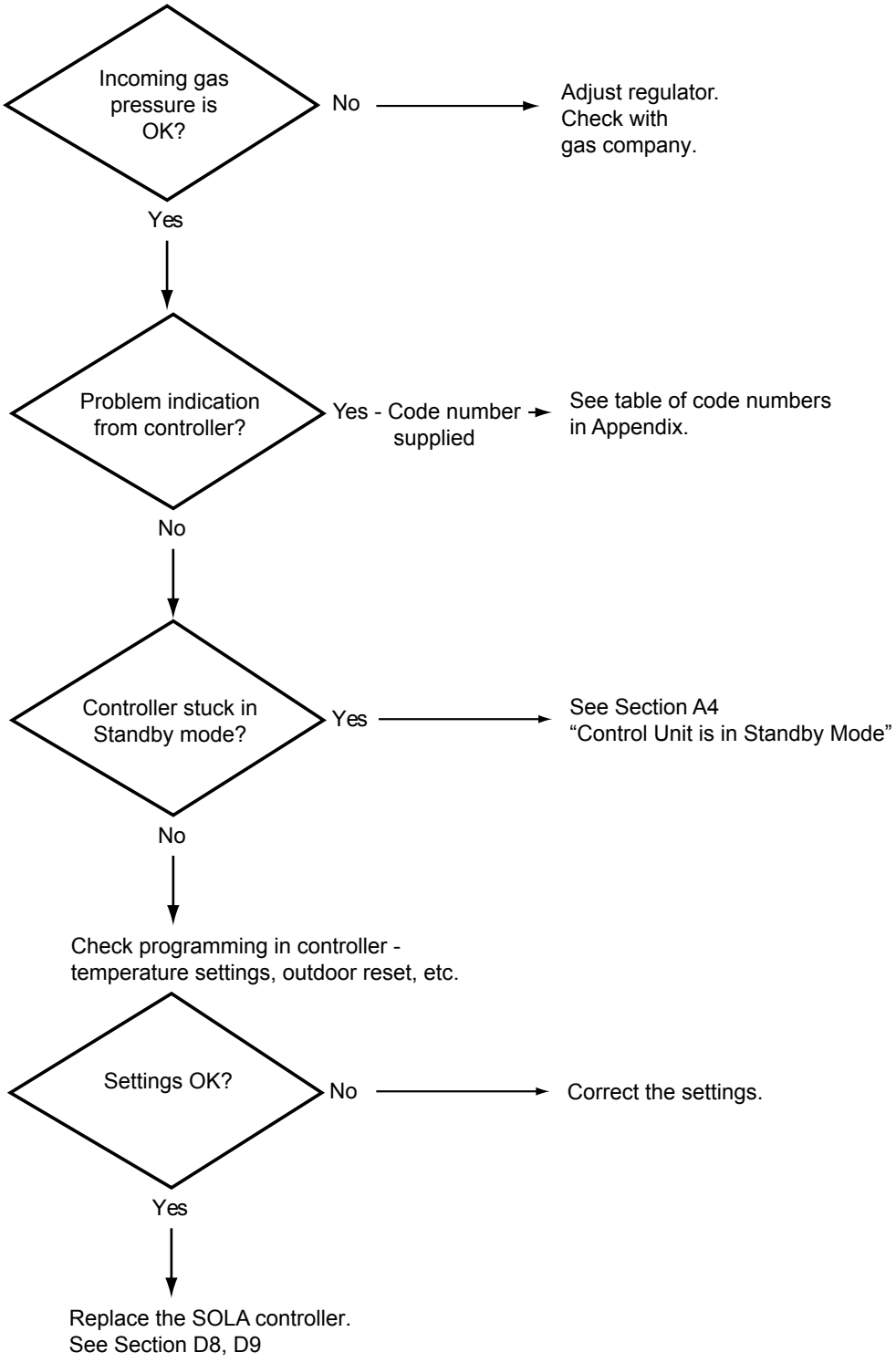
A1



For troubleshooting instructions, see these sections:

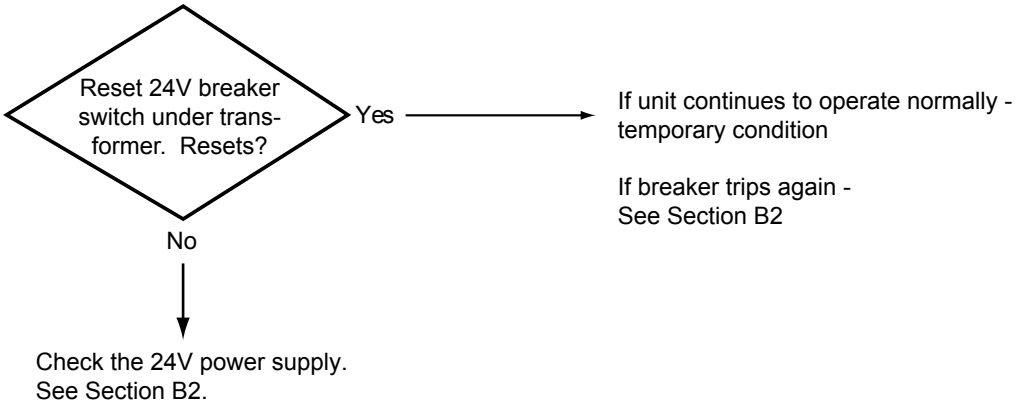
A2 Unit Will Not Fire - Blower is Not Running




Incoming gas pressure is OK?
No
Adjust regulator. Check with gas company.
Yes
Problem indication from controller?
Yes - Code number supplied
See table of code numbers in Appendix.
No
Controller stuck in Standby mode?
Yes
See Section A4 “Control Unit is in Standby Mode”
No
Check programming in controller - temperature settings, outdoor reset, etc.
Settings OK?
No
Correct the settings.
Yes
Replace the SOLA controller. See Section D8, D9

A3 Blower Runs Continuously, No Display

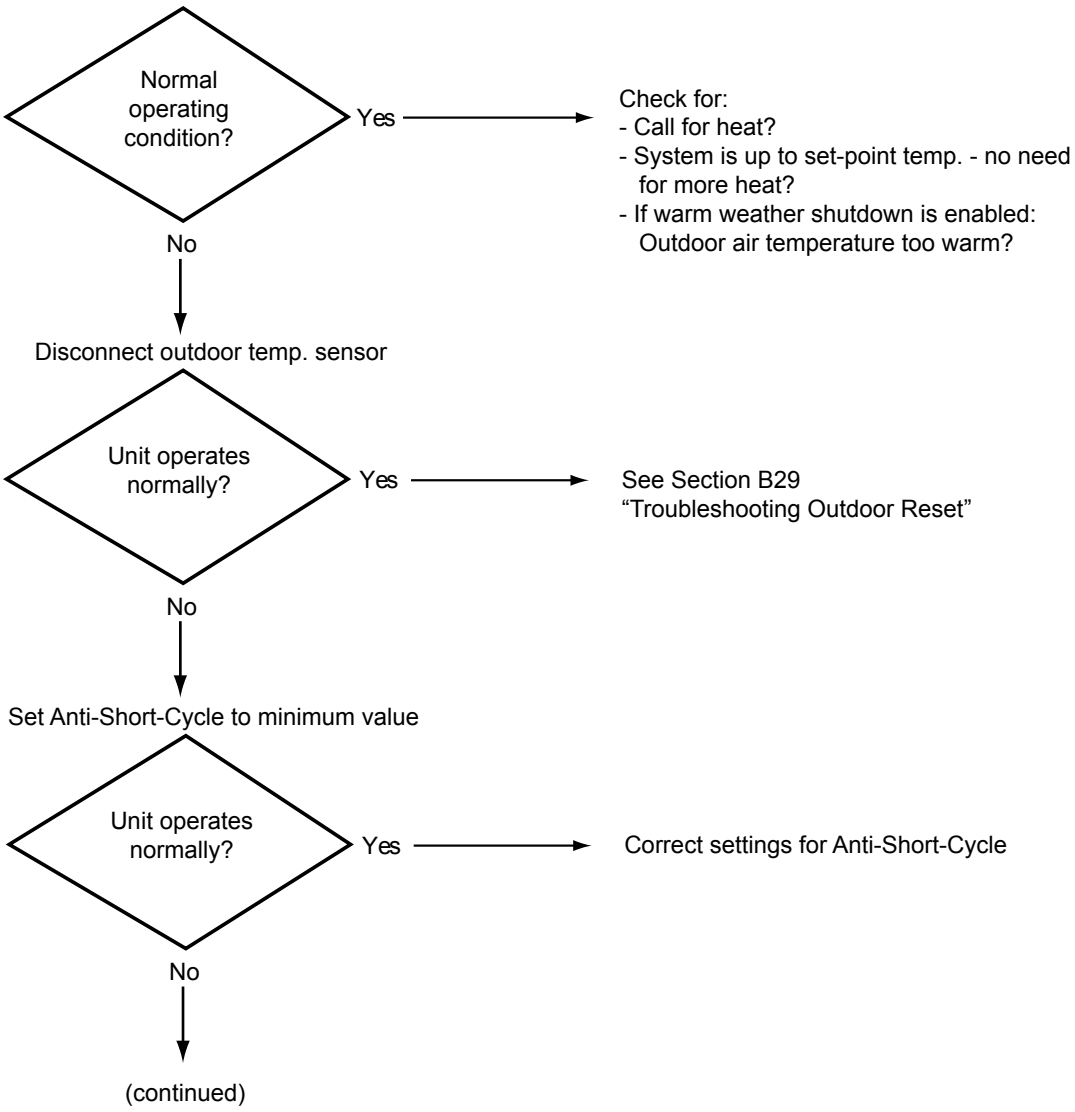
In this condition, the blower is running continuously, but the display is completely blank.



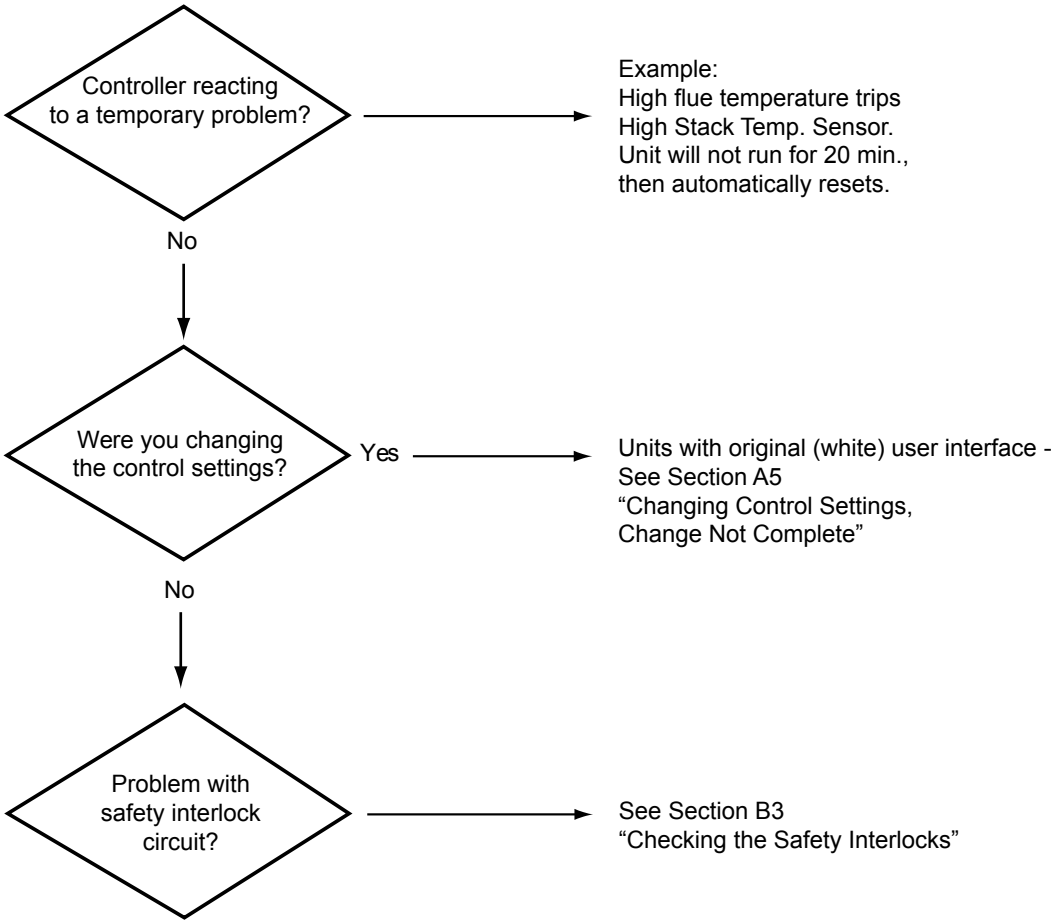
Control Unit is in “Standby” Mode

A4

In certain situations, the controller on this unit can go into “Standby” mode. The Boiler pump is running, so the unit sees a “Call for heat.” There is no lockout or hold, but something is preventing it from going to “Run” mode.



A4 cont. Control Unit is in “Standby” Mode (continued)



Changing Control Settings, Change Not Complete
Original (White) Interface

A5

NeoTherm units were produced using two types of user interfaces. (See Section A1 to identify the kind of interface used on your unit.) These instructions apply to units with the original (white) user interface.

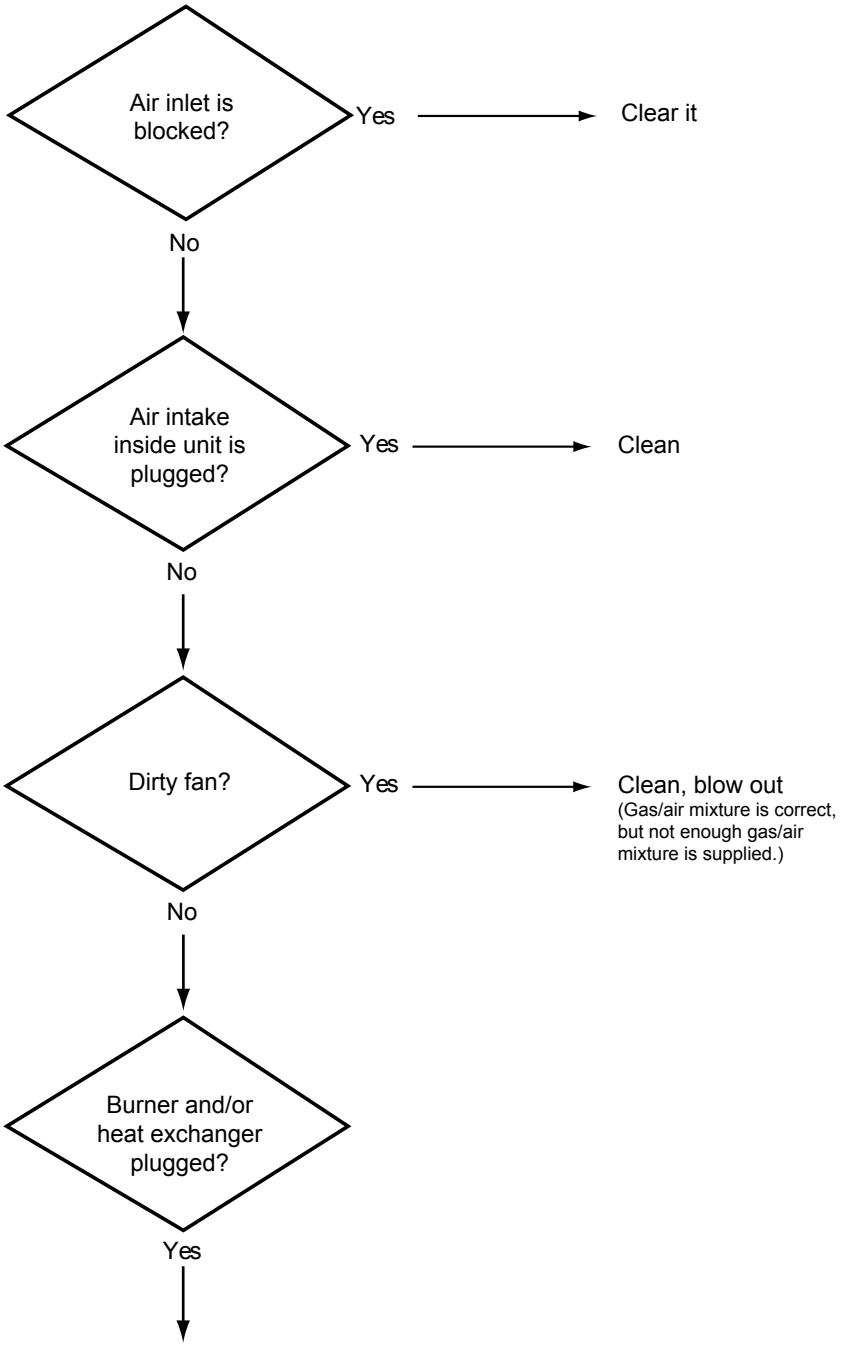
In certain situations, the controller used in this unit can go into a “Stand-by” mode. There is no lockout or hold, but the unit still will not run.

This can happen if you begin to change one of the control settings, but do not finish the process. For example, let’s say you want to change the DHW setpoint from 180° to 175°. You use the menus to go to the item for the DHW setpoint, then enter the new number – “175.” At this point, you are supposed to press the Done button to send the new setting to the controller. However, if you do not press Done or OK, the controller will go into the Standby mode. The setting for the DHW setpoint will remain at the old setting (180°), because at this point the controller still has not received the new setting. More importantly, the unit will not fire because it is still waiting for that new setting. There is no indication of this on the User Interface.

To recover from this, you need to return to the point where you were making the change, and enter the new setting again. In this case, you would step through the menus until you returned to the item for the DHW setpoint. Enter the new number again (175°), then press Done. At that point, the controller will leave the Standby mode, and the unit should begin operating normally.

In order to troubleshoot this kind of situation, ask yourself, “What was I just doing?” Were you trying to change a control setting? Which one? You probably need to return to that setting, enter the new value again, then remember to press Done.

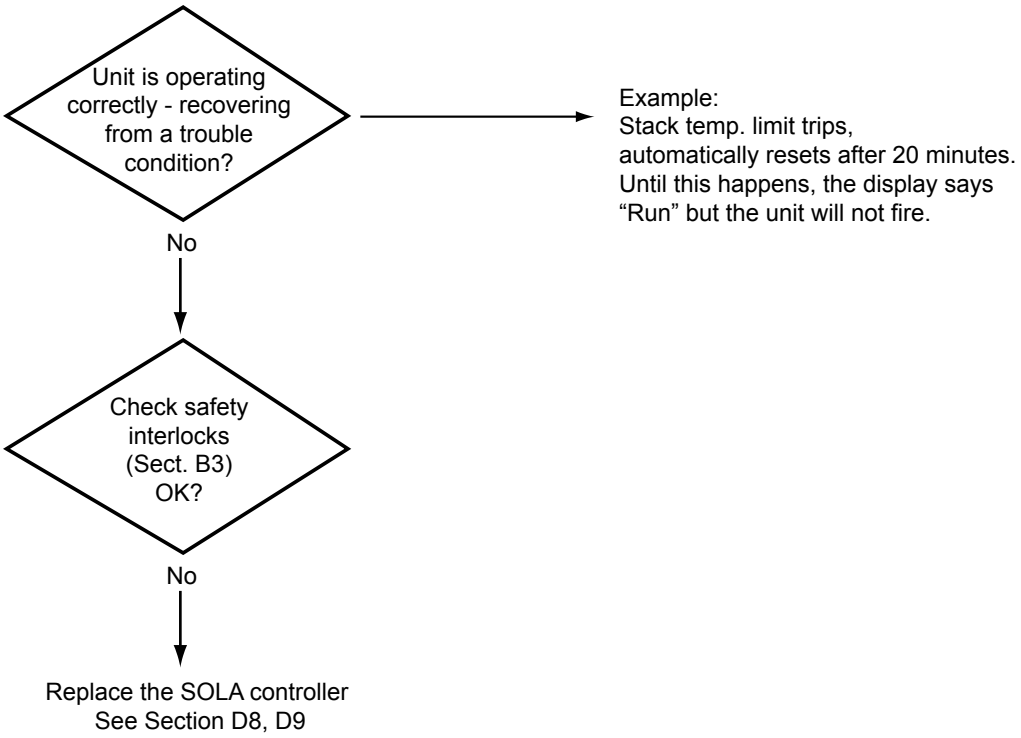
A6 Unit is Running, But Building is Still Cold



Control Unit Says “Run,” But Boiler is Not Firing

A7

In this condition, the panel is lighted, so you know the unit has power. The Boiler pump is running, so you know the unit is receiving the call for heat. The blower is running, the unit has spark, and the gas valve is operating correctly.



Open Safety Interlock Chain - Fault #63

A8

This fault indication can point to several different problems:

- Blocked condensate drain
* Blocked exhaust vent
- High or low gas pressure
- Low water in system
- Problem with circulator pump

Fault #63 is a bit like the “Check Engine” light in a car - it indicates a problem, but does not identify the problem. To identify the specific problem, see Section B3 - “Checking the Safety Interlocks.”

A9 Short-Cycling - Fault #61

There are several conditions that can cause short-cycling, and some of them can be caused by problems with the installation.

Start by checking the control settings for On Hysteresis and Off Hysteresis. If these are set too low, the system can short-cycle.

Short-cycling can occur if the piping in the hydronic loop is too small for the capacity of the boiler. To put this another way, the boiler is producing enough heat, but the surrounding system is too small to move the heat out of the boiler. The minimum firing rate on this unit is 20%. If the hydronic loop cannot accept at least that amount of heat, the unit may short-cycle. The solution to this problem is to use larger pipes in the primary (boiler) loop, or to install a buffer tank.

A similar situation can occur if the boiler is connected to an indirect DHW tank. If the output of the boiler is too large in relation to the size of the tank, the system may short-cycle. You may be able to correct this without changing the tank or piping. Be sure to use the aquastat on the indirect tank to provide the “call for heat.” You can also try lowering the DHW setpoint. If this does not work, you may have to change the DHW tank. The tank should be large enough to accept the output of the boiler when it is running at 20% of the maximum firing rate. The piping between the tank and the boiler must also be large enough to allow for adequate flow. Here’s the rule – ***The pipe diameter for the loop running to the tank must always be larger than the fittings on the tank.*** For example, if the fittings on the tank are ½” dia., you must use ¾” dia. or larger piping for the loop.

A10 Unit is Noisy

On systems using anti-freeze –

This can occur if the concentration of anti-freeze is too high. At concentrations above 35%, localized boiling can occur, and this can produce noise.

Quick Check of Components in the Safety Interlock Chain

B1

This procedure gives you a quick way of checking the safety switches and some of the control functions in the unit. This will allow you to rule out some large sections of the control system, and find the part of the system that actually has the problem.

DANGER! - When the cover is opened, some of the areas carrying 120V AC voltage will not be covered. Do not perform the following tests unless you have been trained how to do this safely by Laars.

1. Remove the front panel assembly and front bezel.
2. Before you start troubleshooting, you should disconnect some parts of the system to make the troubleshooting simpler. If a sensor for the Outdoor Reset function is connected, disconnect it at terminals 1 and 2 on TB-7 on the control board. See Fig. B1-1. (Remember to re-connect the sensor when you are done.)

   If the unit operates with the Outdoor Reset sensor disconnected, go to Section B29 - "Troubleshooting the Outdoor Reset System."
3. Turn off the Anti Short Cycle function by setting it to the minimum value.
4. If you are working with a boiler which can produce both hydronic heat and domestic hot water, work with just one function at a time. This will make it clear whether the "call for heat" is coming from the hydronic side of the system or the DHW side.
5. Insert a jumper across terminals 5 and 6 on TB-7 on the control board. See Fig. B1-2. This will create a permanent "call for heat" signal. (Again, remember to remove this when you are through.)

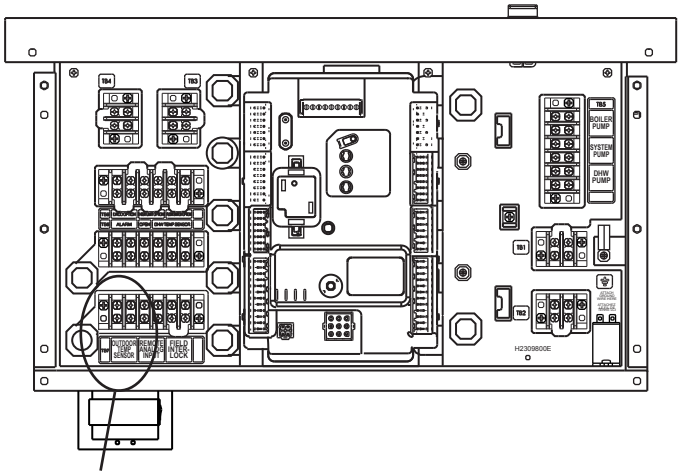


Fig. B1-1 - Terminals for outdoor reset

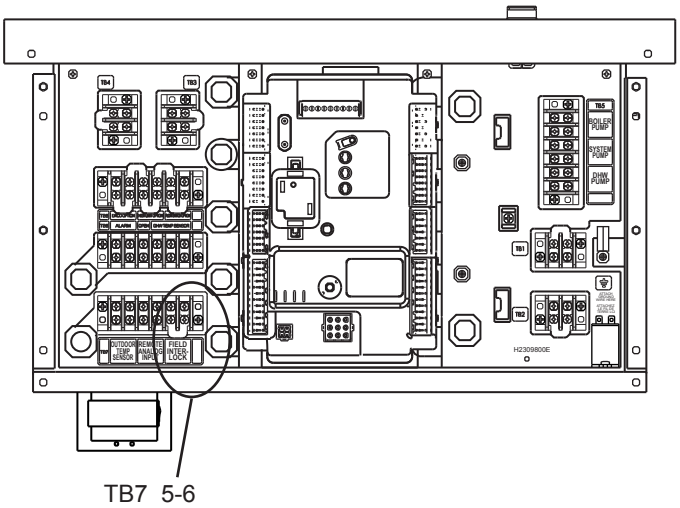


Fig. B1-2 - Simulating a "call for heat" input

B1 cont. Quick Check of Components in the Safety Interlock Chain - continued

6. If this unit is set up to use a separate DHW signal –

   Insert a jumper across terminals 5 and 6 on TB-6 on the control board. See Fig. B1-3. This will create a permanent "Call for DHW" signal. (Again, remember to remove this when you are through.)

7. Turn on power to the unit.

8. Check for 24V AC between terminal blocks TB-3 and TB-4. See Fig. B1-4. If 24V AC is present here, this means that the unit is getting line voltage, and the main power switch and transformer are working correctly.

   If 24V AC is not present, go to Section B2 - "Troubleshooting the 24V AC Power Supply."

9. Connect a volt-meter between TB4-1 and TB8-1. See Fig. B1-5. If 24V AC is present here, this means that the safety interlocks are connected (or jumpered out), and the switches are closed, allowing the unit to fire when a "call for heat" arrives. If you see 24V AC here, this means that the following safety interlock switches are OK:
   - Low water cutoff switch
   - High water temperature limit switch
   - Flow switch

   If 24V AC is not present, go to Section B3 - "Checking the Safety Interlocks."

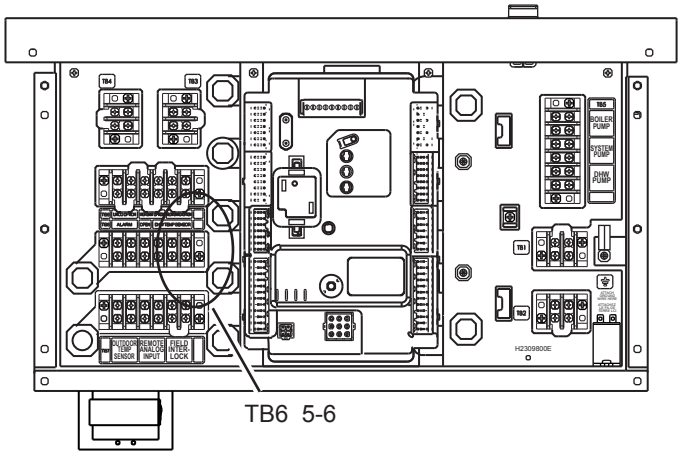


Fig. B1-3 - Simulating a "Call for DHW" input

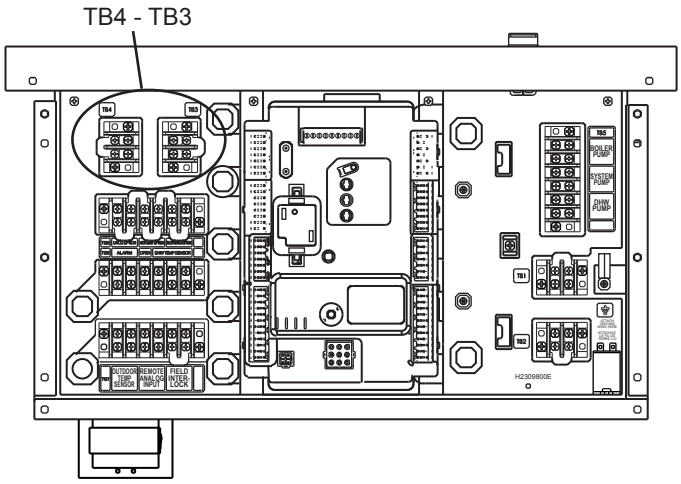


Fig. B1-4 - Check for 24V AC between TB4 and TB3

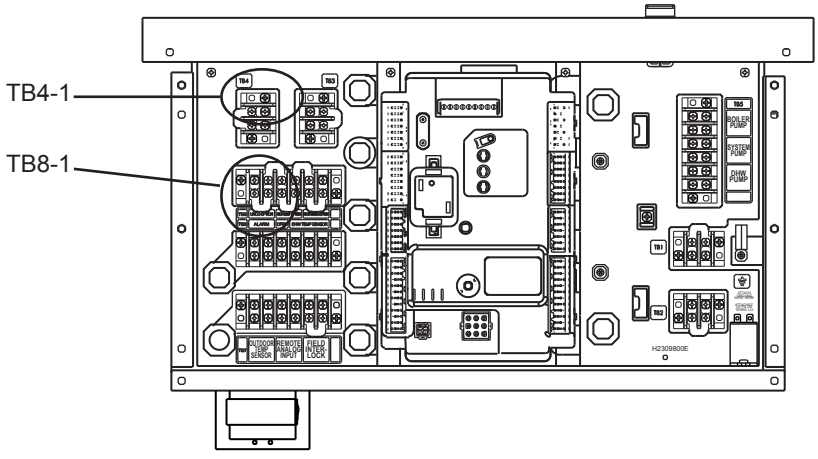


Fig. B1-5 - Check for 24V AC at TB8-1

10. Check for 24V AC between terminals 1 and 2 of J8 on the control module. See Fig. B1-6. If 24V AC is present here, this means that the Condensate trap level switch is OK. If 24V AC is not present, troubleshoot the condensate trap level switch. See Section B12.

11. If you see 24V AC at J8, this means that all of the switches in the safety chain are satisfied. The blower should run, and then the pressure switch should close, allowing the ignition sequence to start. To check the pressure switch, check for continuity (no resistance) between terminal 1 on J6 and terminal 1 on J5 on the control module. See Fig. B1-7.

    If the pressure switch remains open, go to Section B15, “Checking the Air Pressure Switch.”

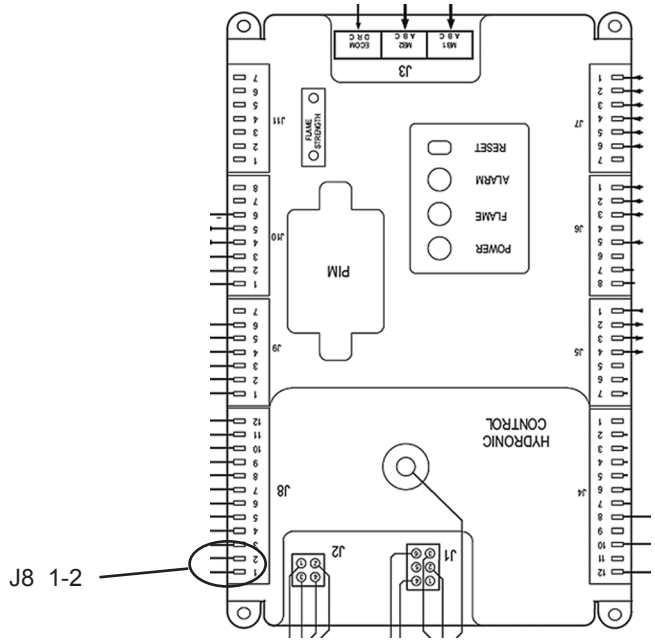


Fig. B1-6 - Checking the safety switches

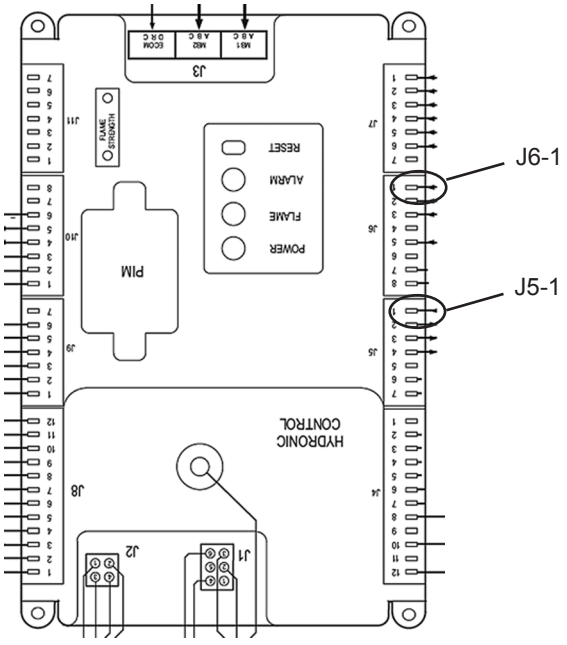


Fig. B1-7 - Checking the safety switches

B1 cont. Quick Check of Components in the Safety Interlock Chain - continued

12. If the unit is receiving a “call for heat,” and all of the safety switches are OK, the blower should be receiving control voltage through J2 on the control module. See Fig. B1-8.
    - If power is available at J2, but the blower is not running, go to Section B18 - “Checking the Blower.”
    - If the blower is running, and the unit does not fire, go to Section B28 - “Testing the Temperature Sensors.”
13. Replace all of the wiring you changed earlier:
    - Remove the jumper for the “call for heat” – TB7 5-6)
    - Reconnect the outdoor temperature sensor (TB7 1-2)
    - Reset the Anti-Short Cycle setting
    - If DHW is connected – Remove the DHW jumper (TB6 5-6)

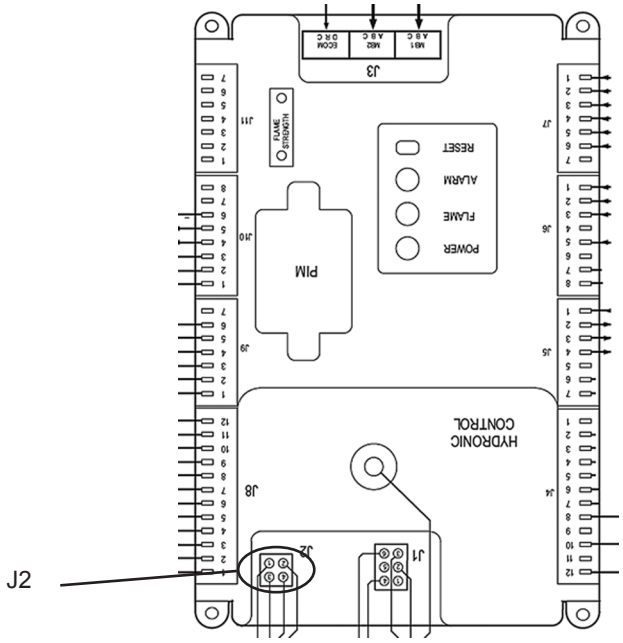
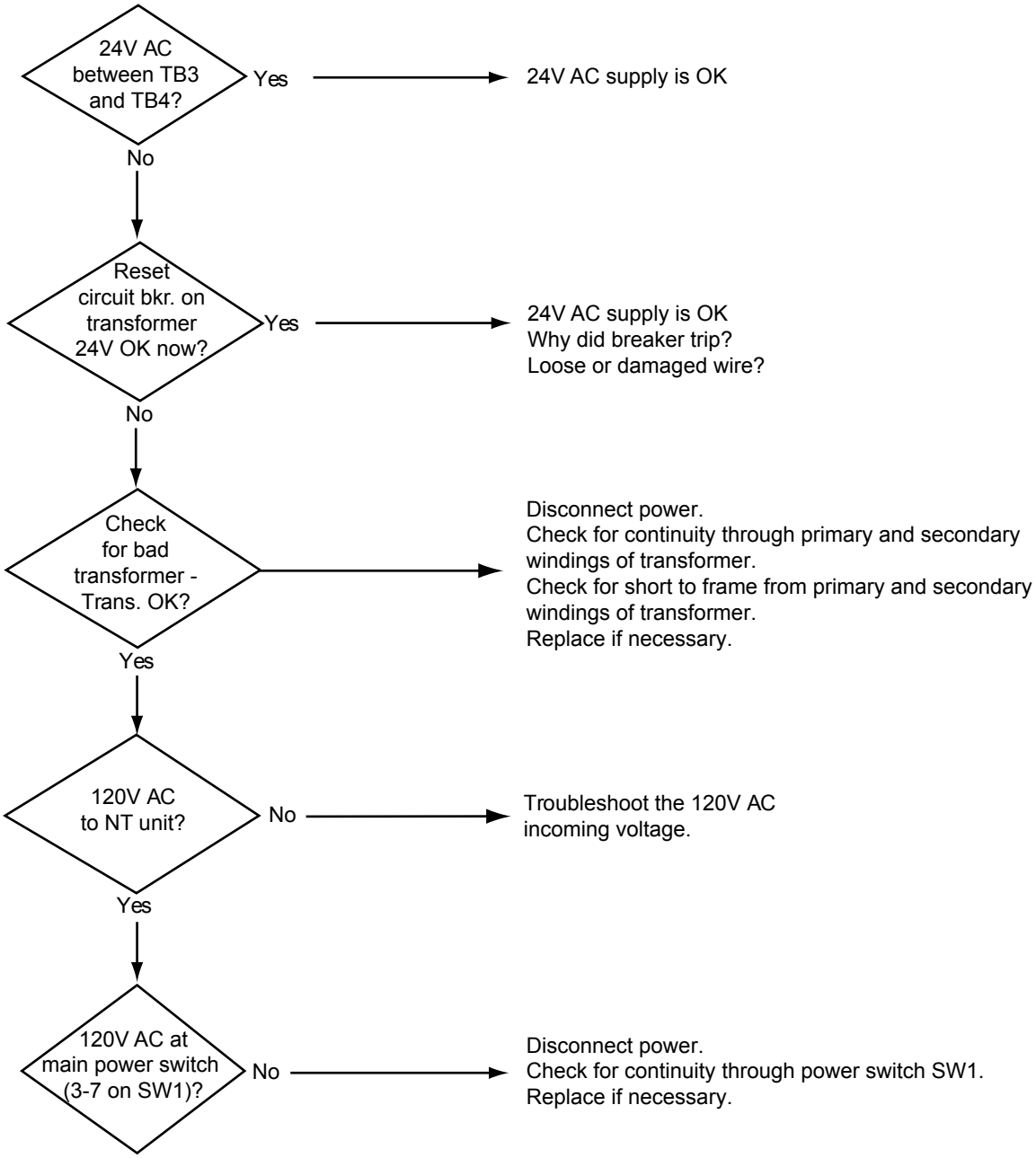
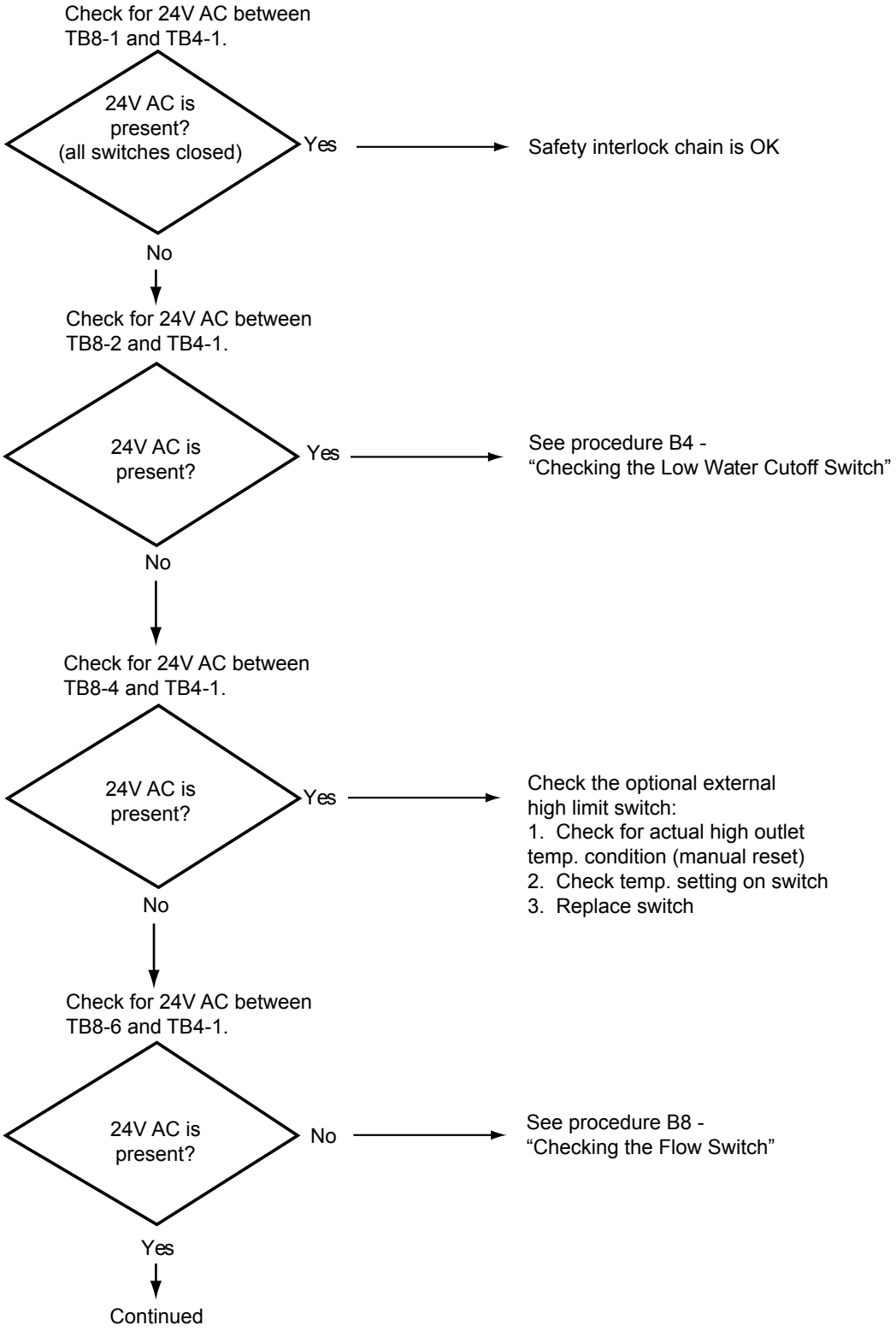


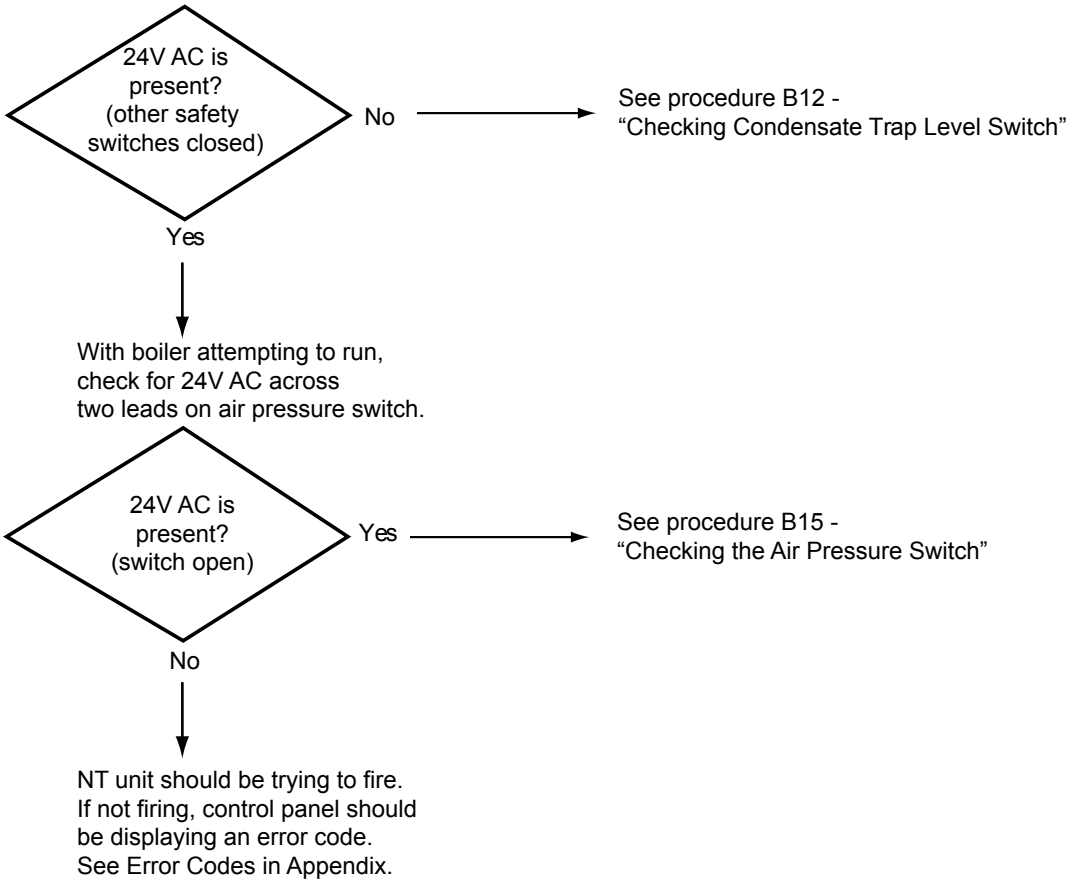
Fig. B1-8 - Control voltage for the blower


24V AC between TB3 and TB4?
Yes
24V AC supply is OK
No
Reset circuit bkr. on transformer 24V OK now?
Yes
24V AC supply is OK
Why did breaker trip?
Loose or damaged wire?
No
Check for bad transformer - Trans. OK?
Disconnect power.
Check for continuity through primary and secondary windings of transformer.
Check for short to frame from primary and secondary windings of transformer.
Replace if necessary.
Yes
120V AC to NT unit?
No
Troubleshoot the 120V AC incoming voltage.
Yes
120V AC at main power switch (3-7 on SW1)?
No
Disconnect power.
Check for continuity through power switch SW1.
Replace if necessary.

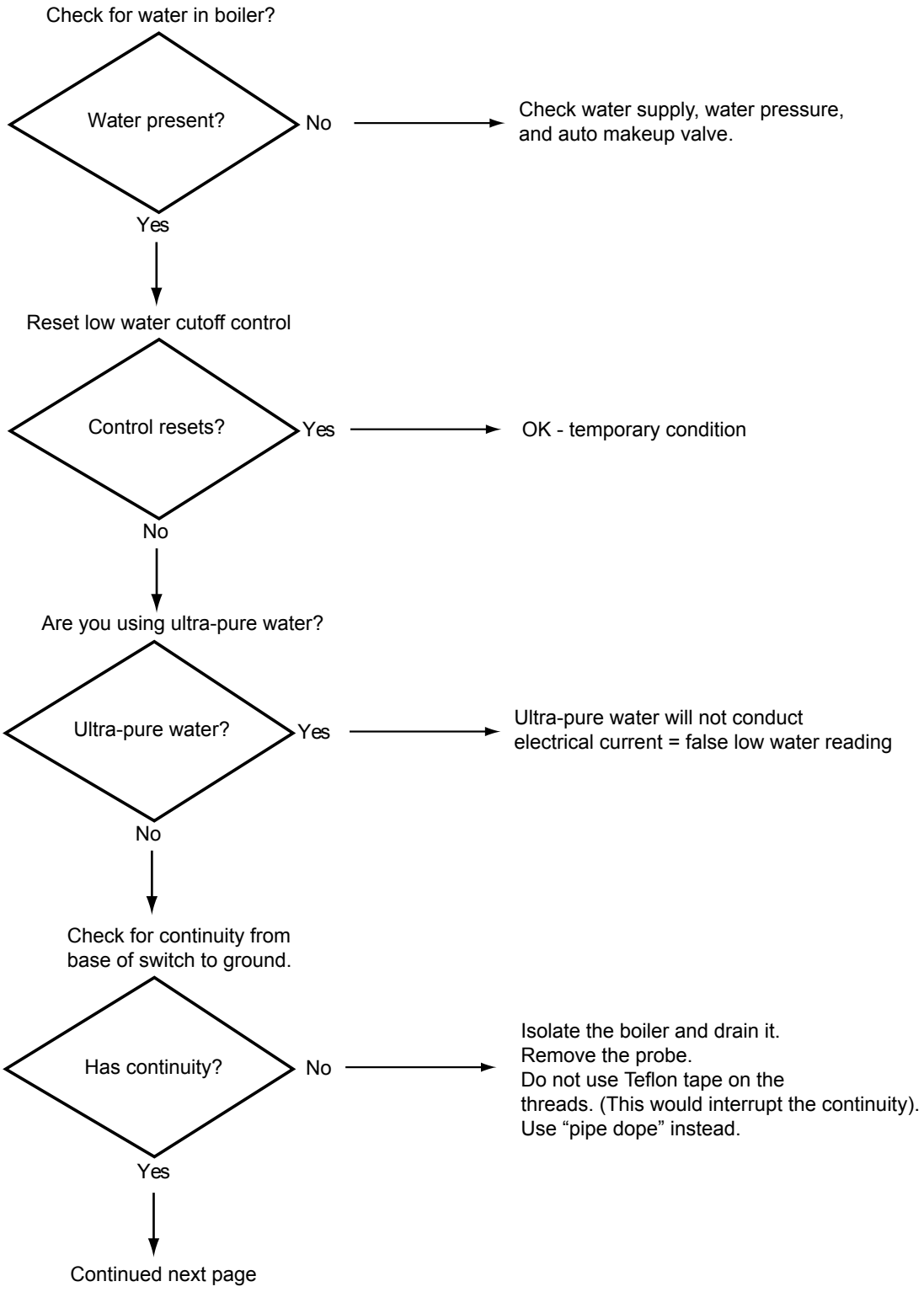
B3 Checking the Safety Interlocks



Check for 24V AC at terminal J6-1.

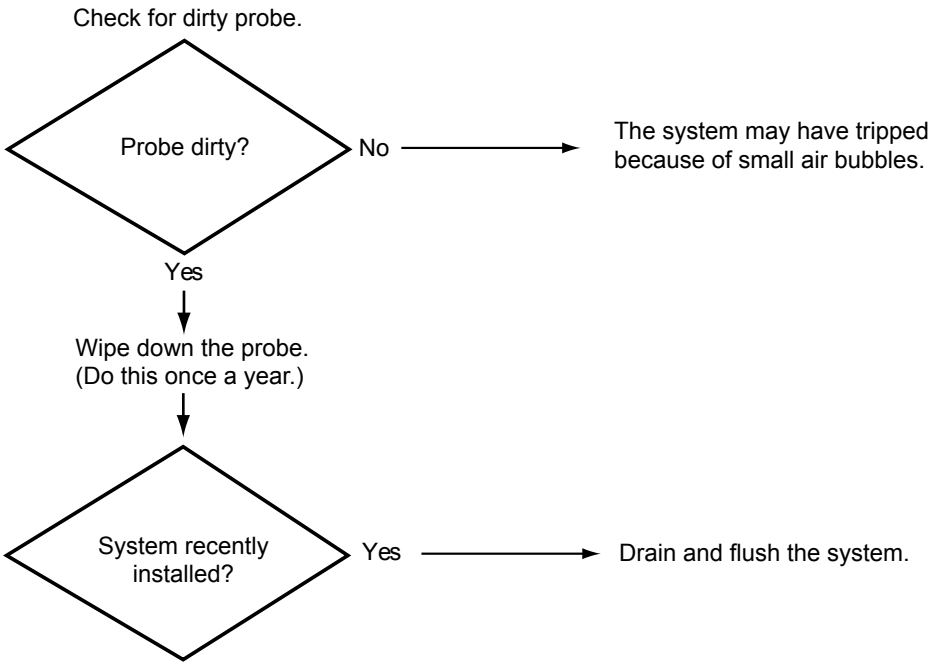


B4 Checking the Low Water Cutoff Switch (option)



Checking the Low Water Cutoff Switch (continued)

B4 cont.



Controller for Low Water Cutoff

B5

The low water cutoff switch operates by passing a slight electrical current between from a probe to ground when water is surrounding the probe. If there is no water, there is no current, and the controller knows that the water level has dropped.

The low water cutoff controller is shown in Fig. B5-1 The controller has two LED indicators:

- Power (red) – When lighted, the control box has power.
- Tripped (yellow) – When lighted, the controller has detected a low water condition.

The controller also has two switches:

- Reset – Use this to cancel the “trip” condition.
- Test – This simulates a “low water” condition.

See “Removing and Replacing the Low Water Cutoff Switch,” Section B6.

Fig. B5-1 - Controller for low water cutoff

B6 Removing and Replacing the Low Water Cutoff Switch

The low water cutoff switch is designed to shut down the unit if there is a low water condition. The control includes two parts: a control box, and a probe which reaches into the water piping.

Tools and equipment required:

- Small Phillips-head screwdriver (#1)
- Two medium-sized pipe wrenches or adjustable wrenches
- 5/16” socket

Procedure - Removing or replacing the probe

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Isolate the boiler. Turn off the water shutoff valves located upstream and downstream of the unit.
3. Drain the boiler. The drain valve is located near the lower end of the heat exchanger.
4. Now you can remove the probe. Remove the top panels on the unit so you can reach the probe.
5. Disconnect the probe wire (violet wire, red cap) and the ground wire (green). See Fig. B6-1.
6. Use two pipe wrenches to unscrew the probe assembly. See Fig. B6-2.

   Turn the probe assembly counter-clockwise to loosen it.

   Note - Two sheet metal screws extend through the plate around the probe assembly. You may have to unscrew these a bit to allow enough space behind the probe for the two wrenches.
7. To reassemble, reverse the procedure we have just described. Keep these points in mind as you do this:
   - Remember to re-tighten the two sheet metal screws, if you unscrewed them to increase the clearance for the wrenches.
   - Use pipe dope or Teflon® tape on the threads on the probe assembly.
   - Be sure the red cap is seated firmly on the contact at the end of the probe.

You may need to unscrew these screws to allow clearance for the wrenches behind the probe assembly.

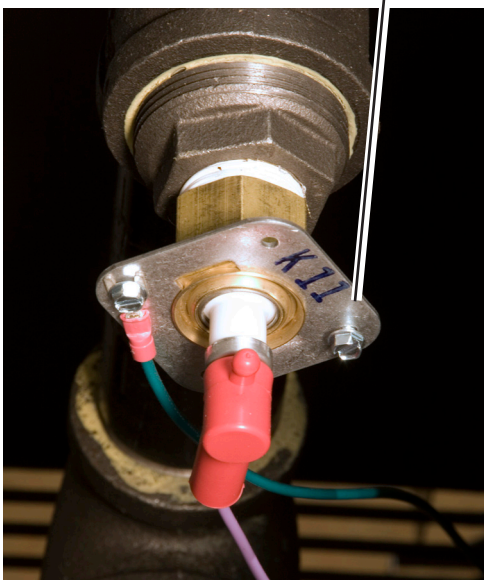


Fig. B6-1 - Removing the probe wires

Fig. B6-2 - Removing the probe

Procedure - Replacing the control box

1. To remove the cover, remove the two sheet metal screws on the sides.
2. Disconnect the three wires on the terminal strip, and the violet wire that runs to the connector above the terminal strip. See Fig. B6-3.
3. The control box is attached to the backing plate by two sheet-metal screws with large heads. See Fig. B6-4. One of these holds the green ground wire. Use the 5/16" socket to loosen both of these. Remove the green ground wire from the left-hand screw. Twist the box slightly and pull it away from the backing plate.
4. To reassemble, reverse the procedure we have just described. Remember to attach the green ground wire to the inner sheet metal screw (5/16" head).

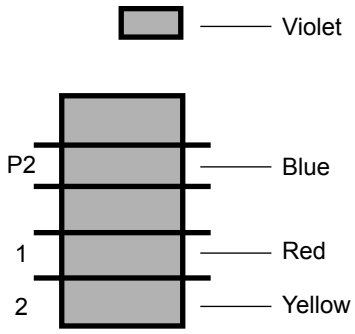


Fig. B6-3 - Connections to low water cutoff control

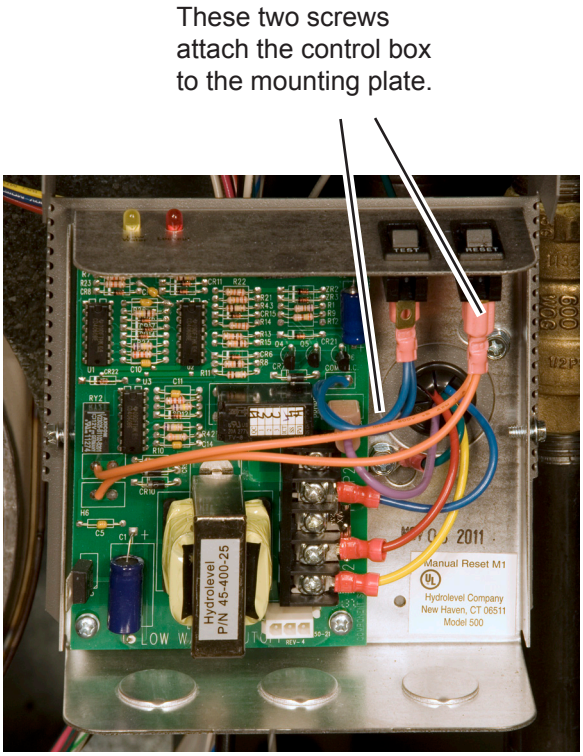


Fig. B6-4 - Control for low water cutoff with cover removed

B7 High Water Temperature Limit Switch (optional)

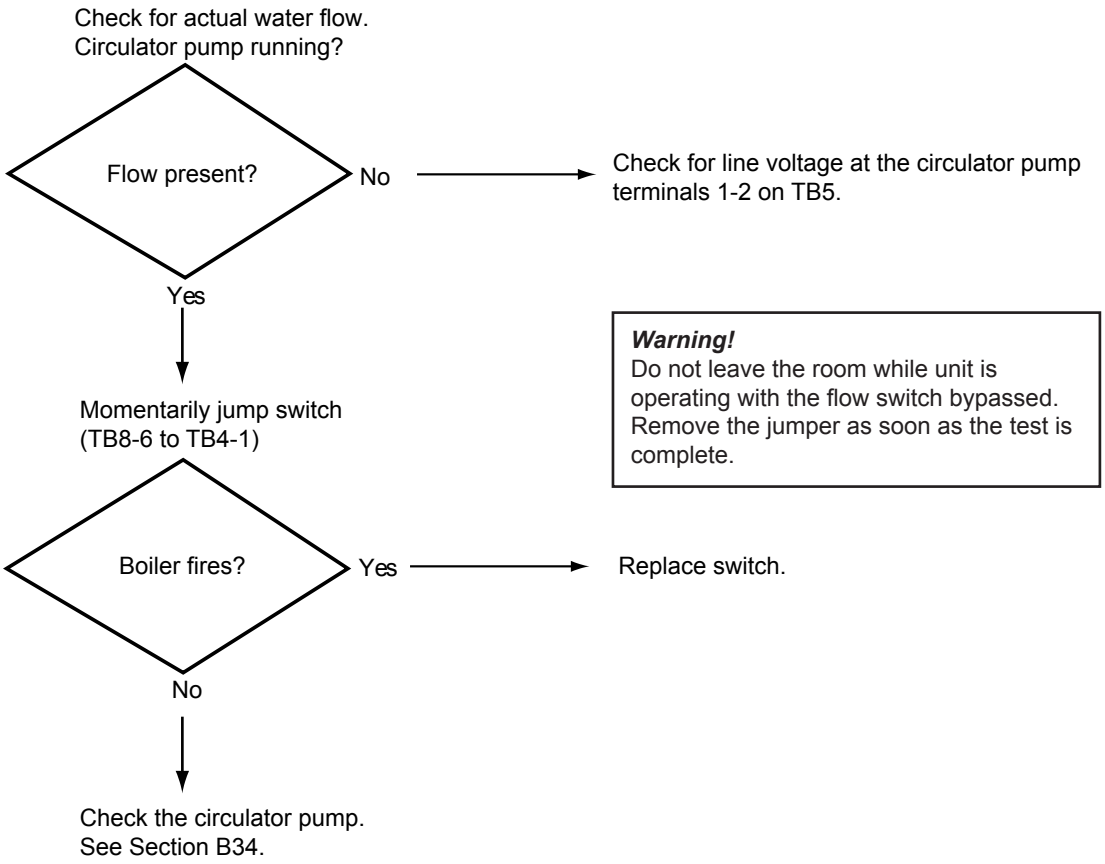
Laars does not provide this switch. It is installed only where required.

This is a normally-closed (NC) switch. If the water temperature rises above the pre-set limit, the switch opens.

Some types of switches must be reset manually. To reset this type of switch, press the button on the control. Other switches will reset automatically.

Correct the cause of the problem and/or replace the switch.

B8 Checking the Flow Switch (optional)



Testing the Flow Switch

The flow switch uses a set of paddles to sense water flowing through the system. See Fig. B9-1. When water is flowing, the switch is normally closed (N.C.). If the water flow stops, the switch opens. After a “no flow” condition, the switch resets itself immediately and automatically.

Use a volt-ohmmeter to test the continuity through the switch. With the paddles in the “relaxed” position (standing upright), the switch should be open. Bend the paddles slightly to one side, and you should see the switch close.

Note - There is a seal at the base of the paddle assembly. If this seal fails, it can allow water to leak into the connection box. From there, the water can flow through conduits to other parts of the control system in the NeoTherm unit.

If it is necessary to replace the flow switch, see Section B10 for instructions.

Fig. B9-1 – Typical flow switch

B10 Removing and Replacing the Flow Switch

The switch assembly includes two parts: a set of paddles that extend into the water pipe, and a control box. See Fig. B10-1.

Figure B10-2 shows the paddles that extend into the piping to detect the water flow.

The paddles are sized to match the amount of water flowing through the system, so a flow switch installed in a smaller system, with a smaller pipe, will have smaller paddles, and a switch in a larger system will have larger paddles. Keep this in mind if you need to replace one of these switches.

Fig. B10-1 - Flow switch installation (typical)

Tools and equipment required:

- Medium-sized pipe wrench
- Sheet-metal shears - use a type that can make a curved cut
- 100-grit sandpaper
- Pipe dope or Teflon® tape

Fig. B10-2 - Metal paddles used to detect water flow (typical)

Procedure:

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Isolate the boiler. Turn off the water shutoff valves located upstream and downstream of the unit.
3. Drain the boiler. The drain valve is located near the lower end of the heat exchanger.
4. Remove the cover from the control box for the switch. Note the positions of the wiring connections, then disconnect the wires.

5. Now you can use the pipe wrench to remove the whole switch assembly.
6. When you receive the new switch, it will include four paddles. These will be longer than necessary for your installation, so you will need to trim these paddles to the correct sizes. The best way to do this is to copy the sizes of the paddles in the old switch. Make a smooth curve at the end of each paddle, as shown in the photo. Remove any burrs from the cut end of the paddle using 100-grit sandpaper.
7. Once you have trimmed the paddles, install them on the switch. Insert the pin to attach the paddles to the center post.
8. Important! When the switch is installed, the ends of the paddles must sit in the correct orientation inside the pipe. The paddles must be placed so they can sense the water flow, and they can bend with the direction of the water flow.
   - The wide sections of the paddles must sit across the line of the water flow, partially blocking the flow.
   - The flowing water should hit the longer paddle first. See Fig. B10-4.
9. Note the arrow and the word “Flow” on the large mounting nut. This will help you to install the paddles in the correct orientation.
10. Coat the threads with pipe dope or Teflon® tape and install the part.

    Important! With the pipe wrench, tighten so the paddles sit in the orientation shown above. Be sure the arrow points in the direction of water flow.
11. Re-connect the wires as shown in Fig. B10-3.
12. Open the water isolation valves and check for a leak where the switch is threaded into the pipe.
13. Turn on power to the unit.

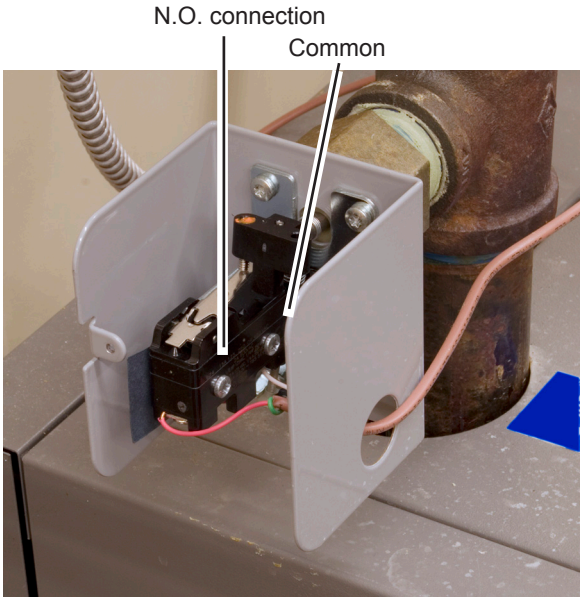


Fig. B10-3 - Wiring connections inside switch box

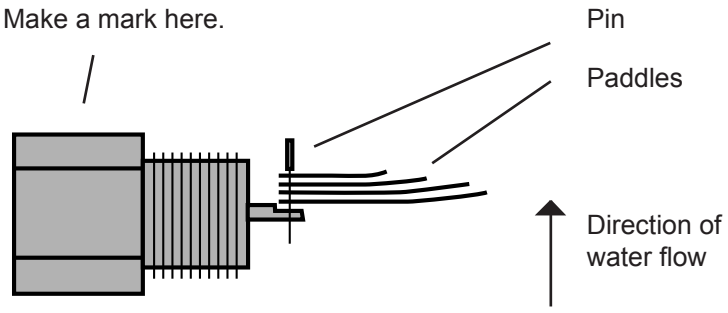


Fig. B10-4 - Attaching the paddles

B11 Removing and Replacing the Gas Valve

The modulating gas valve consists of a valve body that controls the on/off gas flow and a negative pressure regulator. It provides the air/gas ratio control in combination with the Venturi to the unit.

The easiest way to remove the gas valve is to remove the air/gas channel and blower as one assembly, then separate the gas valve from the assembly. Because of the way the gas valve is mounted in the machine, it would be very difficult to remove the gas valve from the machine directly.

Figure B11-1 shows how the parts are arranged.

Tools and equipment required:

- 3 mm and 4 mm Allen wrenches (traditional “L” shaped, ball-head is best)
- #25 Torx® driver
- Gas-resistant pipe dope or Teflon® tape
- Gas leak detection solution (i.e. Hercules Megabubble®)
- Container for removed parts

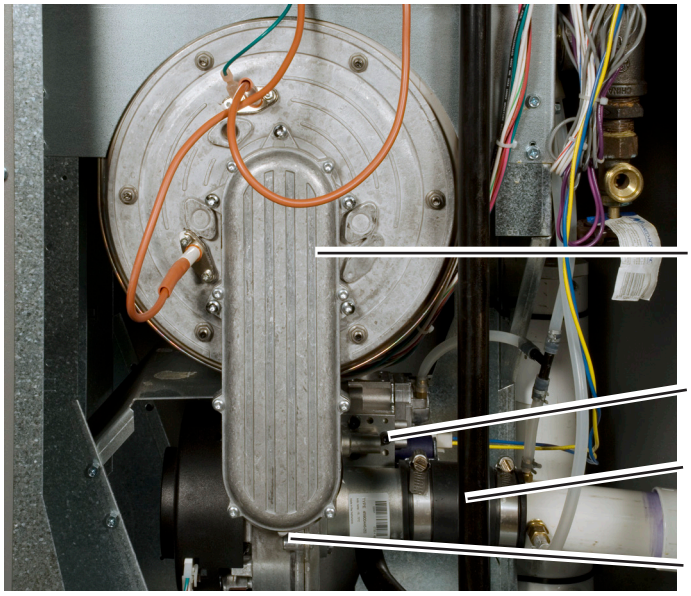


Fig. B11-1 - Gas valve and other parts - NT105 shown

Procedure:

1. Turn off power to the machine. Use the main disconnect switch on the front of the machine, just above the control panel.
2. Remove the front panel.
3. Shut off the gas at the gas shutoff valve on the right side of the machine (yellow handle).

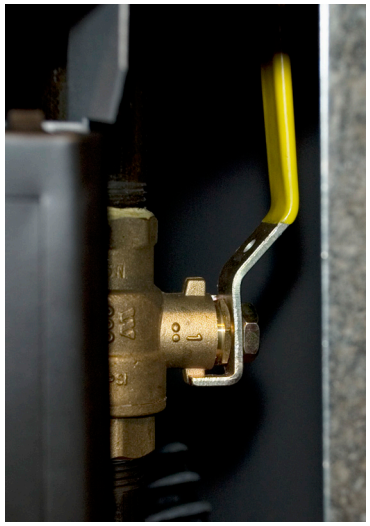


Fig. B11-2 - Gas shutoff valve (typical)

4. Unplug the wires running to the gas valve. The connector is keyed, and can only be plugged in one way. See Fig. B11-3.
5. Disconnect the small vacuum hose running to the top of the gas valve.
6. Disconnect the wires to the blower. There are two connectors. The power wires run to the rear connector, and the control wires connect to the front. See Fig. B11-4.
7. Loosen the left hose clamp on the black rubber air inlet hose, then pull the left end of the hose away from the end of the metal inlet assembly. See Fig. B11-5.

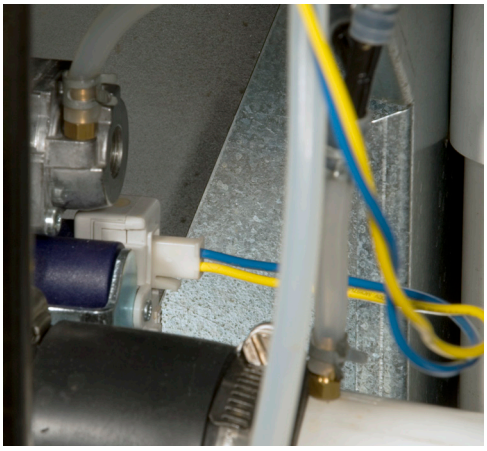


Fig. B11-3 - Wiring connector for gas valve

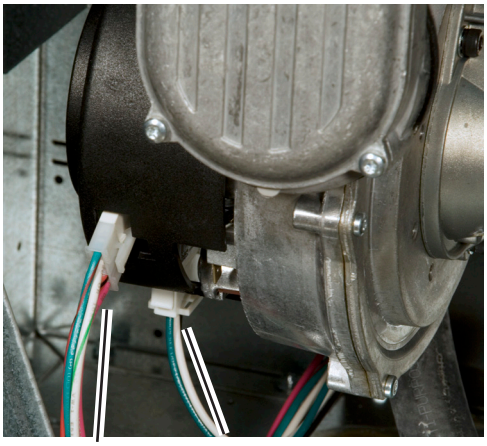


Fig. B11-4 - Wiring connections for blower

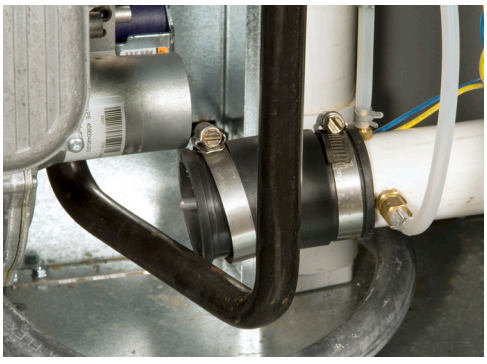


Fig. B11-5 - Loosen the left end of the rubber hose

Removing and Replacing the Gas Valve (continued)

8. The gas inlet pipe runs to the underside of the gas valve. It is attached by four 3mm Allen-head screws, and these are difficult to reach. Figure B11-6 shows the screws as seen from below the gas valve.

   Use a 3mm Allen wrench to undo these screws. It will be hard to reach one of the screws. The best tool for this job is a traditional "L-shaped" Allen wrench, with one long leg and one short leg. You will be able to use the short leg to undo that one difficult screw.

9. Now you can remove the air/gas channel and blower assembly from the machine. Remove the five #25 Torx-head screws around the air/gas channel. See Fig. B11-7. (These are the outer screws on the front of the assembly. The inner screws attach the cover on the air/gas channel - do not remove these.)

10. Support the assembly as you remove the last screws, so it does not fall. Figure B11-8 shows how the assembly looks once it has been removed.

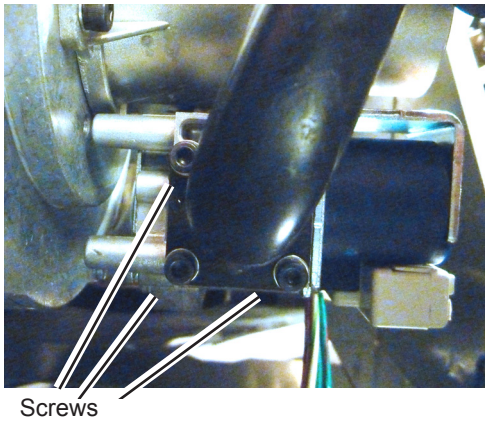


Fig. B11-6 - Four mounting screws for the gas inlet pipe, viewed from below

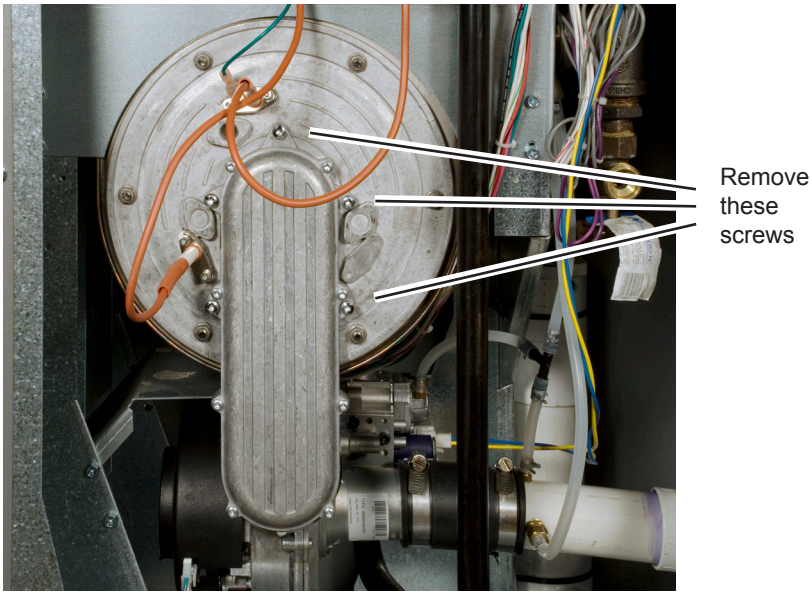


Fig. B11-7 - Removing the air/gas channel and attached blower

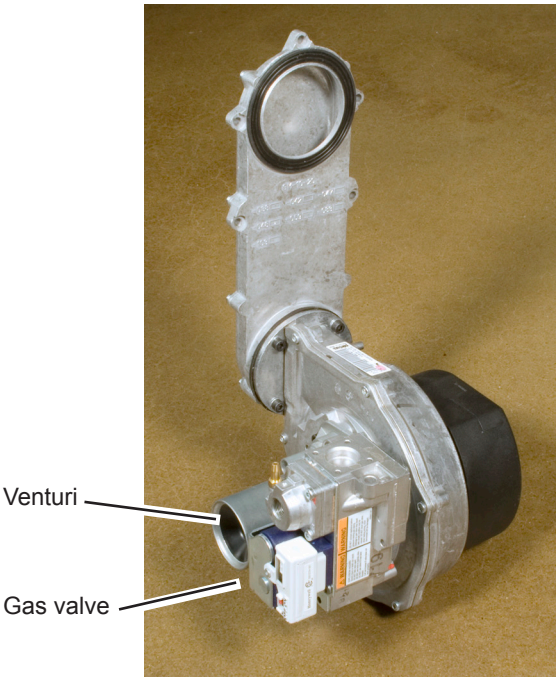


Fig. B11-8 - Gas valve still attached to blower and Venturi

11. Now you can remove the gas valve. There are four 4mm socket-head cap screws. Fig. B11-9 shows the gas valve once it has been removed.

    Here are two points to keep in mind:

    - Notice the rubber washer. Be sure to insert this in the correct position when installing the new valve.

    - The gas valve has an On/Off switch. See Fig. B11-10. When installing the new valve, be sure this is set to On.

12. To reassemble, reverse the procedure listed above.

13. After reassembly, check for gas leaks using a leak detection solution.

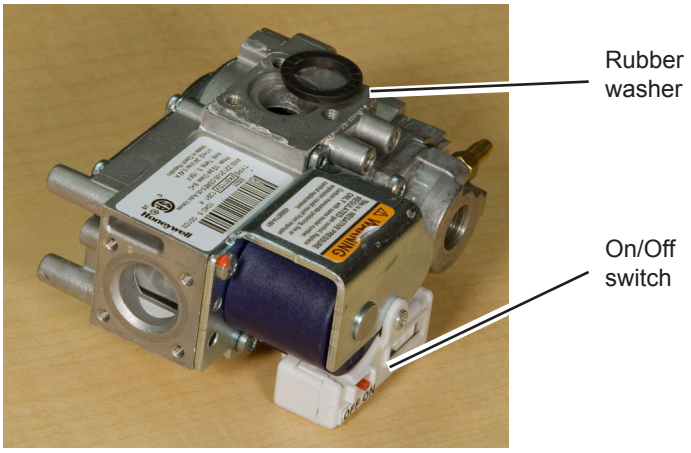
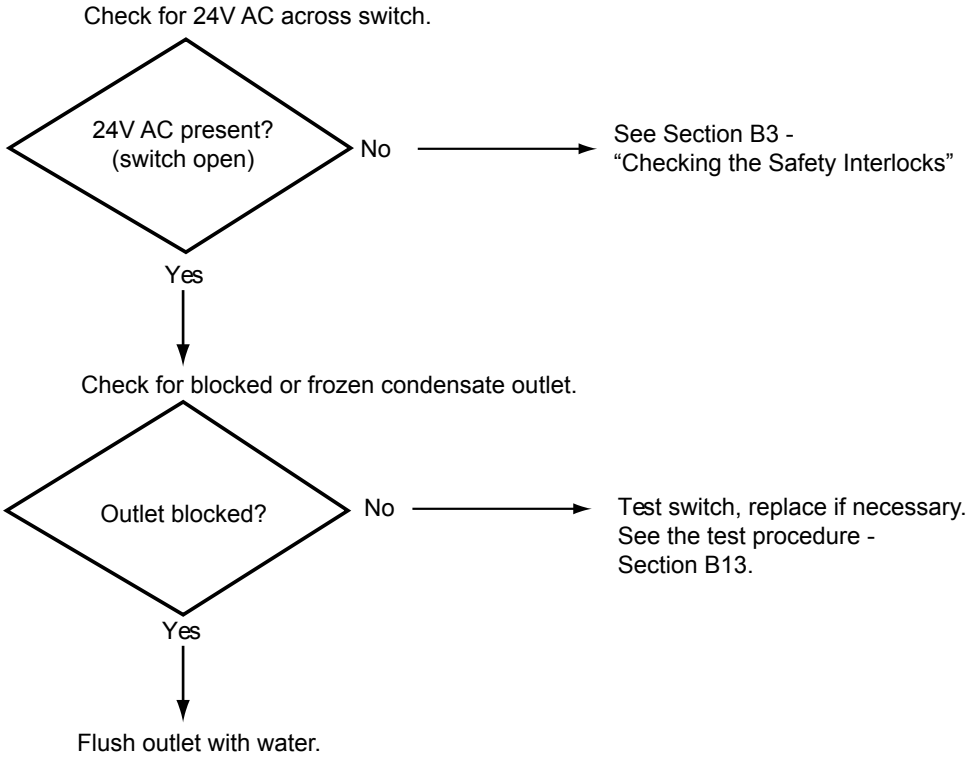


Fig. B11-9 - Gas valve removed

Fig. B11-10 - On/Off switch on gas valve

B12 Checking the Condensate Trap Level Switch



Testing the Condensate Trap Level Switch

B13

Some operating conditions can cause small particles of mineral material to be formed in the heat exchanger and collect in the condensate trap. The drain can also be blocked if it is frozen or plugged with debris. If the water cannot drain freely, it can back up into the heat exchanger. The level switch is designed to prevent this by shutting off the unit before the water can reach the heat exchanger.

This assembly uses a float-type switch. To test, plug the outlet (the higher fitting on the assembly). Measure the resistance across the switch contacts when the assembly is empty. At this point, the contacts should be closed (no resistance). Next, add water at the inlet (the lower fitting). As the water level rises inside the assembly, you should see the contacts open (infinite resistance).

Fig. B13-1 - Small condensate trap assembly (typical)

Removing and Replacing the Condensate Trap

B14

The NeoTherm unit is designed to operate in the “condensing” mode. The combustion of natural gas produces a lot of water vapor. In the NT unit, this water vapor is condensed out of the exhaust gas inside the heat exchanger. The water is collected from the bottom of the heat exchanger, and sent to the condensate trap. The trap includes a float valve. If the condensate drain is plugged or blocked for some reason, the float rises inside the trap. If the water rises high enough, the float trips a switch and prevents the NT unit from firing. This means the condensate water can never back up into the heat exchanger.

Note that the condensate water can be hot. The water is also acidic, and can damage metal pipes.

The photo above shows a condensate trap from a smaller NT unit. The water enters through the hose at the bottom of the unit, and exits through the top. At the top of the unit you can see the two wires for the float switch.

The cap on the PVC assembly is held in place by a set-screw. Once you remove this screw, you can remove the cap and unscrew the switch.

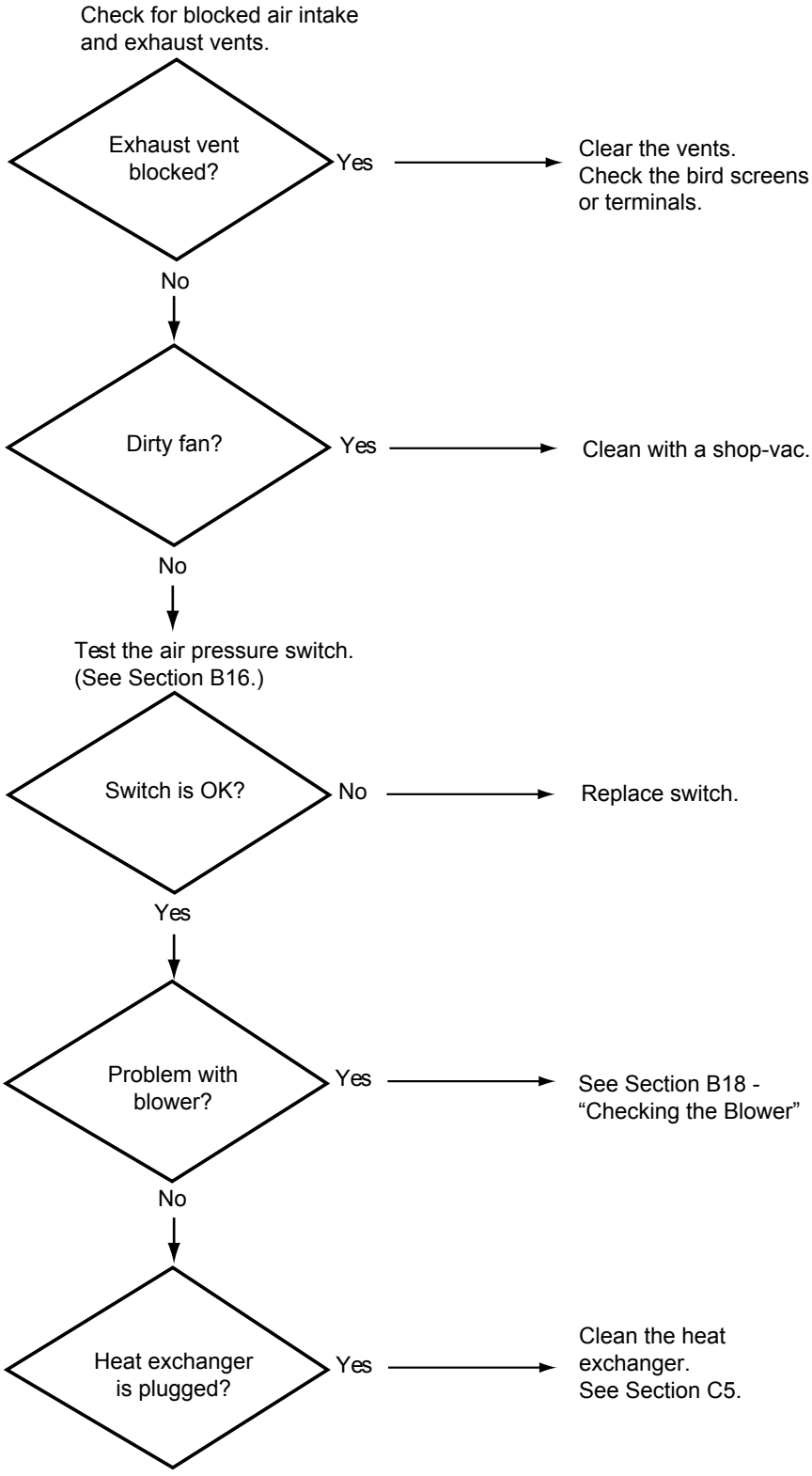
B14 cont. Removing and Replacing the Condensate Trap (continued)

Tools and equipment required:

* 1/4” socket
- Small diagonal cutters or knife
- Water-pump pliers
- 11” Ty-wrap

Procedure

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Remove the front panel from the unit.
3. You won’t be able to do this procedure unless you also remove the panel on the right side of the unit. Remove the mounting screws, then remove the right side panel.
4. Disconnect the two wires from the top of the trap assembly.
5. Notice the position of the Ty-wrap, then cut it.
6. Use the water-pump pliers to remove the clip holding the inlet hose (lower end of the trap assembly). Pull the end of the hose away from the trap assembly.
7. Once the assembly is free, flush it out with water to remove any collected sediment.
8. To replace the assembly, reverse the steps we have just described. It does not matter which way the wires are connected.


Check for blocked air intake and exhaust vents.
Exhaust vent blocked?
Yes
Clear the vents. Check the bird screens or terminals.
No
Dirty fan?
Yes
Clean with a shop-vac.
No
Test the air pressure switch. (See Section B16.)
Switch is OK?
No
Replace switch.
Yes
Problem with blower?
Yes
See Section B18 - “Checking the Blower”
No
Heat exchanger is plugged?
Yes
Clean the heat exchanger. See Section C5.

B16 Test Procedure for Air Pressure Switch

1. The switch is located behind the front panel. Disconnect the two leads, and connect a Volt-Ohmmeter set to check for continuity (reading Ohms).
2. Insert a hose “T” in the clear plastic hose that runs to the positive pressure port (closest to the electrical connections). Attach a length of hose to the branch of the “T.”
3. Blow on the end of the hose.

   With pressure –
   You should see continuity (low Ohms - switch closed)

   Without pressure –
   You should not see continuity (high Ohms – switch open)
4. Disconnect the “T.” Attach a manometer to the negative port on the blower. When the fan starts, you should see a vacuum of about ½” w.c.

B17 Removing and Replacing the Air Pressure Switch

The air pressure switch acts as a “blower proving switch” to ensure that the blower is running before the unit will fire.

Tools and equipment required

- Small Phillips-head screwdriver (#1) or 5/16” socket
- Small standard pliers
- Electrical tape

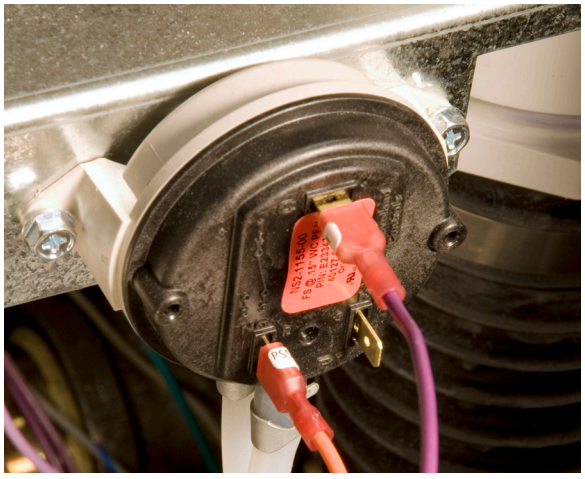


Fig. B17-1 - Air pressure switch (typical)

Procedure - Removing or replacing the switch

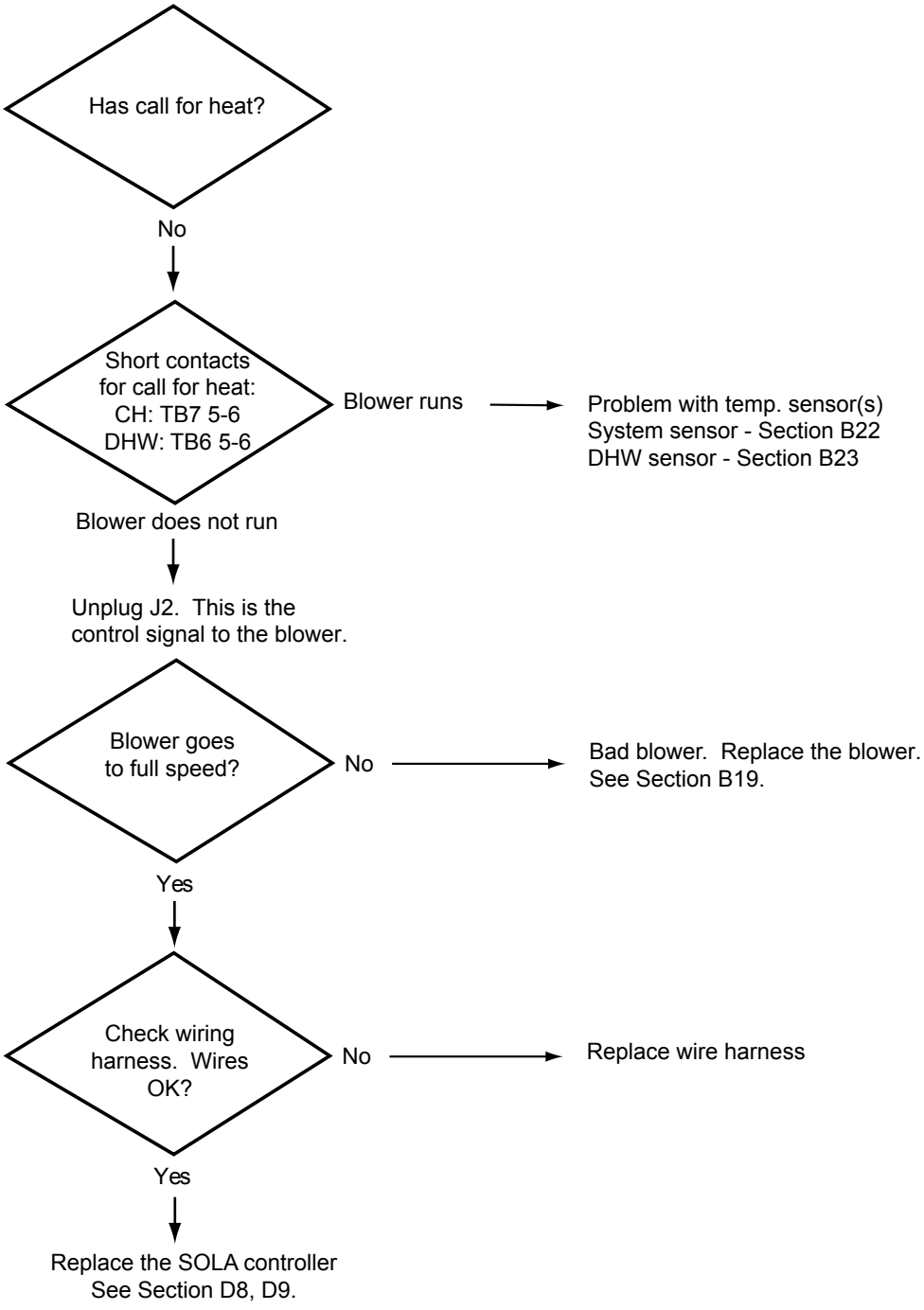
1. Turn off power to the machine. Use the main disconnect switch located above the top of the control panel.
2. Remove the covers on top of the unit so you can reach the air pressure switch.
3. Remove the mounting screws on both sides of the switch. Use the screwdriver or the 5/16" socket.
4. Use the pliers to release the hose clamps and remove the air hoses from the bottom of the switch.

   Important! During reassembly, the hoses must be connected to the correct barbs on the switch. Do not reverse the connections.

   To prevent this, you should mark one of the hoses. Remove the front hose first. Mark the rear hose with a piece of electrical tape, then remove the rear hose.
5. To reassemble, reverse the procedure we have just described. Be sure to connect the two air hoses in the correct locations.

B18 Checking the Blower

At start of test, unit should be ready to run (”Standby”)



Removing and Replacing the Blower

The easiest way to remove the blower is to remove the air/gas channel and blower as an assembly, then separate the blower from the assembly. Because of the way the blower is mounted in the machine, it would be very difficult to remove the blower from the machine directly.

Figure B19-1 shows how the parts are arranged.

Tools and equipment required:

- 3 mm and 4 mm Allen wrenches (traditional “L” shaped, ball-head is best)
- #25 Torx® driver
- Gas-resistant pipe dope or Teflon® tape
- Gas leak detection solution (i.e. Hercules Megabubble®)
- Container for removed parts

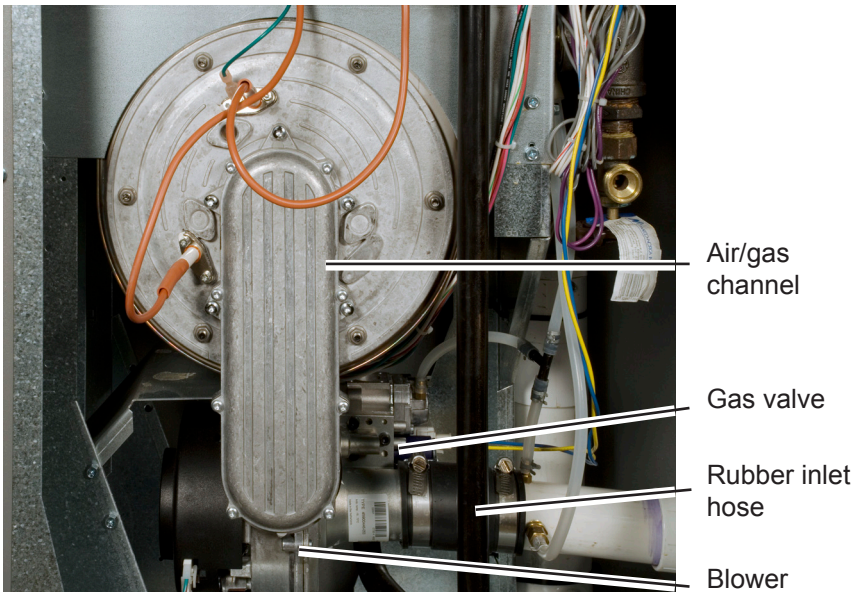


Fig. B19-1 - Blower and other parts

Procedure:

1. Turn off power to the machine. Use the main disconnect switch on the front of the machine, just above the control panel.
2. Remove the front panel.
3. Shut off the gas at the gas shutoff valve on the right side of the machine (yellow handle). See Fig. B19-2.

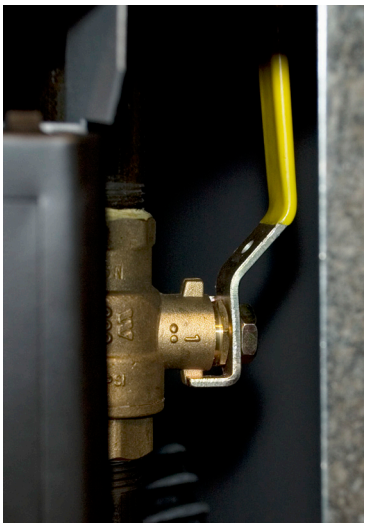


Fig. B19-2 - Gas shutoff valve (typical)

Removing and Replacing the Blower (continued)

4. Unplug the wires running to the gas valve. The connector is keyed, and can only be plugged in one way. See Fig. B19-3.
5. Disconnect the small vacuum hose running to the top of the gas valve.
6. Disconnect the wires to the blower. There are two connectors. The power wires run to the rear connector, and the control wires connect to the front. See Fig. B19-4.
7. Loosen the left hose clamp on the black rubber air inlet hose, then pull the left end of the hose away from the end of the metal inlet assembly. See Fig. B19-5.
8. The gas inlet pipe runs to the underside of the gas valve. It is attached by four 3mm socket-head cap screws, and these are difficult to reach. Figure B19-6 shows the screws as seen from below the gas valve.

   Use a 3mm Allen wrench to undo these screws. It will be hard to reach one of the screws. The best tool for this job is a traditional “L-shaped” Allen wrench, with one long leg and one short leg. You will be able to use the short leg to undo that one difficult screw.

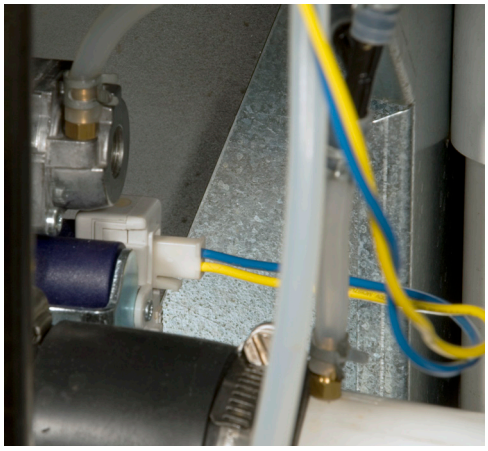


Fig. B19-3 - Wiring connector for gas valve

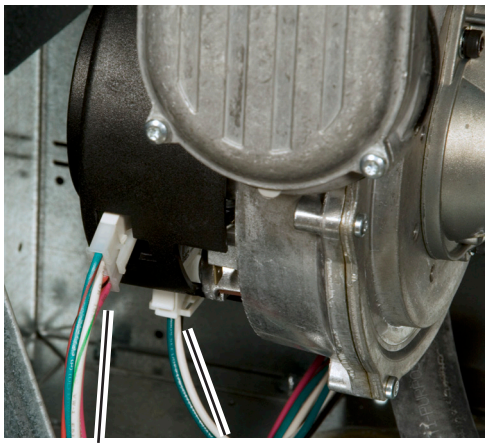


Fig. B19-4 - Wiring connections for blower

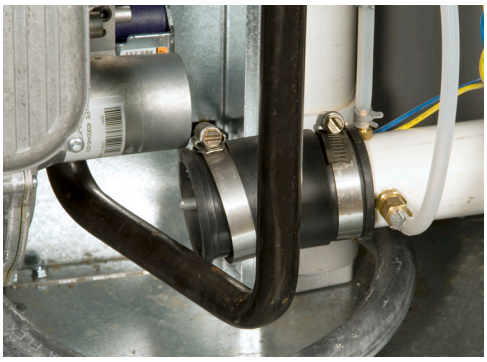


Fig. B19-5 - Loosen the left end of the rubber hose

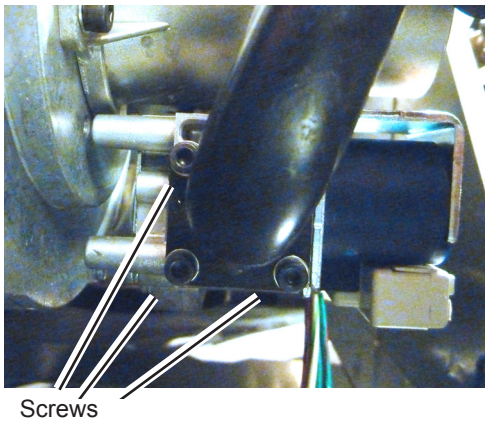


Fig. B19-6 - Four mounting screws for the gas inlet pipe, viewed from below

9. Now you can remove the air/gas channel and blower assembly from the machine. See Fig. B19-7. Remove the five #25 Torx-head screws around the air/gas channel assembly. (These are the outer screws on the front of the assembly. The inner screws attach the air/gas channel cover - do not remove these.)

   Support the assembly as you remove the last screws, so it does not fall. Figure B19-8 shows how the assembly looks once it has been removed.

10. Next, remove the gas valve and Venturi together. These are attached to the blower by two 4mm cap screws. See Fig. B19-9.

11. Remove the four 4mm screws and separate the air/gas channel from the assembly. Now the blower is free.

12. The location where you removed the Venturi is the air intake for the blower. To clean the blower, blow compressed air through the intake and spin the impeller.

13. To reassemble, reverse the procedure listed above.

14. After reassembly, check for gas leaks using a leak detection solution.

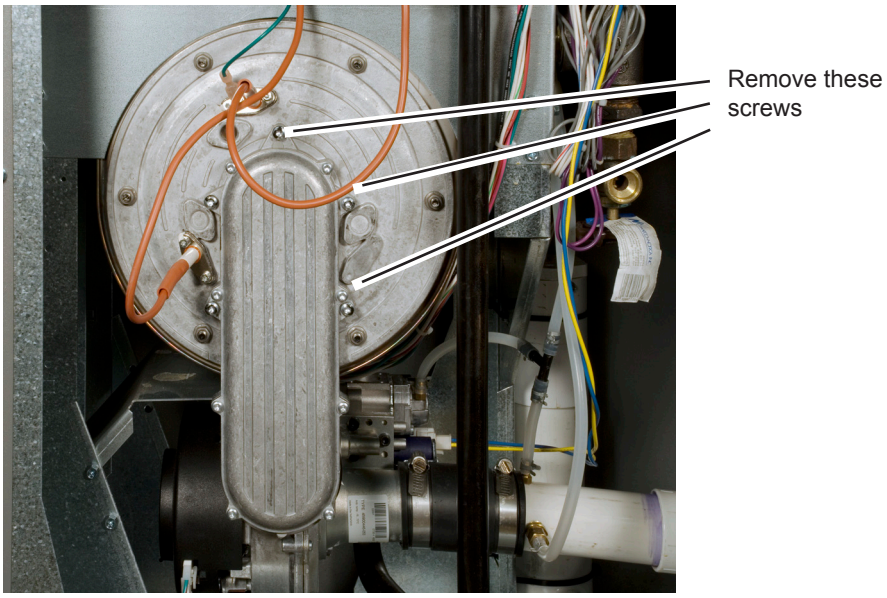


Fig. B19-7 - Removing the air/gas channel and attached blower

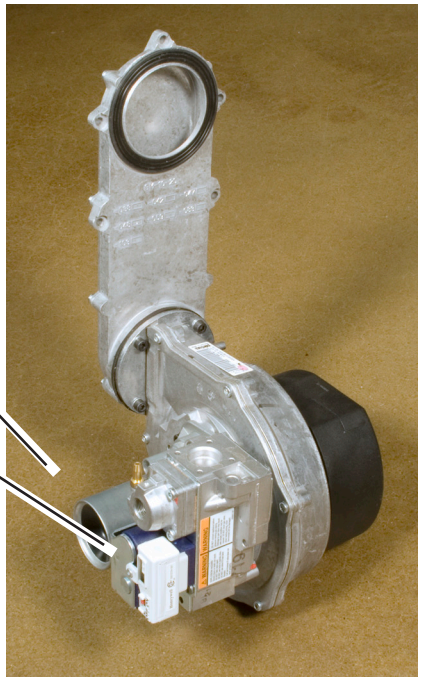


Fig. B19-8 - Blower, gas valve, and Venturi

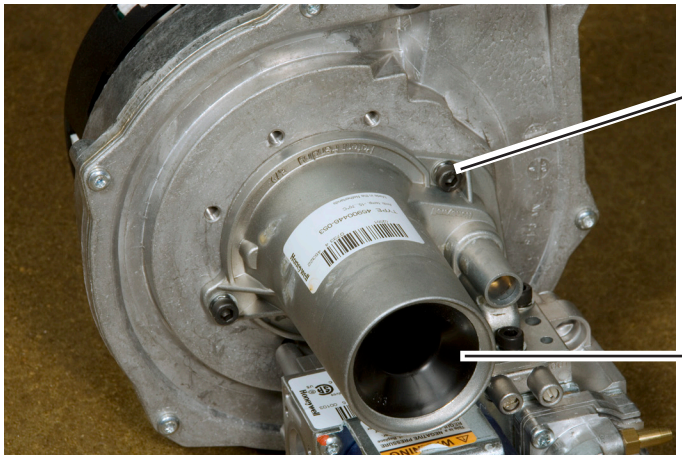
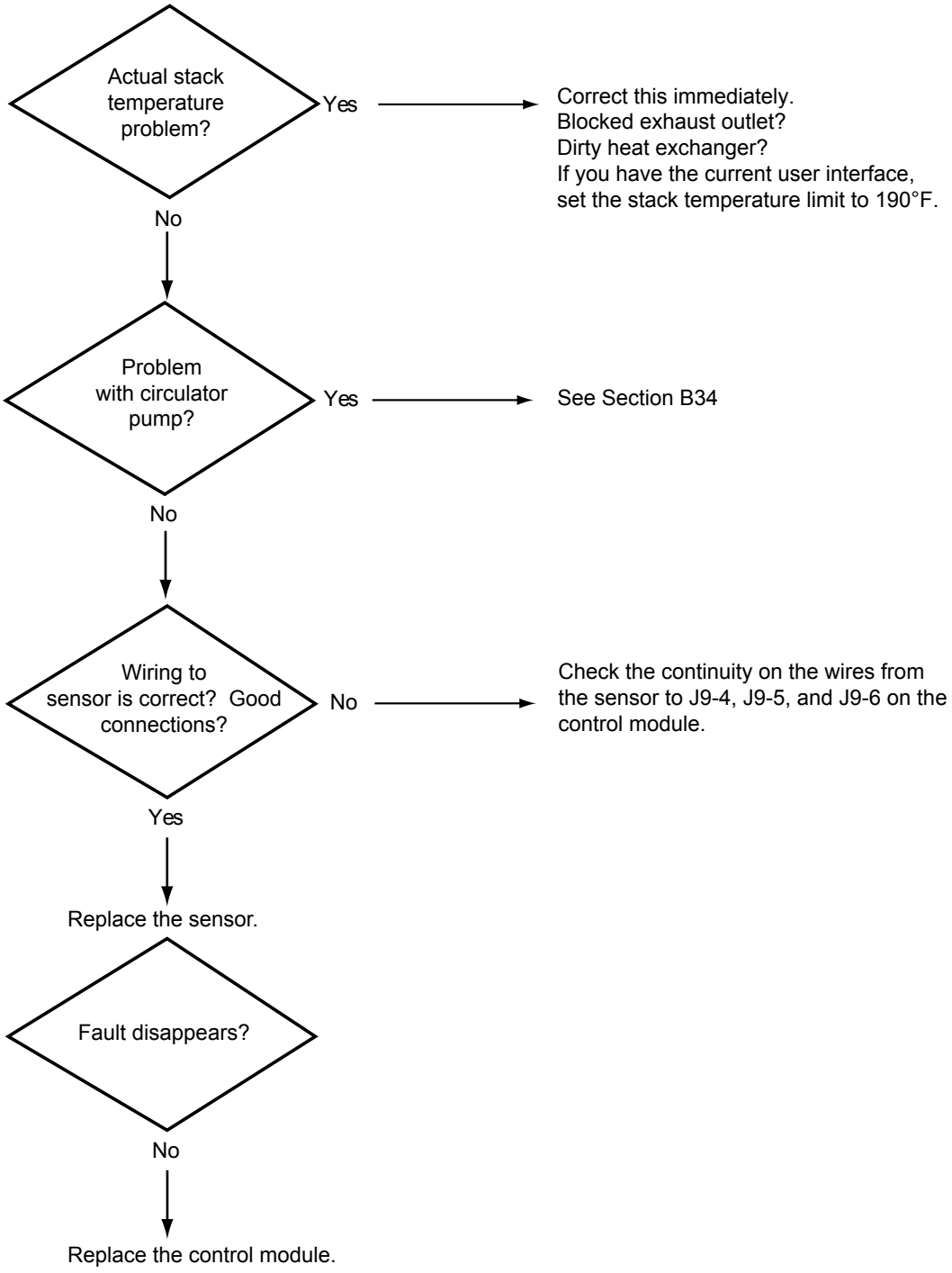


Fig. B19-9 - Removing Venturi and gas valve

B20 High Stack Temperature Fault



Removing and Replacing the Stack Temperature Limit Switch

The stack temperature limit switch will shut down the NT unit if the stack temperature rises above 195°F. This is a “duplex” sensor - it actually includes two separate thermistors. The control system constantly compares the readings from the thermistors. If there is a large difference between the readings, or if one of the thermistors is “open” or “shorted,” the control system will shut down the NT unit, and display a “Hold 95” error message.

Tools and equipment required:

- Crescent wrench or 17 mm socket

Procedure:

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. The stack temperature limit switch is mounted in the “far” end of the heat exchanger assembly (the end which is farthest from the operator control panel.) You should be able to reach this switch from the top of the unit. Remove the top panels so you can see the switch.
3. Unplug the wiring connector (four wires). The connector is locked in place by a “squeeze tab.” Press on the tab to release the connector.
4. Unscrew the sensor using the 17 mm socket or a crescent wrench. Turn counter-clockwise to unscrew the part.
5. To reassemble, reverse the process we have just described. There is no need to use pipe dope or Teflon® tape on the threaded part of the sensor.

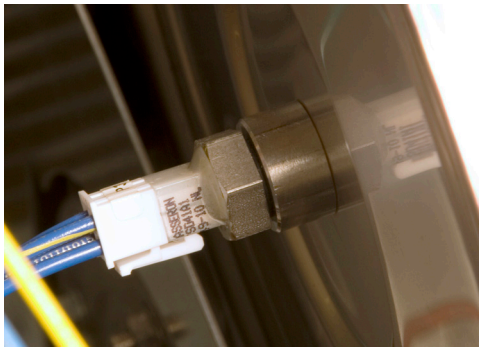


Fig. B21-1 - Stack temperature limit switch (typical)

B22 Checking the System Sensor

The System sensor is mounted in the circulating loop, and provides the input for the CH (Central Heating) function. This type of sensor can fail in either an “open” or “shorted” condition, or may become inaccurate.

On a unit with the current user interface -
Check the line on the display for “LL OPER TEMP.” If the sensor is operating normally, the unit will display a temperature on this line. The display will indicate an open sensor as “OPEN”, and a shorted sensor will be shown as “SHORT.”

On a unit with the original user interface -
Check the line on the display for “LL.” If the sensor is operating normally, the unit will display a temperature on this line. If the sensor is not working, or is disconnected, the display will present three dashes: “- - - .”

To check the sensor for accuracy, see Section B28.

B23 Checking the DHW Sensor

The DHW sensor is mounted in the indirect hot water tank, and provides the input for the DHW (Domestic Hot Water) function. This type of sensor can fail in either an “open” or “shorted” condition, or may become inaccurate.

On a unit with the current user interface -
Check the line on the display for “DHW TEMP.” If the sensor is operating normally, the unit will display a temperature on this line. The display will indicate an open sensor as “OPEN”, and a shorted sensor will be shown as “SHORT.”

On a unit with the original user interface -
Check the line on the display for “DHW.” If the sensor is operating normally, the unit will display a temperature on this line. If the sensor is not working, or is disconnected, the display will present three dashes: “- - - .”

To check the sensor for accuracy, see Section B28.

Inlet Water Temperature Sensor

B24

A typical installation for the inlet water temperature sensor is shown in Fig. B24-1. The sensor is connected to J8 4-5 on the control module. This sensor uses an electronic device called a “thermistor.” For instructions on testing the sensor, see Section B28.

To reset the control system after the inlet sensor trips:

- On a unit with the original (white) user interface -

  Press the Reset button near the lower left-hand corner of the display. This will reset the lockout, and the lockout code will disappear.

- On a unit with current user interface -

  Reset by pressing the OK button.

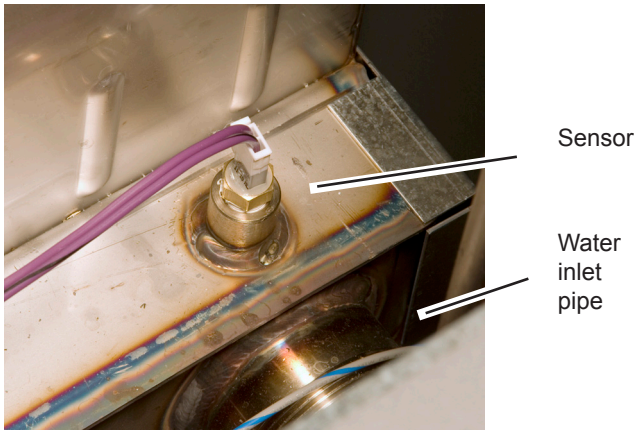


Fig. B24-1 - Inlet water temperature sensor (typical)

Removing and Replacing the Inlet Water Temperature Sensor

B25

The inlet water temperature sensor allows the control system to monitor the temperature of the water as it returns to the NT unit.

Tools and equipment required:

- Crescent wrench or 14 mm socket
- Pipe dope or Teflon® tape

Procedure:

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Isolate the boiler. Turn off the water shutoff valves located upstream and downstream of the unit.
3. Drain the boiler. The drain valve is located near the lower end of the heat exchanger.
4. The inlet water temperature sensor is mounted in the shoulder of the heat exchanger assembly, just above the point where the water inlet pipe is attached to the heat exchanger. (The inlet pipe is marked with a label on top of the unit.) Remove the top panels on the unit so you can reach the temperature sensor.
5. Unplug the wiring connector (two wires). The connector is locked in place by a “squeeze tab.” Press on the tab to release the connector.
6. Unscrew the sensor using the 14 mm socket or a crescent wrench. Turn counter-clockwise to unscrew the part.
7. To reassemble, reverse the process we have just described. Be sure to use pipe dope or Teflon® tape on the threaded part of the sensor.

B26 Outlet Water Temperature Sensor

The outlet water temperature switch allows the control system to monitor the temperature of the water as it leaves the NT unit. A typical installation for the outlet water temperature sensor is shown in Fig. B26-1. The sensor is connected to J8 8-9-10 on the control module.

This sensor assembly includes two electronic devices called “thermistors.” As long as the resistance readings from both sensors agree, the NeoTherm will continue to operate. If there is a large difference between the readings, or if one of the thermistors is “open” or “shorted,” the control system will shut down the NT unit and display a “Hold 92” error message.

For instructions on testing the assembly, see Section B28.

To reset the control system after the outlet sensor trips:

- On a unit with the original (white) user interface - Press the Reset button near the lower left-hand corner of the display. This will reset the lockout, and the lockout code will disappear.
- On a unit with current user interface - Reset by pressing the OK button.

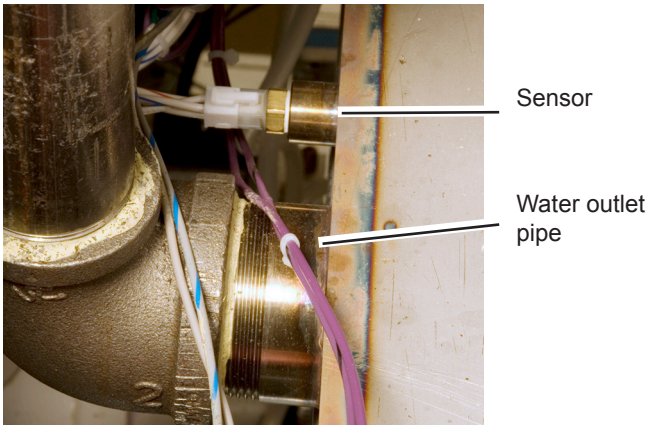


Fig. B26-1 - Outlet water temperature sensor (typical)

B27 Removing and Replacing the Outlet Water Temperature Sensor

See Fig. B26-1 for a typical installation.

Tools and equipment required:

- Crescent wrench or 14 mm socket
- Pipe dope or Teflon® tape

Procedure:

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Isolate the boiler. Turn off the water shutoff valves located upstream and downstream of the unit.
3. Drain the boiler. The drain valve is located near the lower end of the heat exchanger.

Removing and Replacing the Outlet Water Temperature Sensor (continued)

B27 cont.

4. The outlet water temperature sensor is mounted in the shoulder of the heat exchanger assembly, just above the point where the water outlet pipe is attached to the heat exchanger. (The outlet pipe is marked with a label on top of the unit.) Remove the top panels on the unit so you can reach the temperature sensor.
5. Unplug the wiring connector (four wires). The connector is locked in place by a "squeeze tab." Press on the tab to release the connector.
6. Unscrew the sensor using the 14 mm socket or a crescent wrench. Turn counter-clockwise to unscrew the part.
7. To reassemble, reverse the process we have just described. Be sure to use pipe dope or Teflon® tape on the threaded part of the sensor.

Testing the Temperature Sensors

B28

The temperature sensors used in this unit are devices called "thermistors." The electrical resistance across a thermistor drops as the temperature rises. The table below shows some typical resistance readings at different temperatures.

There are three temperature sensors mounted directly on the NT unit:

- Inlet water temperature sensor
- Combined outlet water temperature sensor and water temperature high limit (duplex sensor)
- Stack sensor (duplex sensor)

There are up to three more sensors mounted at remote locations:

- System sensor
- DHW sensor (if installed)
- Sensor for Outdoor Reset function (if installed)

Each "duplex" sensor assembly actually uses two thermistors. The control module compares the readings of the two. If the difference becomes greater than allowed, the controller declares a lockout and prevents the NeoTherm unit from firing.

To check a thermistor, unplug the sensor wires and check the resistance through the thermistor using a volt-ohmmeter. Note the temperature of the part, and check the resistance against the table. If there is an open-circuit or no resistance at all, replace the part.

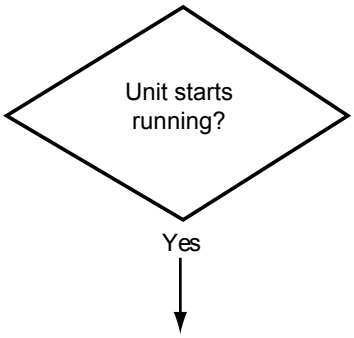
The connector for a "duplex" sensor will include four pins. Two of these run to one thermistor, and two go to the other. You should see the same resistance reading on both of the thermistors in the assembly.

°F	±°F	Ohms
-22	1.6	176.1 kΩ
-4	1.6	96.7 kΩ
14	1.6	55.2 kΩ
32	1.6	32.6 kΩ
50	1.6	19.9 kΩ
68	1.6	12.5 kΩ
77	1.6	10.0 kΩ
86	1.6	8.0 kΩ
104	1.4	5.3 kΩ
122	1.4	3.6 kΩ
140	1.4	2.4 kΩ
158	1.6	1.7 kΩ
176	1.8	1.2 kΩ
194	2.0	912 Ω
212	2.2	674 Ω
230	2.5	506 Ω
248	2.7	384 Ω
266	2.9	296 Ω
284	3.1	230 Ω
302	3.2	181 Ω

Table B28-1 - Thermistor Resistance Chart

B29 Troubleshooting the Outdoor Reset System

Disconnect 1 lead from
outdoor temperature sensor



Reconnect the sensor lead

Is Outdoor Reset enabled on the controller?

Check programming -

Example - Low boiler temp. set to 130°, heat setpoint set to 120°, so unit never fires.

Example - High and low boiler temps. set the same, so unit never fires.

The high temp. setting must always be higher than the low temp. setting.

Note -

On units with the current interface produced before October 2012 -
If the sensor for outdoor reset is disconnected, the unit will operate at the highest setpoint, as if the outdoor reset function was inoperative.

On units with the current interface produced after October 2012 -
The unit will operate at 140°F.

B30 Servicing the Transformer

The transformer changes the 120V AC input power into 24V AC for use by the controls in the NT unit. The transformer includes an integral 4 Amp circuit breaker, and is mounted on the machine frame, near the top of the unit. A reset switch on the bottom of the unit can be used to reset the circuit breaker.

The transformer is sized for the appliance load only, and should not be used to supply power to additional field devices. Additional loads may cause the circuit breaker to trip.

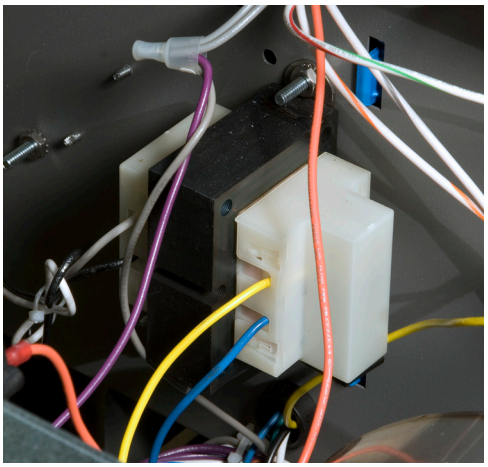


Fig. B30-1 - Transformer installation (typical)

Tools and equipment required:

- Volt-Ohmmeter
- Phillips head screwdriver (size #1)
- Deep socket for transformer mounting nuts

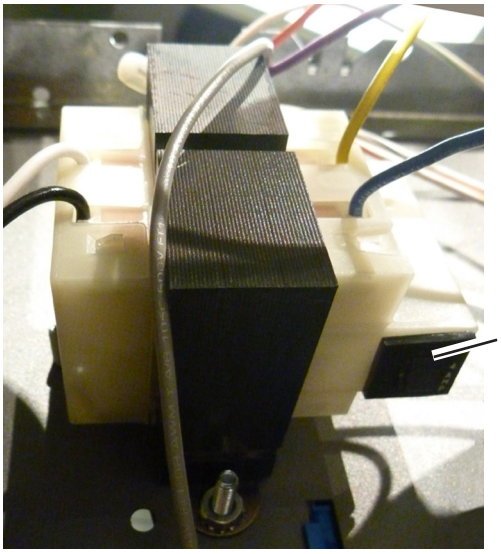


Fig. B30-2 - Reset switch on bottom of transformer (viewed from below)

Test Procedure:

It is simplest to test the transformer by checking the voltages at other points on the NT unit.

1. Turn on power to the unit.

   Warning! You will be working with sections of the machine that will carry 120V AC. Do not attempt this procedure unless you have been trained in safe techniques when working around "live" electrical parts.

2. Remove the top covers on the NT unit so you can reach the transformer.
3. Try resetting the Reset switch. If the Reset switch trips again, there is a short-circuit in the 24V AC circuitry or inside the transformer itself.
4. If the power remains on (Reset switch does not trip), you can check for normal voltages:

   120V AC input:
   Black wire on TB1 (120V hot) to white wire on TB2 (neutral)

   24V AC output:
   Blue wire on TB3 (24V hot) to yellow wire on TB4 (common)

   If the meter indicates 120V input, but there is no 24V output, this indicates a bad transformer. If there is no 24V AC output, the operator display will not light up.

Replacement Procedure:

1. Turn off the power to the NT unit. Use the power switch located above the center of the control panel.
2. Disconnect the four wires which run to the transformer. Before removing each wire, carefully note the way it is threaded through the NT unit.
   - black wire to TB1
   - white wire to TB2
   - blue wire to TB3
   - yellow wire to TB4
3. Remove the two bolts which attach the transformer to the frame of the machine.
4. To install the new transformer, reverse the procedure we have just described. Once the power has been turned on again, you may need to press the Reset switch on the bottom of the transformer.

B31 Removing and Replacing the Pressure Relief Valve

If the system pressure exceeds the relief valve setting, the pressure relief valve is designed to open and release the excess pressure and water. Note - This type of valve is designed to relieve a limited number of times during its life cycle, so it is not a good idea to "test" the valve by tripping the small metal handle on top. Sometimes when this type of valve is opened, it will not re-seat correctly, causing a slow leak. If this happens, and the valve cannot be cleared, it must be replaced.

Fig. B31-1 - Pressure relief valve (typical)

Tools and equipment required:

* Plumber's torch, solder, and flux
- Two pipe wrenches
- Pipe dope or Teflon® tape

Procedure:

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. The pressure relief valve is mounted on a pipe that extends up a few inches above the top panel of the NT unit.
3. Disassemble and remove the drain pipe.
4. Unscrew the valve from the vertical pipe using the two pipe wrenches.
5. The replacement valve must be the correct size and capacity to match the size of the NT unit. Check the old valve for two important numbers:
   - The capacity of the old valve, listed in BTU
   - The relief pressure of the old valve, listed in p.s.i.

   These numbers will be marked on the body of the valve. Check for this before you get a replacement.

   For example, a 105 NT unit (105,000 BTU/hr) might have a valve with ratings of 535,000 BTU and 30 p.s.i.

   The replacement valve must have ratings for both BTU and psi which ***are the same as or higher*** than the ratings on the old valve
6. Wrap a piece of Teflon® tape around the threads on the end of the vertical pipe. Install the new valve using the two pipe wrenches.
7. Reassemble the drain pipe.

   WARNING! Always re-install the drain pipe. If the pressure relief valve were to open without the drain pipe in place, the boiling water could shoot out, causing personal injury or property damage. Most plumbing codes call for the drain pipe to extend straight down to a point about 6" above the floor. Check your local code.

Ignitor Assembly

The ignitor assembly is a two-rod system that consists of a ground rod and a spark rod.

Adjustment Procedure:

1. Shut off the 120V power supply to the unit.
2. Turn off all manual gas valves connecting the unit to the main gas supply line.
3. Remove the front door of the unit to gain access to the ignitor assembly.
4. The end of each spark rod should be at least 1/4" away from the burner.
5. Set the gap between the spark rods at 3/16" ± 1/16."

Replacement Procedure:

1. Shut off the 120V power supply to the unit.
2. Turn off all manual gas valves connecting the unit to the main gas supply line.
3. Remove the front door of the unit to gain access to the ignitor assembly.
4. Remove the two wires connected to the assembly.
5. Remove the two bolts connecting the ignitor assembly to the burner door. Remove the old ignitor assembly.
6. Install a new assembly by reversing the instructions listed above. Replace the ignitor assembly gasket if it is damaged.

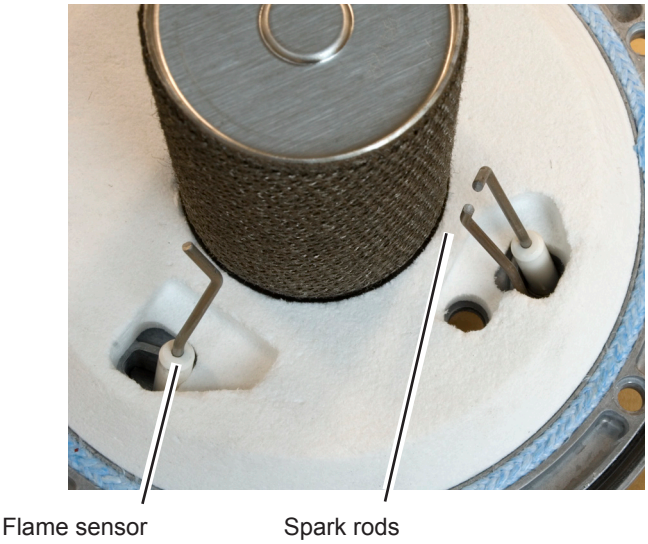


Fig. B32-1 - Spark rods and flame sensor

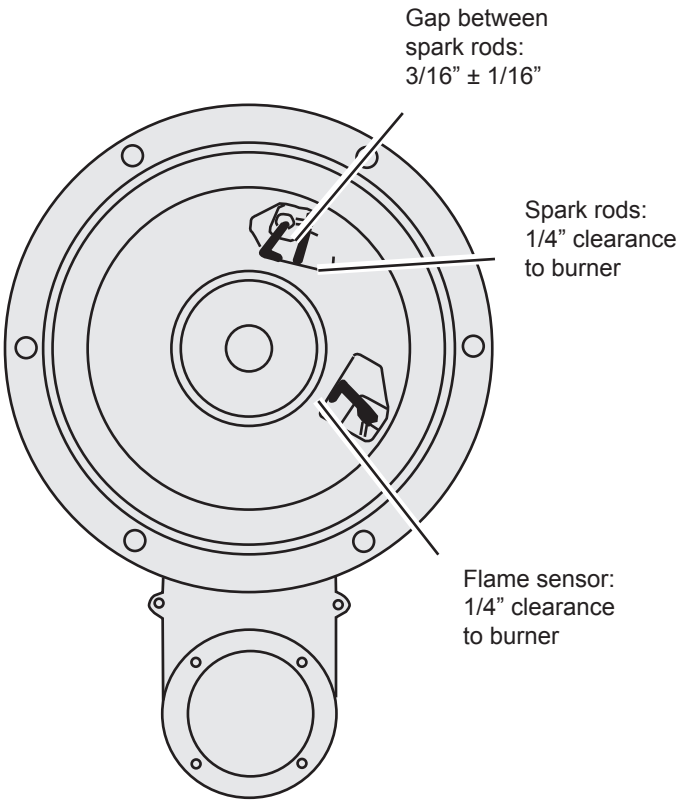


Fig. B32-2 - Correct setting for spark gap

B33 Flame Sensor

The flame sensor is a single-rod system, and is mounted in the front cover of the heat exchanger. Over time, this sensor can become tarnished or coated. (This will happen more quickly if the NT unit has been operating often at a low firing rate.) The flame sensor has a protective coating.

Important! Do not use sandpaper, steel wool, or emery board to clean the flame sensor. These materials will clean the sensor, but they will also remove the protective coating. The sensor will work, but only for a short time.

Fig. B33-1 - Correct way to clean the flame sensor

Adjustment Procedure:

1. Shut off the 120V power supply to the unit.
2. Turn off all manual gas valves connecting the unit to the main gas supply line.
3. Remove the front door of the unit to gain access to the flame sensor electrode.
4. The end of the flame rod should be at least 1/4" away from the burner. See Fig. B32-2.

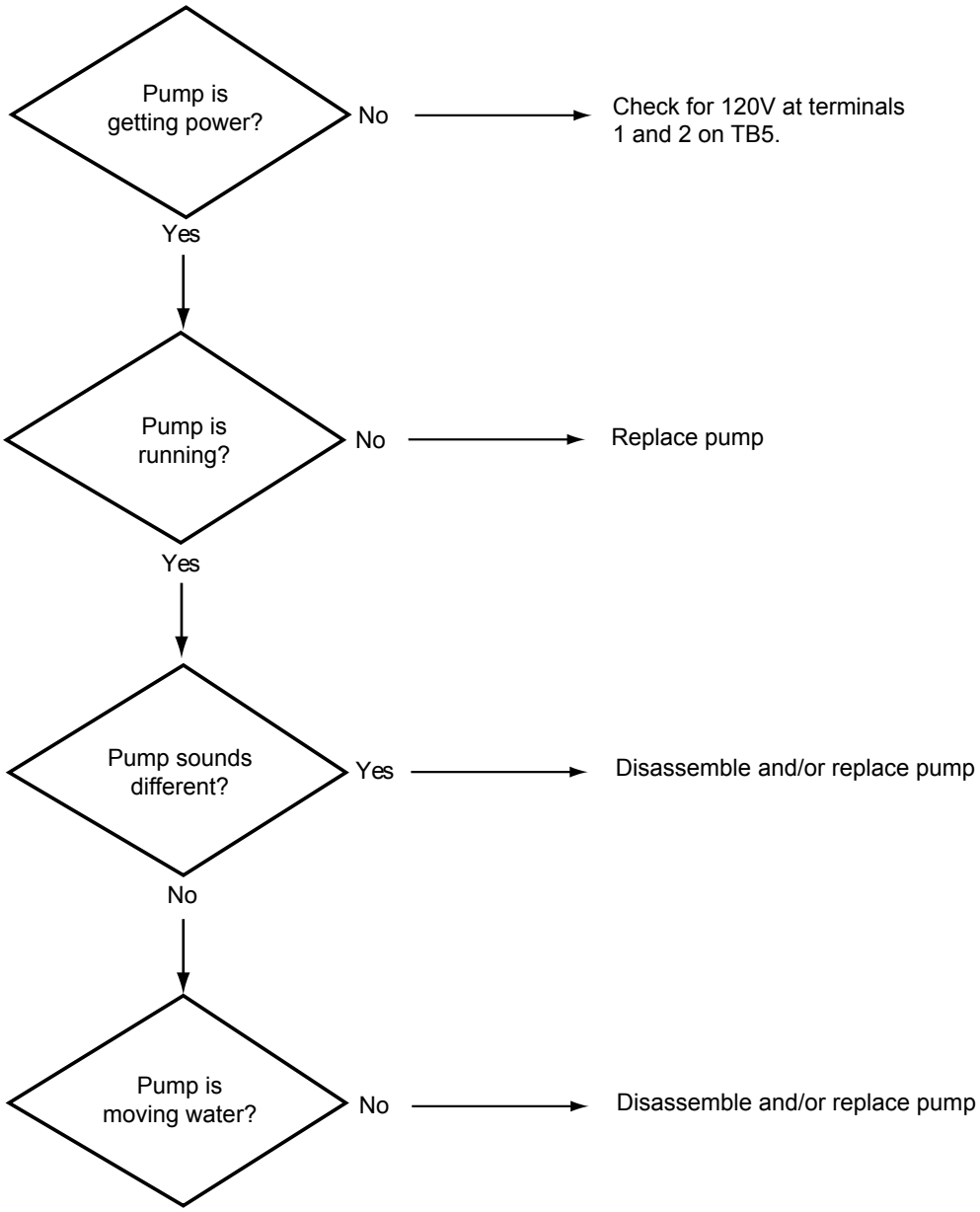
Cleaning or Replacement Procedure:

1. Shut off the 120V power supply to the unit.
2. Turn off all manual gas valves connecting the unit to the main gas supply line.
3. Remove the front door of the unit to gain access to the flame sensor electrode.
4. The best way to clean the flame sensor is to use a dollar bill, as shown in Fig. B33-1. The paper used in the bill is just abrasive enough to clean the sensor correctly, without removing the protective coating.
5. If you need to replace the part, remove the flame sensor wire from the electrode.
6. Remove the two bolts fastening the electrode to the burner door. Remove the old flame sensor.
7. Install a new assembly by reversing the instructions listed above. The end of the flame rod should be at least 1/4" away from the burner. See Fig. B32-2. Replace the flame sensor gasket if it is damaged.

Pump Fault

B34

A problem with the circulator pump could appear as a #79 error (Outlet High Limit). It could also appear as a #63 error (LCI - Limit Control Input) if the interlock loop includes a flow switch. The SOLA controller also can display error #51 - Pump Fault.



About Correct Combustion

When the unit is firing, the gas valve must always supply the correct amount of gas to match the amount of air going through the burner. The ratio of gas to air remains constant, but the control module adjusts the blower speed to adjust for changes in heat load. If the ratio of gas to air is not correct, this will cause poor combustion, and this can cause several different problems:

- Poor combustion can cause the unit to produce carbon monoxide, and this may lead to personal injury or death.
- Poor combustion will make the unit run less efficiently, and cause it to use more gas than necessary.
- Poor combustion can cause maintenance problems, including sooty exhaust and a fouled heat exchanger. Eventually this can reduce the life of the unit.

Before the unit leaves the factory, it is test-fired and the combustion settings are adjusted. However, once the unit is installed, the airflows (air inlet and exhaust) will be different, because of the different arrangements of the inlet and exhaust piping. This is why the combustion settings must be re-set after installation. (For the setup procedure, see the instructions in the following sections.)

Depending on the gas/air mixture, the burner can operate in three different ways:

- When the burner is burning correctly (correct gas and air mixture), enough air is available to combine with the gas, and the flame produces CO_2 (“carbon di-oxide”) and H_2O (water). (“Carbon di-oxide” includes two oxygen atoms attached to every carbon atom.)
- When the burner cannot get enough air, the flame is “starved” for air. The flame continues to burn, but since enough oxygen is not available the result is CO (“carbon mon-oxide”). (“Carbon mon-oxide includes just one oxygen atom attached to each carbon atom.) This is dangerous because carbon mon-oxide can replace the oxygen in the air you are trying to breathe. This is the reason for the warnings we have included in this manual.
- Another kind of problem can happen if the flame has too much air for the amount of gas supplied. In this case, the extra air cools the flame temperature. The flame lifts off of the burner surface, and begins to produce too much CO.

Of course, the main concern is that bad combustion is potentially dangerous, but bad combustion can also cause maintenance problems in the unit. A “sooty” flame can eventually create enough soot to plug up the heat exchanger. So the goal is to set up the burner so that it is always producing the correct amount of CO_2, and the minimum amount of CO. To do this, you use two adjustments on the gas valve: the high- and low-fire CO_2 adjustment screws.

As you adjust the combustion, you will need to set the control system to the High Fire and Low Fire conditions. NeoTherm units have been produced using two different types of user interfaces. In the following section we have listed instructions for both types of interfaces. Please check Section D1 at the end of this manual to identify the type of interface used on your unit.

C2 Combustion Adjustment Procedure - Units with Original (White) User Interface

⚠ WARNING

Improper adjustment may lead to poor combustion quality, increasing the amount of carbon monoxide produced. Excessive carbon monoxide levels may lead to personal injury or death.

Equipment required:

- Combustion analyzer
- 2 mm Allen wrench

Procedure:

1. Measure the CO_2 and O_2 in the flue products at High Fire. The NeoTherm must be forced go to High Fire to obtain accurate results.

   How to get there: From the "Home" screen, press and hold the Next button for 3 seconds to go to Diagnostic mode. Press the Next button several times until you see "Rate" and "100%." The NT unit is now forced into high fire mode for 5 minutes.

   The CO_2 readings should be between the values shown in Table C2-1. If the CO_2 is not within the range shown, adjustments may be made. To adjust the high fire CO_2, locate the high fire adjuster screw as shown in Fig. C2-1. Slowly make adjustments in 1/16 of a revolution increments until the CO_2 is within the range identified. For the high fire adjustment, turning the screw counter-clockwise (CCW) opens the adjustment and makes the mixture richer.

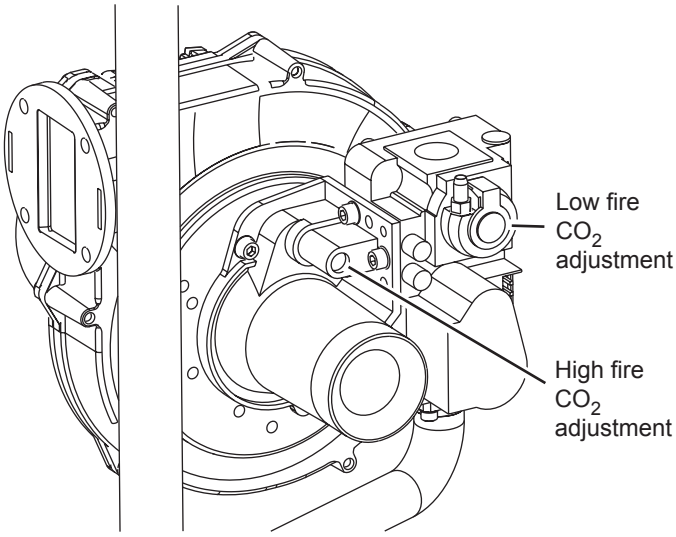


Fig. C2-1 - High- and low-fire adjustments on gas valve - NT 85 through NT 285

Gas Type	High Fire CO_2	Low Fire CO_2
Natural	8.8% to 9.0%	0.5% lower than high fire CO_2
Propane	9.8% to 10.0%	0.5% lower than high fire CO_2

Table C2-1 - CO_2 Range

2. Once you have completed the high fire combustion test, measure the CO_2/O_2 in the flue products at Low Fire.

   How to get there: Use the Down arrow to set the "Rate" to "20%." The NT unit is now forced to low fire mode for 5 minutes.

   The CO_2 readings should be between the values shown in Table C2-1. If the CO_2 is not within the range shown, adjustments may be made. To adjust the low fire CO_2, locate the low fire adjuster screw as shown in Fig. C2-1. Slowly make adjustments in 1/16 of a revolution increments until the CO_2 is within the range identified. For the low fire adjustment, turning the screw clockwise (CW) opens the adjustment and makes the mixture richer.

3. Repeat steps 2 and 3 to confirm that the CO_2 readings are within the required ranges. Adjust each setting again if necessary.

4. Confirm that the differential pressure is still within the appropriate range.

5. If any of the measurements cannot be adjusted to the specified ranges or the CO levels are above 150 ppm when adjusted, see Section C4, "Troubleshooting Combustion Problems."

6. Remove the differential pressure gauge from the air and gas pressure taps making sure to close all ports after the gauge has been removed.

C3 Combustion Adjustment Procedure - Units with Current User Interface

⚠ WARNING

Improper adjustment of the high fire and low fire settings may lead to poor combustion, increasing the amount of carbon monoxide produced. Excessive carbon monoxide levels may lead to personal injury or death.

Equipment required:

- Flue product analyzer
- 2 mm Allen wrench

Procedure:

1. Start by measuring the CO_2 and O_2 in the flue products at high fire. The controller has a feature that makes it easy to go directly to the high fire condition. The unit will operate at high fire for 5 minutes, then shut down automatically.

   How to get there: From the "Home" screen, press "I" to go to "Info/ Install." Choose "Test," then go to "Forced Rate." Select "Set High Fire," then select "Start Test."

   The CO_2 readings should be between the values shown in Table C3-1. If the CO_2 is not within the correct range, adjust the high fire setting. See Fig. C3-1 to locate the high fire adjuster screw. Slowly make adjustments (1/16 of a turn at a time) until the CO_2 is within the range shown in the table. For the high fire adjustment, turning the screw counter-clockwise (CCW) opens the adjustment and makes the mixture richer.

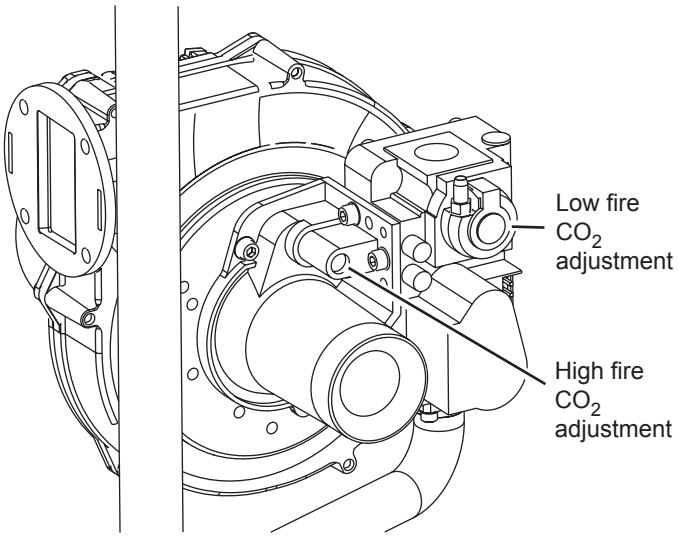


Fig. C3-1 - High- and low-fire adjustments on gas valve - NT 85 through NT 285

Gas Type	High Fire CO_2	Low Fire CO_2
Natural	8.5% to 9.0%	0.5% lower than high fire CO_2
Propane	9.8% to 10.0%	0.5% lower than high fire CO_2

Table C3-1 - CO_2 Range and Pressure Differential

2. Next, measure the CO_2 and O_2 in the flue products at low fire. The NeoTherm can be forced to remain in low fire during the setup.

   How to get there: From the "Home" screen, press "I" to go to "Info/ Install." Choose "Test," then go to "Forced Rate." Select "Set Low Fire," then select "Start Test."

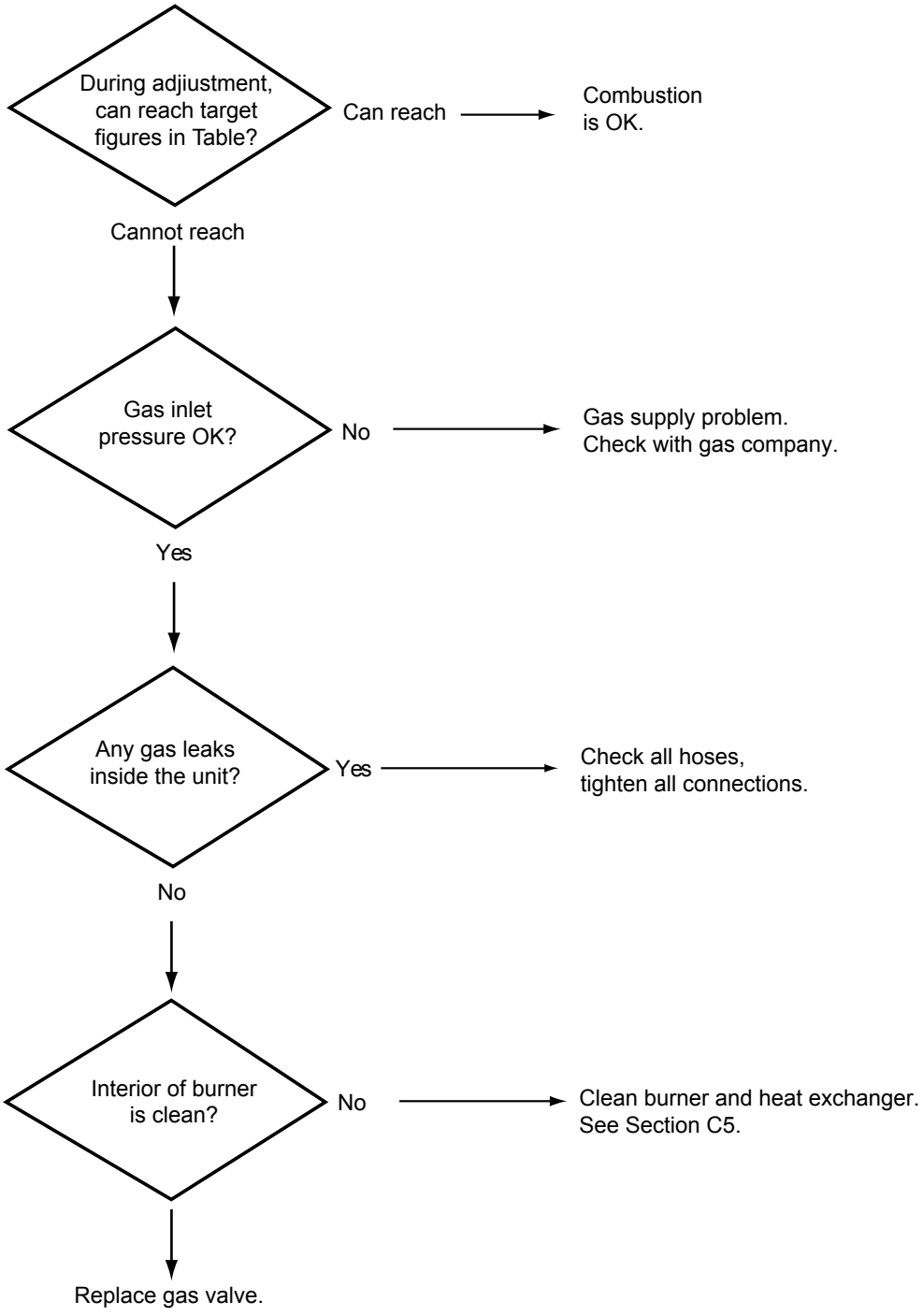
   Again, the CO_2 readings should be between the values shown in Table C3-1. See Fig. C3-1 to locate the low fire adjuster screw for your unit. For the low fire adjustment, turning the screw clockwise (CW) opens the adjustment and makes the mixture richer.

3. You might have to go back and forth between high fire and low fire several times before the CO_2 readings are correct in both cases. Repeat steps 2 and 3 and continue to adjust until the CO_2 readings are stable.

4. Check to see that the differential pressure is still within the correct range.

5. If any of the measurements cannot be adjusted to the specified ranges or the CO levels are above 150ppm when adjusted, see Section C4, "Troubleshooting Combustion Problems."

6. Remove the differential pressure gauge from the air and gas pressure taps. Be sure to close all ports after you remove the gauge.


During adjiustment, can reach target figures in Table?
Can reach
Combustion is OK.
Cannot reach
Gas inlet pressure OK?
No
Gas supply problem. Check with gas company.
Yes
Any gas leaks inside the unit?
Yes
Check all hoses, tighten all connections.
No
Interior of burner is clean?
No
Clean burner and heat exchanger. See Section C5.
Replace gas valve.

Cleaning the Burner and Heat Exchanger

The buildup of black carbon soot on the external surfaces of the heat exchanger can be caused by one or more of the following: incomplete combustion, combustion air problems, venting problems, and short-cycling. Soot buildup or other debris on the heat exchanger may restrict the flue passages.

Laars recommends the unit be inspected once a year, and cleaned if necessary. If a condensing boiler is operated consistently at high temperatures, it may need to be cleaned more often.

In order to clean the unit, it is necessary to remove the front of the heat exchanger. Because of the way the air-gas channel is attached to the blower, the simplest way to do this is to remove the whole air-gas channel/ blower/ gas valve assembly. This will require you to disconnect the gas inlet first.

Figure C5-1 shows how the parts are arranged.

Tools and equipment required:

Disassembly/ Reassembly:

- Combustion analyzer
- 3 mm and 4 mm Allen wrenches (traditional “L” shaped, ball-head type is best)
- Socket wrench with 10 mm socket and 4” extension
- #25 Torx® driver
- Gas leak detection solution (i.e. Hercules Megabubble®)
- Electrical tape
- Replacement gasket for front of heat exchanger
- Container for removed parts

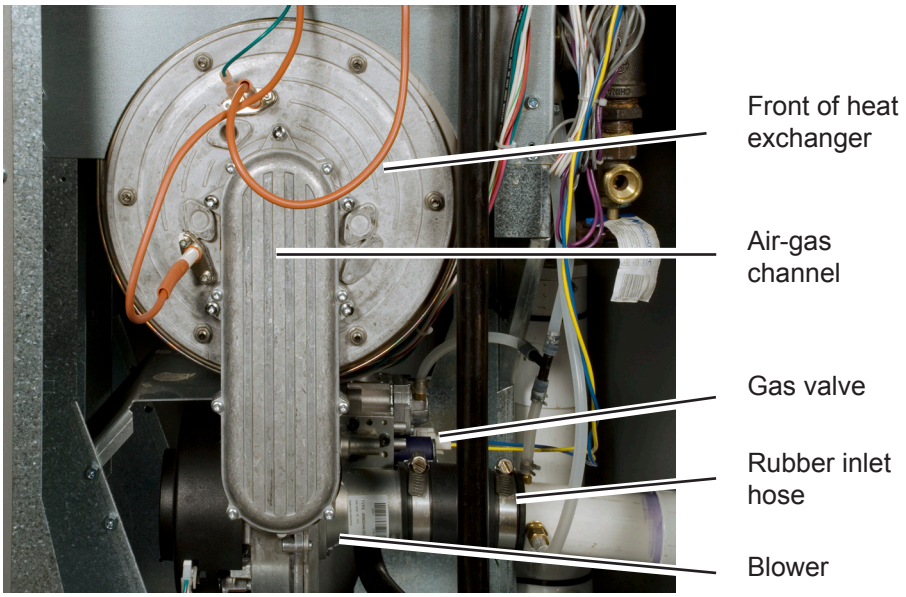


Fig. C5-1 - Front of heat exchanger and other parts (typical - NT105 shown)

Cleaning:

- Long-handled toilet brush or other soft brush
- Furnace vacuum (i.e. SootMaster ®)
- Drain hose (approx. 6’)
- White vinegar

Cleaning the Burner and Heat Exchanger (continued)

Disassembly Procedure:

1. Turn off power to the machine. Use the main disconnect switch on the front of the machine, just above the control panel.
2. Remove the front panel.
3. Shut off the gas at the gas shutoff valve on the right side of the machine (yellow handle).
4. Unplug the wires running to the gas valve. The connector is keyed, and can only be plugged in one way.
5. Disconnect the small vacuum hose running to the top of the gas valve.
6. Disconnect the wires to the blower. There are two connectors. The power wires run to the rear connector, and the control wires connect to the front.
7. Loosen the left hose clamp on the black rubber air inlet hose, then pull the left end of the hose away from the end of the Venturi.

Fig. C5-2 - Gas shutoff valve (typical)

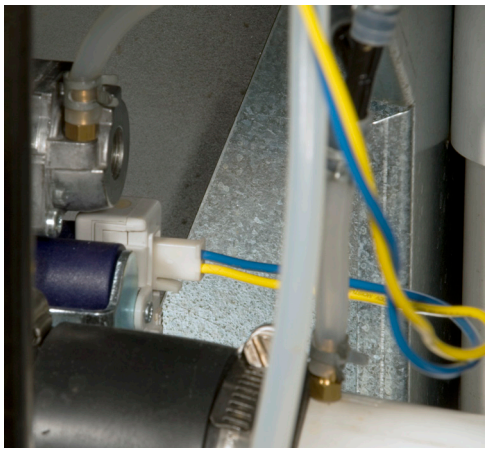


Fig. C5-3 - Wiring connector for gas valve

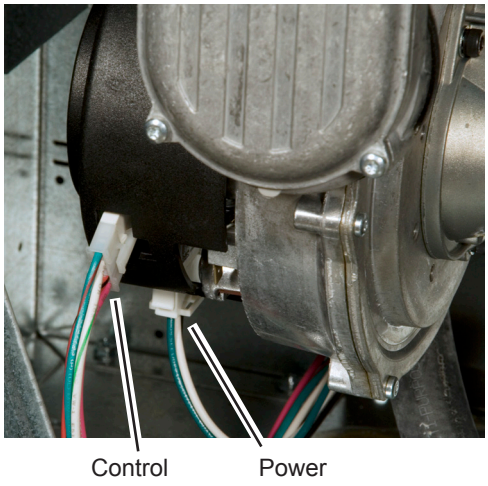


Fig. C5-4 - Wiring connections for blower

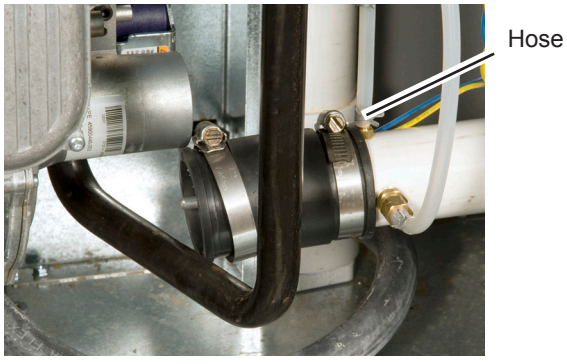


Fig. C5-5 - Loosen the left end of the rubber hose

8. The gas inlet pipe (black pipe) runs to the underside of the gas valve. It is attached by four 3mm socket-head cap screws. The photo below shows the screws as seen from below the gas valve.

   Use a 3mm Allen wrench to undo these screws. It will be hard to reach the right front screw. The best tool for this job is a traditional "L-shaped" Allen wrench, with one long leg and one short leg. You will be able to use the short leg to undo that one difficult screw.

9. Now you can remove the air-gas channel and blower assembly from the machine. Remove the five #25 Torx-head screws around the air-gas channel. (These are the outer screws on the front of the assembly. The inner screws attach the cover - do not remove these.)

   Support the assembly as you remove the last screws, so it does not fall.

10. Fig. C5-8 shows how the front of the unit looks at this point.

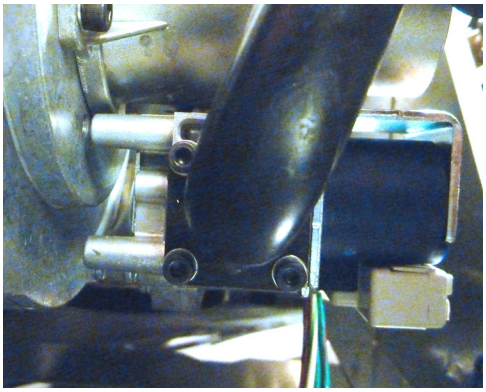


Fig. C5-6 - Four mounting screws for the gas inlet pipe (viewed from below)

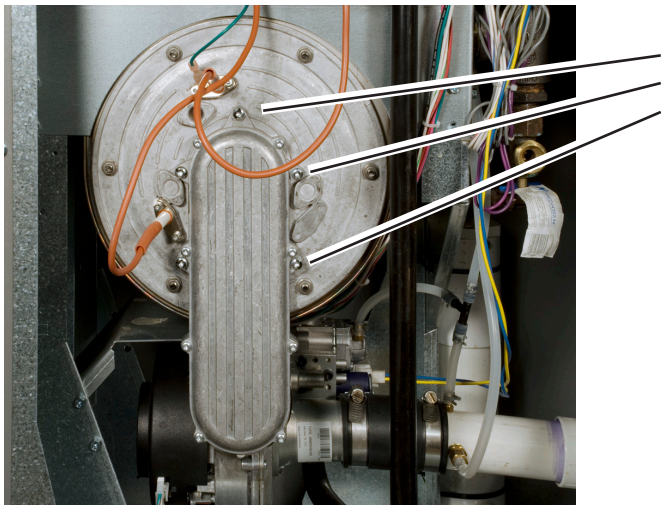


Fig. C5-7 - Removing the front plate with attached air-gas channel and blower

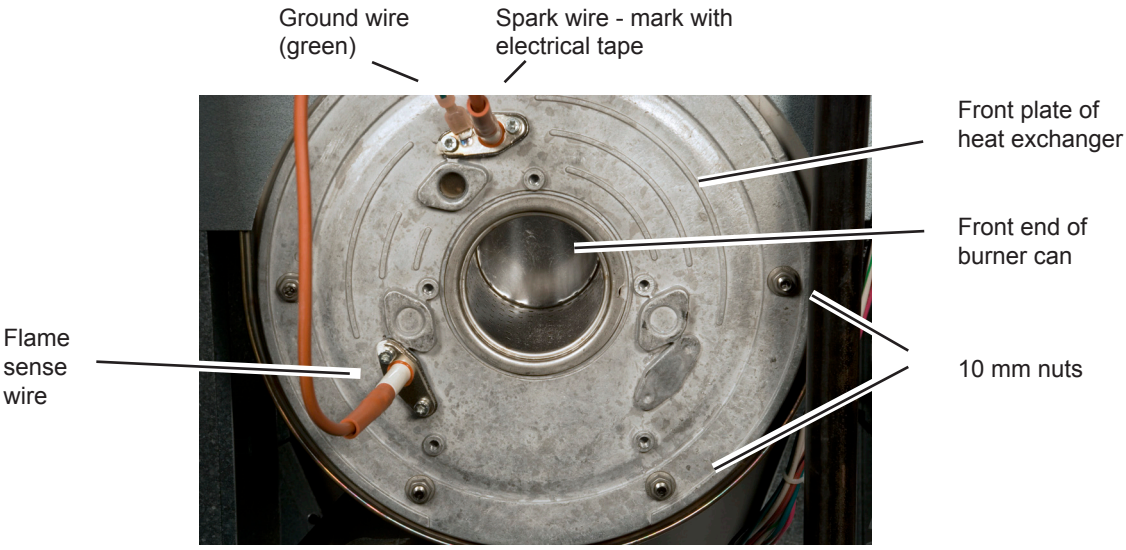


Fig. C5-8 - Front plate of heat exchanger with air-gas channel removed

Cleaning the Burner and Heat Exchanger (continued)

11. Note the two large wires running to this assembly. The spark wire and the flame sense wire look alike. ***The unit will not run if you reverse these wires.*** Before removing the wires, mark the spark wire with a piece of electrical tape. Also disconnect the green ground wire.

12. Pull out the burner can. Figure C5-9 shows how the can looks once it has been removed. The can shown here is new, so it is completely clean. On a used unit, you will see some soot or dust on the thin metal vanes on the outside of the can. Blow soot or dust off of the vanes using compressed air (50 psi max.). Wipe out the inside of the can with a non-detergent cleaner like Windex®.

    Note - Be careful when handling the burner can. The thin metal vanes are delicate, and can be damaged easily.

13. Once the burner can has been removed, remove the front of the heat exchanger. Undo the six 10mm nuts. As you remove the burner door, note the position of the large black gasket.

14. The flame sensor is mounted in the front cover of the heat exchanger. Over time, this sensor can become tarnished or coated. (This will happen more quickly if the NT unit has been operating often at a low firing rate.) The flame sensor has a protective coating.

    Important! Do not use sandpaper, steel wool, or emery cloth to clean the flame sensor. These materials will clean the sensor, but they will also remove the protective coating. The sensor will work, but only for a short time.

    The best way to clean the flame sensor is to use a dollar bill, as shown in Fig. C5-10. The paper used in the bill is just abrasive enough to clean the sensor correctly, without removing the protective coating.

    Note - The white ceramic "refractory" material on the inside of the heat exchanger cover is brittle, and can be damaged easily. Handle the heat exchanger cover carefully.

Fig. C5-9 - Burner can removed

Fig. C5-10 - Correct way to clean the flame sensor

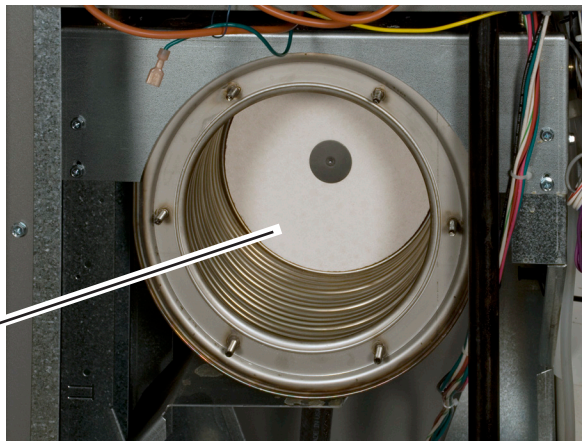


Fig. C5-11 - Inside of heat exchanger (new unit)

15. Figure C5-11 shows the inside of the heat exchanger.

    Black carbon soot can build up on the coils as a result of poor combustion, combustion air problems, venting problems, or short-cycling. This can reduce the efficiency of the unit or plug up the flue passages. Your job is to get all of this extra material out of the heat exchanger so that it can operate properly.

    The heat exchanger in Fig. C5-11 is new, so it is clean. Figure C5-12 is a photo of a dirty heat exchanger.

    This appearance is normal. However, sometimes a heat exchanger can be really dirty. Figure C5-13 shows an example.

Cleaning Procedure:

1. Attach one end of the hose to the condensate drain located under the heat exchanger. Run the other end of the hose to a bucket or drain. See Fig. C5-14.

Fig. C5-14 - Drain hose connected under the heat exchanger

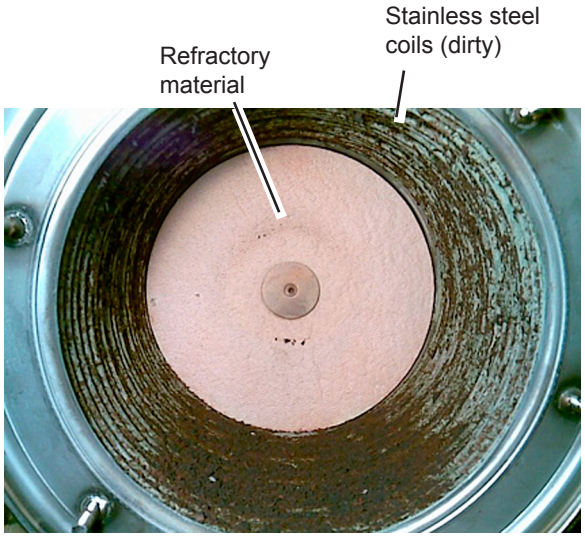


Fig. C5-12 - Dirty heat exchanger

Fig. C5-13 - Very dirty heat exchanger

Cleaning the Burner and Heat Exchanger (continued)

2. Clean the heat exchanger by brushing away any soot with the toilet brush, and collecting the dust using a vacuum cleaner. Use the vacuum to remove any mineral granules.

   Caution! Do not use a stiff brush with wire bristles. This can scratch the tubes on the heat exchanger.

   Note - It is not necessary to remove the refractory material at the far end of the heat exchanger.

3. Once the tubes are clean, rinse them with white vinegar. You do not need a lot of vinegar to do this - just enough to flush any remaining dust out of the spaces between the coils.

Reassembly Procedure:

1. To reassemble, reverse the procedure we have just listed.
2. Replace the gasket on the inner surface of the cover for the heat exchanger. Figure C5-15 shows how the gasket should sit in its slot. Replace the gasket (p/n R2069400) if it is damaged.
3. When attaching the front cover of the heat exchanger, tighten the nuts in a cross-pattern. See Fig. C5-16. (If you tighten all of the nuts on one side first, this might bend or distort the cover.)
4. The gas valve includes a rubber washer. See Fig. C5-17. Be sure to insert this in the correct position when replacing the valve.
5. The gas valve has an On/Off switch. When replacing the valve, be sure this is set to On.
6. When re-attaching the gas inlet, remember to position the O-ring correctly. Replace the O-ring if it is damaged. To connect the gas inlet pipe, start by inserting the right rear screw, but do not tighten it completely. This will make it easier to line up the right front screw.
7. Check for gas leaks using a leak detection solution.
8. Finish reassembling the unit and turn on the power and gas. Check for proper venting and combustion air. Fire the boiler and check the combustion using a combustion analyzer.

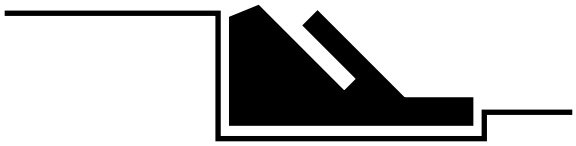


Fig. C5-15 - Gasket in correct position

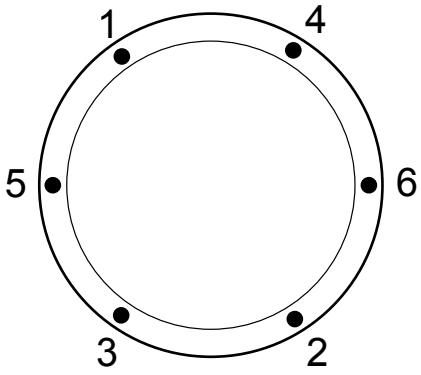


Fig. C5-16 - Tightening sequence for nuts on front cover

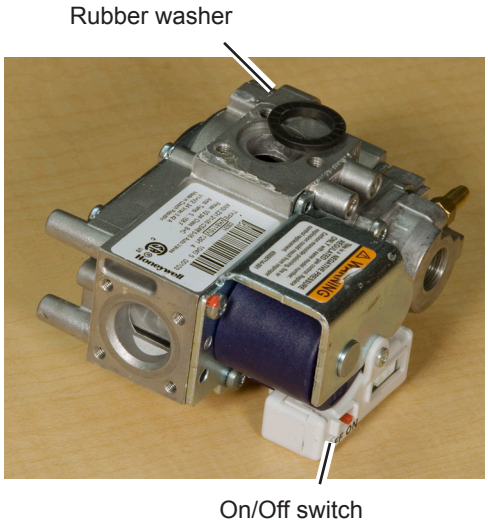


Fig. C5-17 - Gas valve and rubber washer

There are two main parts to the control system on a NeoTherm unit:

- The “controller” - This is the control module that contains the computer that actually operates the unit. The controller is located inside the cabinet of the unit.
- The “user interface” - This is the control panel that allows the operator to change control settings and get readings from the unit. The user interface is mounted on the front of the unit.

NeoTherm units have been produced with two different types of user interfaces, as shown below. Notice that Laars has been using the same *control module* throughout (the SOLA controller), but the *user interfaces* were changed in 2012. (There were actually two versions of the current user interface, issued before and after October 2012. There are slight differences in the way these two versions operate.)

The type of interface used on your unit will affect the way you navigate between the different control functions. In the following sections, we will include quick summaries of the instructions for the two types of interfaces.

Fig. D1-1
Original (“white”) user interface - 2012 and earlier

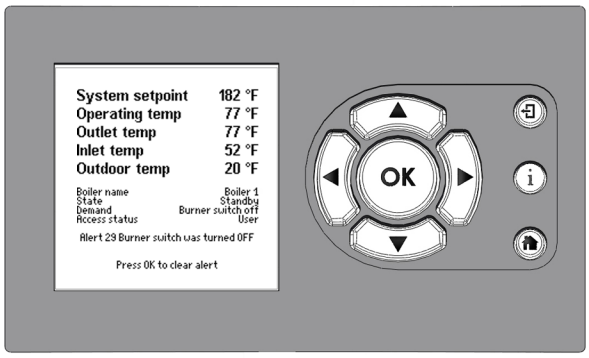


Fig. D1-2
Current user interface - production after 2012

D2 Using the Original (White) User Interface

This interface was used on all NeoTherm models produced through 2012.

There are a few features on this interface that you should know about -

- When the NeoTherm unit is first turned on, the interface will go through a self-test routine for 90 seconds. During this time, none of the buttons will work. Just wait for the self-test to be completed before you try to use the interface.
- The interface records the last lockout and alert codes, but these are erased if the interface is reset or power to the NeoTherm unit is turned off. (We will explain how to handle lockouts on this interface in Section D3.)
- Whenever you change a setpoint or value, you must press the Done button. If you do not do this, the interface will continue to use the old setpoint or value.

The display navigation is divided into three operating modes: User, Setup, and Diagnostic.

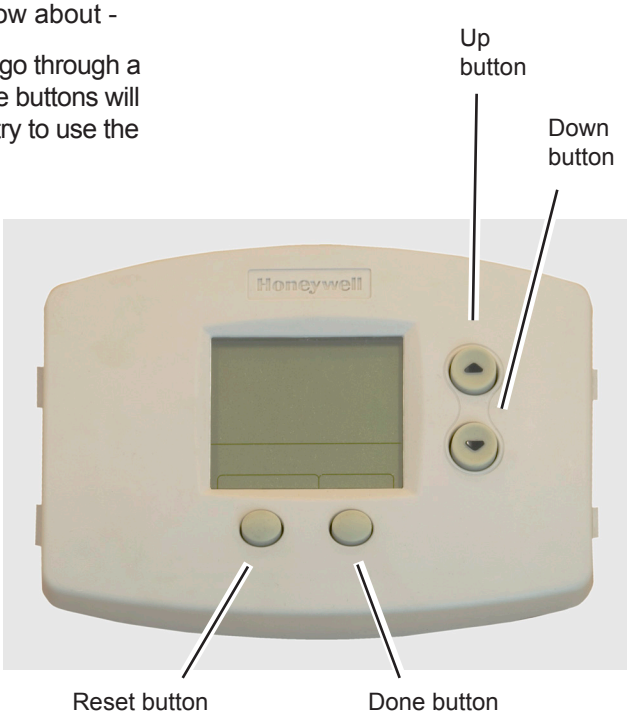


Figure D2-1 -Typical display on original (white) user interface

User Mode

Normally the unit will display the User mode screen shown to the right. Notice the entry for Outlet in the upper left-hand corner. This means the interface is displaying the current outlet temperature.

To check the setpoint for Central Heat, press the Up button. Use the Up or Down buttons to change the setpoint. ***Important*** - You must press the Done button to save the new setpoint, or the interface will use the old setpoint.

To go to the next item in this menu, press the Next button. The interface will show the inlet water temperature. Use the Next button to step through the other items in this menu. See the table to the right.

If you want to change the DHW (domestic hot water) setpoint, use the same procedure we have just described - use the Up and Down buttons to set the new value, then press Done.

MENU ITEM	FUNCTION	RANGE	DEFAULT
Outlet	Displays the current outlet water temperature and allows the setpoint to be adjusted	55-190°F	120°F
Inlet	Displays the current inlet water temperature	—	—
Delta T	Displays the current temperature rise across the heat exchanger	—	—
DHW water temperature	Displays the current DHW temperature and allows the setpoint to be adjusted	60-182°F	120°F
Stack temperature	Displays the current stack temperature	—	—
Outdoor temperature	Displays the current outdoor air temperature	—	—
Firing Rate	Displays the current firing rate based on fan RPM.	—	—
LL	Displays the current system temperature for Lead/Lag operation and allows the setpoint to be adjusted	60-190°F	120°F

Table D2-1 - User Mode Menu Structure

Setup Mode

To go to the Setup Mode, press and hold the Up and Down buttons at the same time for about three seconds. The interface will indicate "°F."

Press Next to go to the setup for Outdoor Reset (shown as "LBT HOD LOD"). Use the Up button to turn on the Outdoor Reset feature, if desired. Once this is enabled, press Next to go to the lines for Low Boiler Setpoint (LBT), High Outdoor Temperature (HOD), and Low Outdoor Temperature (LOD). To change any of these, use the Up and Down buttons. (You do not need to press Done yet.)

Use the Next button to step through the other items in this menu. To see the current setpoint for an item, press the Up button. Then use the Up and Down buttons to change the setpoint.

Important - When you want to leave the Setup Mode, press the Done button to save any changes you have made. If you do not do this, the system will use the old setpoints.

MENU ITEM	DEFINITION
F or C	Selects temperature units
LBTHODLOD	Outdoor reset enable/disable - enables following menu items
LBT	Low boiler setpoint during outdoor reset
HOD	High outdoor temperature setpoint
LOD	Low outdoor temperature setpoint
RMT Add	Remote address - used for Lead/Lag setup
LL	Lead/Lag enable/disable - enables menu items
HS	Hysteresis - temp range between on/off cycles
bL	Base Load % - input rate before next boiler fires
Sd	Warm weather shut-down temperature
ASC	Anti short cycle - minutes of delay between startups

Table D2-2 - Setup Mode Parameters

Diagnostic Mode

Diagnostic Mode allows you to see any alerts or lockouts. This mode is also used to set up the "high fire" and "low fire" conditions so you can do the gas valve/CO_2 adjustment.

To go to the Diagnostic Mode, press and hold the Next button for three seconds. The display will indicate a value, followed by "µA." This is the signal from the flame sensor.

Press Next again to see the last alert (since the unit was last turned on), and press Next again to see the last lockout. (There is a list of the lockout codes in the Appendix at the end of this manual.) The table below shows the other functions in the Diagnostic Mode. Use the Next button to step through these functions.

To set up the gas valve, press Next until the display says "Min." When you press Next again, the display will step between a number (the current outlet temperature) and "10%" (the current firing rate). At this point the controller is ready to do the "low fire" setup.

MENU ITEM	DESCRIPTION
µA	Displays the flame sense signal
Alert codes	Displays the current alert code
Lockout code	Displays the current lockout code
Outlet Limit	Displays the outlet temperature limit
DHW limit	Displays the Domestic Hot Water limit setting
Stack Limit	Displays the Stack limit setting
Min. firing rate	Displays the minimum firing rate allowed
Min. forced firing rate	Allows the user to force the boiler to fire at the minimum firing rate
Max forced firing rate	Allows the user to force the boiler to fire at the maximum firing rate
Rate indicator	Displays the current firing rate based on the fan RPM.

Table D2-3 - Diagnostic Mode Menu Structure

D2 cont. Using the Original (White) User Interface - continued

Normally you will want to do the “high fire” setup first. Press Next again until you see “Max,” then press Next one more time. The display will step between a number (again, the current outlet temperature) and “100%” (the firing rate for high fire. Adjust the gas valve to get the correct CO_2 value.

To do the “low fire” setting, you do not have to press Next again. Instead, use the Down arrow to reduce the firing rate to 10%.

Important - When you have finished the combustion testing and gas valve adjustment, press the Done button to return to normal operations. When you are finished changing values in the User or Setup mode, you must press the Done button to save the new values, or the interface will use the old values.

D3 Reacting to Lockouts on the Original (White) User Interface

The system responds to three kinds of trouble indications:

- A ”lockout” is caused by a serious problem that might involve a safety issue. Once the controller enters a lockout, the burner will shut down, and will not be allowed to run again until the cause of the problem is corrected, and you reset the control system.
- The system may enter a “hold” for a period of time before locking out. This allows the controller to see if the error is corrected before it goes to a hard lockout.
- An “alert” indicates that some feature of the control system’s operation was not correct, delayed, or waiting for a response. This does not necessarily indicate a problem.

Here is the procedure used to recover from a Lockout.

- The “Lockout” indication will appear in the lower left-hand corner of the display, and the lockout code will flash in the center.
- Write down the lockout code, and look it up in the Appendix at the end of this manual.
- Press the Reset button near the lower left-hand corner of the display. This will reset the lockout, and the lockout code will disappear. (This is why we told you to write it down.)

If the problem condition is still present, the unit will lockout again. See Section A for troubleshooting instructions.

You can also check the last lockout or alert code using the Diagnostic mode of the display:

Press and hold the Next button until the display shows the flame signal followed by “µA.” This tells you the display is in the Diagnostic mode.

Press Next again to see the last alert. Press Next one more time to see the last lockout.

Removing and Replacing the Original (White) User Interface

D4

Please check the troubleshooting instructions in Section A before replacing the user interface. Here is the removal/ replacement procedure:

1. Turn off all power to the NeoTherm unit, and shut off all manual gas valves.
2. Remove the front door on the NeoTherm, and remove the plastic bezel from the control panel.
3. Disconnect all of the wiring connections to the control module. (The connectors are keyed so that they can only be inserted one way. Be careful not to bend the wires sharply or pull them out of the connectors.)
4. To remove the user interface, push in on the two tabs on the left side of the board to unlatch the clips from the control panel. Rotate the board around the fastening points on the right side to separate the hooks from the board.
5. To replace the part, repeat the steps listed above in the reverse order. Be sure to re-connect all of the wiring connectors in their proper locations.

D5 Using the Current User Interface

This interface is used on all NeoTherm models produced since 2012.

The table below lists the functions of the various parts of the user interface. In a moment, we will explain how to use the buttons to reach the different sections of the control system.

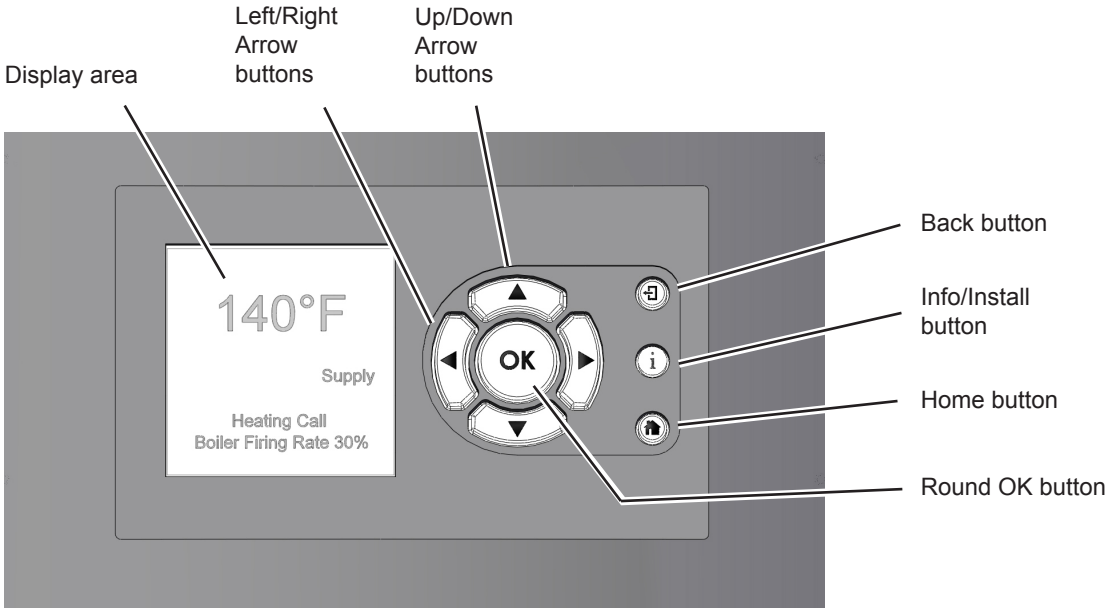


Fig. D5-1 - Control buttons on current user interface

Display area	This area displays several different kinds of information, including current operating information, setup parameters, and messages from the SOLA controller.
Up/ Down Arrow buttons	Use these to go to the choice you want to select in the display area, then press the round OK button.
Left/ Right Arrow buttons	Use these to go to the choice you want to select in the display area, then press the round OK button.
Back button	Use this to go back to the previous display.
Info/ Install button	Press this button at any time to go to the sub-menus that allow you to set up and monitor the controller.
Home button	Press this button at any time to go back to the Home display. (See the section on “Home Display.”)
Round OK button	Use the round OK button to confirm a value or action. Note – Sometimes the system will present the Keyboard display screen, which also includes a separate “OK” area. This is not the same as the round OK button – the two have different functions.)

Table D5-1 - Button Functions on Current User Interface

Home Display

When the boiler is operating normally, the controller will display the Home display. See Fig. D5-2.

The screen display area has three sections:

- The upper section of this screen displays the most important operating information for the unit. In the example shown here, the display is showing the system setpoint, the operating temperature, the outlet and inlet temperatures for the water entering and leaving the boiler, and the outdoor temperature.

  (Note that the five lines at the top of the screen are customizable, and may be arranged differently on your system.)

- The central section shows some additional operating and setup information. In this case, this area lists the boiler name, boiler state, current demand, and the current password level (the “access status”).

- The lower section shows any current lockouts, holds, or alerts.

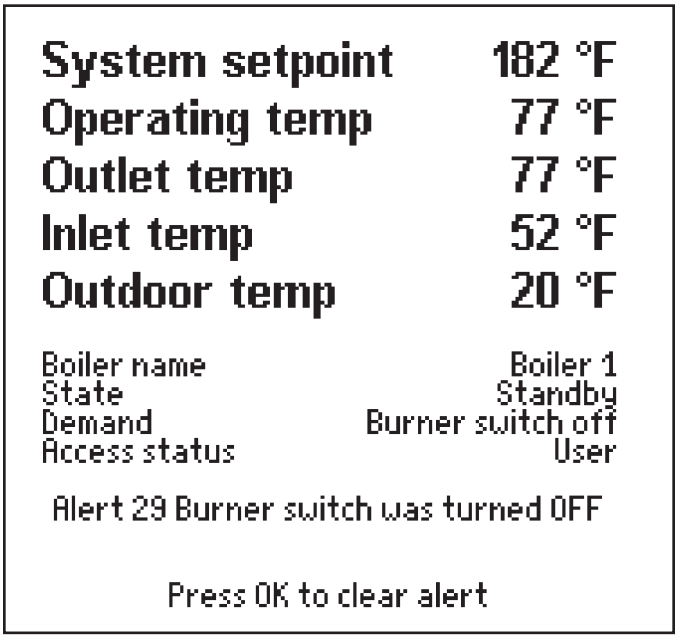


Fig. D5-2 - Home display

Info/Install Display

From the Home display shown in Fig. D5-2, press the “I” button (“Info/ Install”). The display will change to show the six sub-menus available. See Fig. D5-3.

- To move from one choice to another, use the Left- and Right-Arrow buttons or the Up- and Down-Arrow buttons.

- Once you have highlighted the choice you want, press the round OK button.

Table D5-2 shows the functions listed under each of the sub-menus.

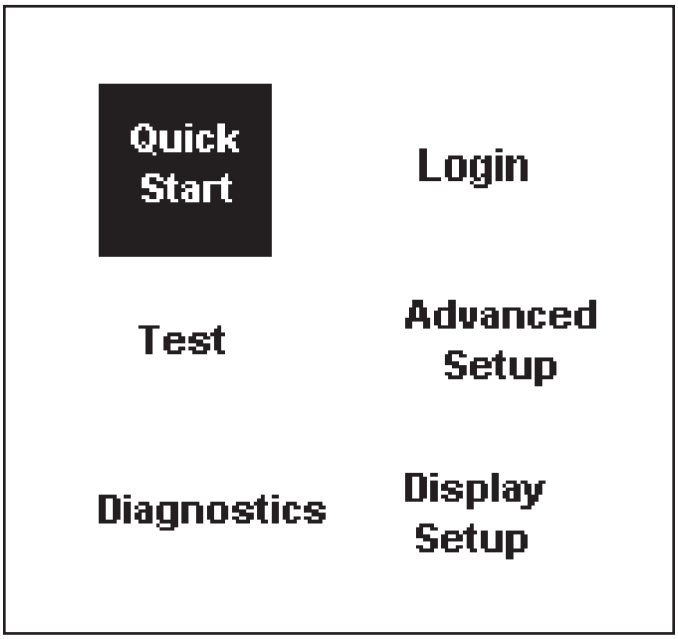


Fig. D5-3 - Info/ install display

Using the Current User Interface - continued

Quick Start	This menu gives you an easy way to check or change the most common settings on the unit: • CH setpoint • DHW setpoint • Outdoor reset (Note - You cannot disable this function from the interface) • Low water temperature • Maximum outdoor temperature • Minimum outdoor temperature • Adjustable high limit • Adjustable low limit
Login	If you want to change a setup value or function, and the system requires a password, you can enter it here.
Test	These parameters let you set the burner operation for combustion testing, and control pump operation.
Advanced Setup	The sub-menus listed here allow you to set up most of the functions on the controller. (For many of these functions, the system will require a password before it will allow you to make changes.)
Diagnostics	Use the Diagnostics to check the status of the sensors and the digital inputs and outputs. The system also records a history of lockouts and alarms.
Display Setup	You can use this option to adjust the contrast of the display or change the items which appear at the top of the Home display.

Table D5-2 - Functions on Info/ Install Menu

Changing a Value

The procedure for changing a control value used by the system is listed below. (In this example, we will use the screen for the CH Setpoint.)

- Use the Up- and Down-Arrow buttons to step down through the list until you have highlighted the correct line on the display.
- Press the round OK button to select that line. Figure D5-4 shows a typical screen for this type of setting.
- The current setting for the setpoint appears in the box at the top of the screen. In this example, this is 182°F.
- The numbers near the left edge of the screen show the allowable range for this value. In this case, the setpoint can be set anywhere between 190°F and 55°F.
- Press the Up- and Down-Arrow buttons to scroll the setpoint until you see the correct value in the box.
- When the value is correct, press the round OK button.

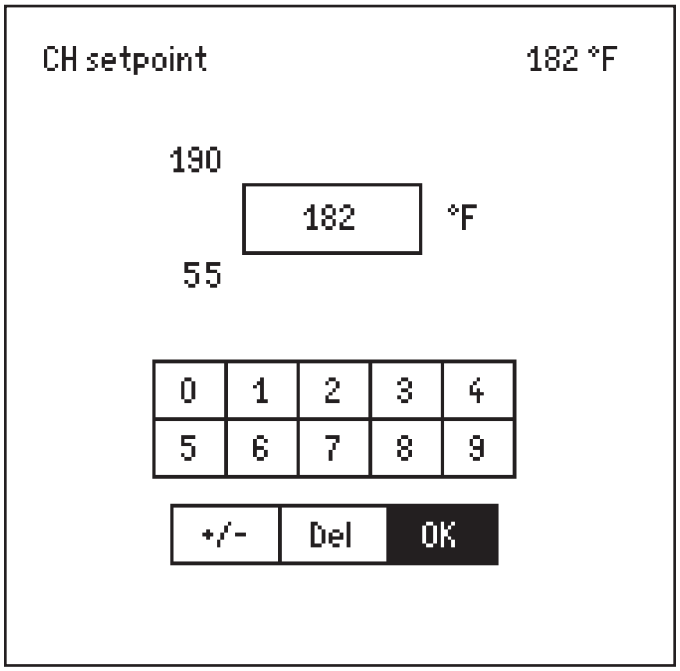


Fig. D5-4 – Changing a value

You will notice that the system did not ask you for a password, so this is one of the values that can be changed by anyone.

Entering a Time

The controller uses several different timing functions, and you can change some of these. (In the example shown in Fig. D5-5, we will use the screen for the Anti Short-Cycle Time.

- The current setting appears in the upper right-hand corner of the screen. In this example, this is 1 minute.
- The numbers near the left edge of the screen show the allowable range for this value. In this case, the time can be set anywhere between 1 minute and 15 minutes.

In this example we will change the time delay to 5 minutes.

- Press the Left- and Right-Arrow buttons to move to the box you want. In this case, we want to change the middle box - the box for Minutes.
- Use the Up- and Down-Arrow buttons to change the value in that box.
- You can change the numbers in the other boxes in the same way.
- When the new setting is correct, press the round OK button.

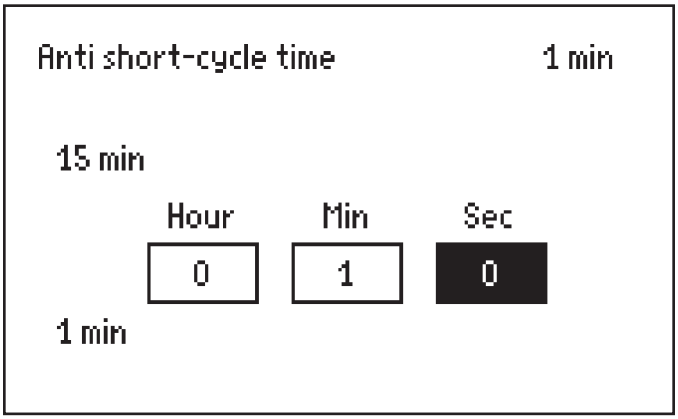


Fig. D5-5 - Changing a timing function

Using the Current User Interface - continued

Entering a Password or Name

The system uses a different type of screen to enter a password or name. If you want to change a setup value or function, and the system requires a password, you can enter it using the Login screen.

There are two ways you can reach this screen:

- From the Info/ Install screen, select Login.
- If you try to change a function that requires a password, the unit will prompt you to log in. See Fig. D5-6.

The controller for this unit uses three levels of password protection:

User Level - Some of the settings can be changed or read by anyone, without a password. These non-critical adjustments and functions include setting the Central Heat and Domestic Hot Water setpoints, monitoring the input and output variables, reading parameters from the controller, and reading the error log.

Installer Level - Settings that might affect the safe operation of the unit can only be changed by a trained technician who enters a password. These include setup and parameter changes made when the system is installed, and some diagnostic and troubleshooting functions. The installer level password is "lnt" (lower case "LNT").

OEM Level - Some of the settings can only be changed at the Laars factory.

Once you enter a password, the password access remains valid until you exit to the normal no-password state. If you do not make any edits for 10 minutes, the password access will be cancelled.

The areas on the Login display are arranged a bit like a computer keyboard.

- To enter a letter or number, use the Up-, Down, Left- and Right-Arrow buttons to highlight the character you want to use, then press the round OK button. You will see the character appear in the line at the top of the screen.
- When the characters in the line at the top of the screen are correct, move to the OK space at the bottom of the screen, and press the round OK button. This will send the new "string" of characters to the controller.

Fig. D5-6 – Password required

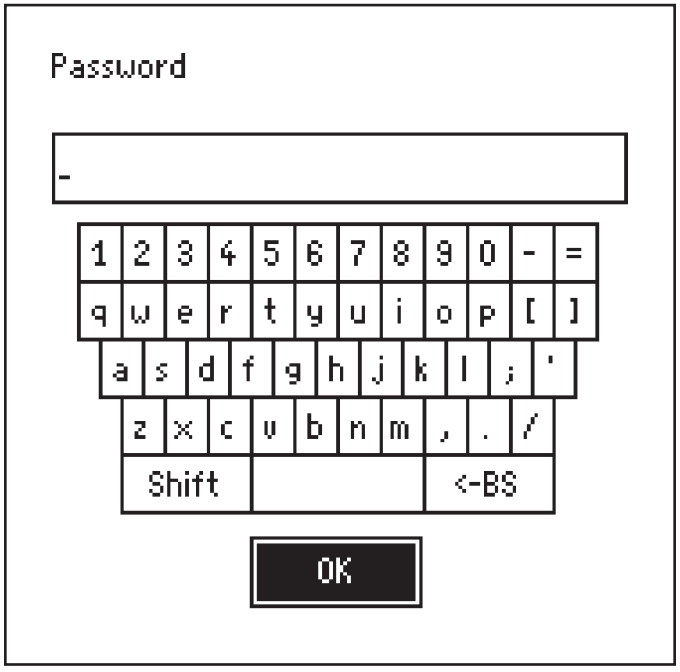


Fig. D5-7 – Login screen

Turning a Function On and Off

Some of the values can be enabled or disabled. Figure D5-8 shows one example.

- Use the Up- and Down-Arrows to highlight the line you want, then press the round OK button.

Changing a Value Using a "Slider"

There is another type of control screen you may see. This type of screen uses a "slider" to set the value. This system is used on the LCD Contrast screen (available under Display Setup.) See Fig. D5-9.

- Use the Left- and Right-Arrow buttons to move the bar and adjust the contrast.
- When the setting is correct, press the round OK button.

Using the Diagnostics -

Use the Diagnostics to check the status of the sensors and the digital inputs and outputs. The system also records a history of lockouts and alarms.

Analog Sensors -You can use this display to check on operating temperatures, fan speed, firing rate, etc. (The word "analog" refers to values that can change continuously between zero and a higher value.) The values shown here are "Read Only" – you can't change them from this display.

Digital Input/Output -This display shows whether different functions, inputs and outputs are either on or off. The functions listed here include pumps, valves, alarms, etc. The values shown here are "Read Only" – you can't change them from this display.

History - The system records the most recent lockouts or alerts. (If there is a current lockout or alert, a note about this will also appear at the bottom of the Home screen.)

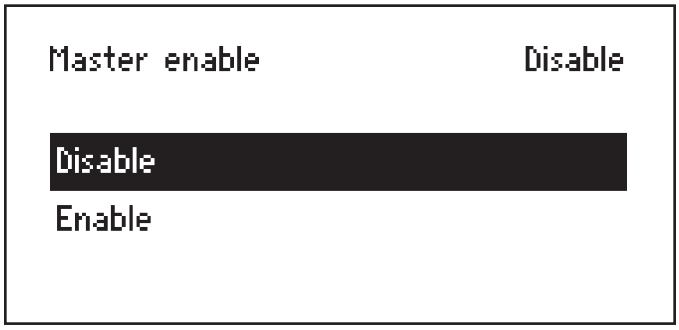


Fig. D5-8 - Enable/ disable screen

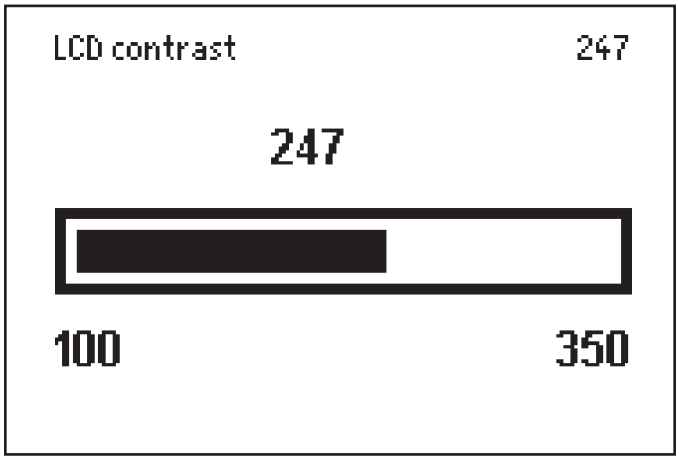


Fig. D5-9 – Changing LCD contrast

D6 Reacting to Lockouts on the Current User Interface

The system responds to three kinds of trouble indications:

- A"lockout" is caused by a serious problem that might involve a safety issue. Once the controller enters a lockout, the burner will shut down, and will not be allowed to run again until the cause of the problem is corrected, and you reset the control system.
- The system may enter a "hold" for a period of time before locking out. This allows the controller to see if the error becomes resolved prior to the hard lockout.
- An "alert" indicates that some feature of the control system's operation was not correct, delayed, or waiting for a response. This does not necessarily indicate a problem.

If a problem occurs while the system is starting up, the system will declare a Hold. A brief explanation of the cause of the Hold will appear in a line across the bottom of the screen.

If a serious problem continues, the system will declare a Lockout. A brief explanation of the cause of the Lockout will appear in a line across the bottom of the screen. Correct this by pressing the OK button. You can also press the Reset button on the SOLA controller. See Fig. D6-1.

If an Alert occurs while the system is running, the system will present a note in a line across the bottom of the screen.

Each error message includes a number. For a more detailed description of each message, see the Appendix at the end of this manual.

Fig. D6-1 – Resetting the SOLA controller

Tools and equipment required:

* Soft cloth (clean towel, etc.)
- Small Phillips-head screwdriver (size #1)

Procedure

1. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
2. Pull the upper front panel outward. Grip the two handles, and pull straight out. Once the panel is free, handle it carefully, because the wires will still be connected. Place the soft cloth on top of the NT unit. Swing the panel up and place it, face down, on the cloth.

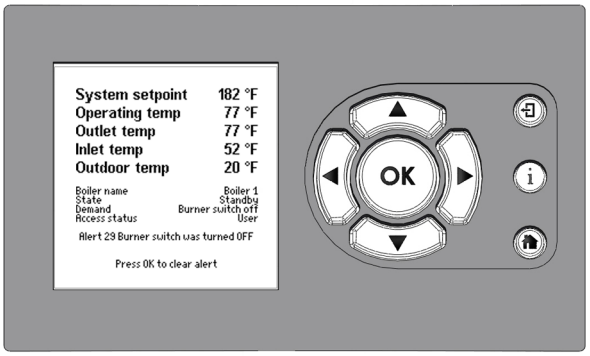


Fig. D7-1 - Current user interface

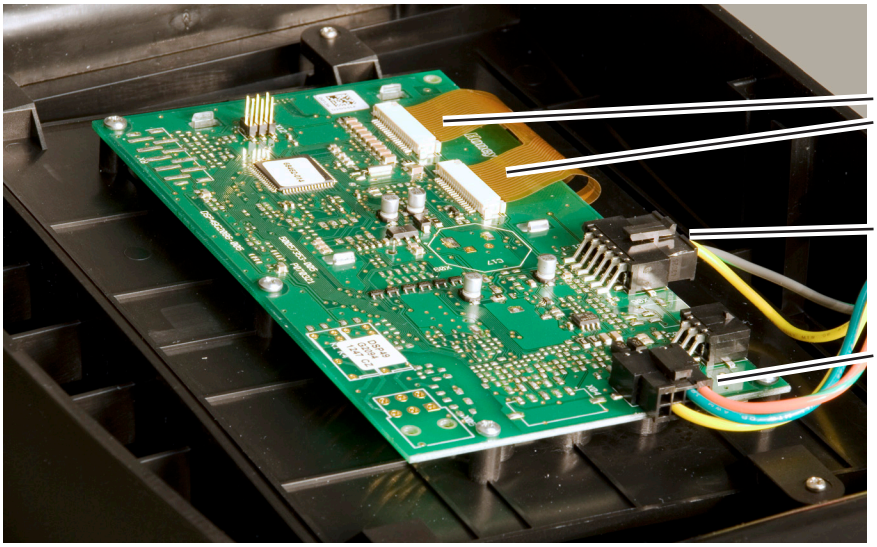


Fig. D7-2 - Removing the connectors

3. Disconnect the two wiring connectors:
   - 8-pin connector X07
   - 12-pin connector X01

   Each connector is held in place by a locking tab. To release the connector, push the tab down.
4. Disconnect the two ribbon-cable connectors.
5. Remove the four Phillips-head screws and separate the user interface board from the back of the front control panel.
6. Below the circuit board you will see the button actuator. This is a small soft plastic part that is part of the button assembly. Be sure this part remains in the position shown in the photo.

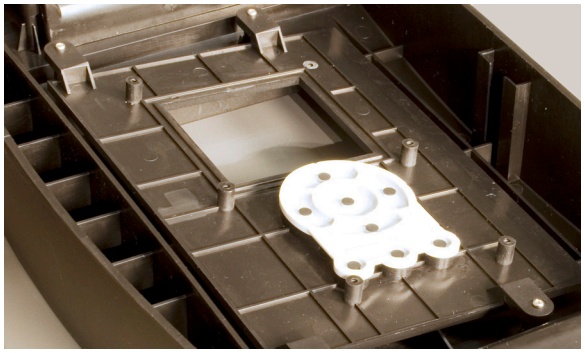


Fig. D7-3 - Placing the button actuator

D7 cont. Removing and Replacing the Current User Interface (continued)

7. Place the new circuit board in position and replace the screws.
8. Plug in the two ribbon cable connectors.
9. Plug in connectors X01 and X07.
10. Replace the front panel assembly.
11. Turn on power to the unit.

D8 When to Replace a SOLA Controller

When a technician is troubleshooting a problem with a NeoTherm unit, because the Honeywell SOLA controller is the most complicated part, it's tempting to assume that the controller is causing the problem. Usually the problem is caused by an input (a sensor or switch), or by a programming problem.

Don't automatically assume that every problem is caused by a bad controller.

Laars uses the same SOLA controller in many different NeoTherm models. The controllers are programmed differently for the different NeoTherm models. The replacement must be programmed at the factory for the specific model of the NeoTherm unit in which it will be used.

Removing and Replacing the SOLA Controller

D9

All of the NT units use the SOLA controller. This procedure explains how to remove and replace this controller.

Notice that, as installed in the NT unit, the SOLA controller is mounted "upside down." This does not affect the way the controller operates.

If you order a replacement, the SOLA controller will arrive with the EE-PROM (programming software) already installed. The programming is different from one type of NT unit to the next. This means that the SOLA controllers are not interchangeable. When you order the replacement, you must specify the exact type of NT unit you have.

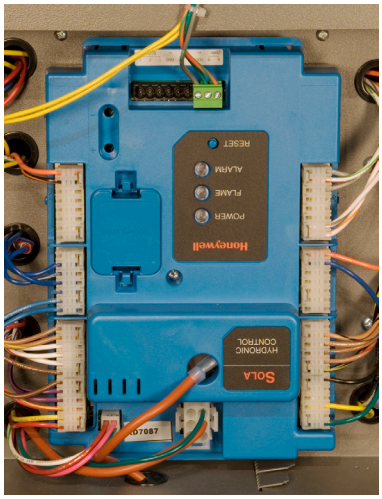


Fig. D9-1 - Honeywell SOLA controller

Tools and equipment required

- 1/4" socket

Procedure

1. Before you begin, record all of the existing control settings, if possible. This will allow you to re-enter the settings after you install the new controller. Record the current settings for temperature set-points, outdoor reset, and lead/lag.
2. Turn off power to the system. Use the main disconnect switch mounted above the front panel.
3. Remove the front panel from the unit by pulling it straight out.
4. Disconnect the wires and cables leading to the unit:

   At the top of the controller:

   - Disconnect the green connector. (Notice that this is plugged into the right end of the socket. Be sure to replace it in the correct position.)

   On the left side of the controller (reading top to bottom):

   - Disconnect connector CP10 from J10
   - Disconnect connector CP9 from J9
   - Disconnect connector CP8A from J8 (upper part)
   - Disconnect connector CP8B from J8 (lower part)

   On the bottom of the controller:

   - Unplug connector J2
   - Unplug connector J1

Removing and Replacing the SOLA Controller (continued)

On the right side of the controller (reading top to bottom):

- Disconnect connector CP6 from J6
- Disconnect connector CP5 from J5
- Disconnect connector CP4A from J4 (upper part)
- Disconnect connector CP4B from J4 (lower part)

At the lower center of the controller:

- Disconnect the large orange spark cable

5. Now you can remove the controller itself. The controller is attached to the support plate by four clips. To remove the control, push the lower ends of the left side clips, and swing the left side of the control toward you.
6. Mount the new controller using the four clips.
7. Replace the wires and cables listed above. The cables and connectors are all labeled.
8. Replace the front cover and turn on the power to the unit.
9. You may need to reset the control on initial startup. Press the "OK" button to reset the control.

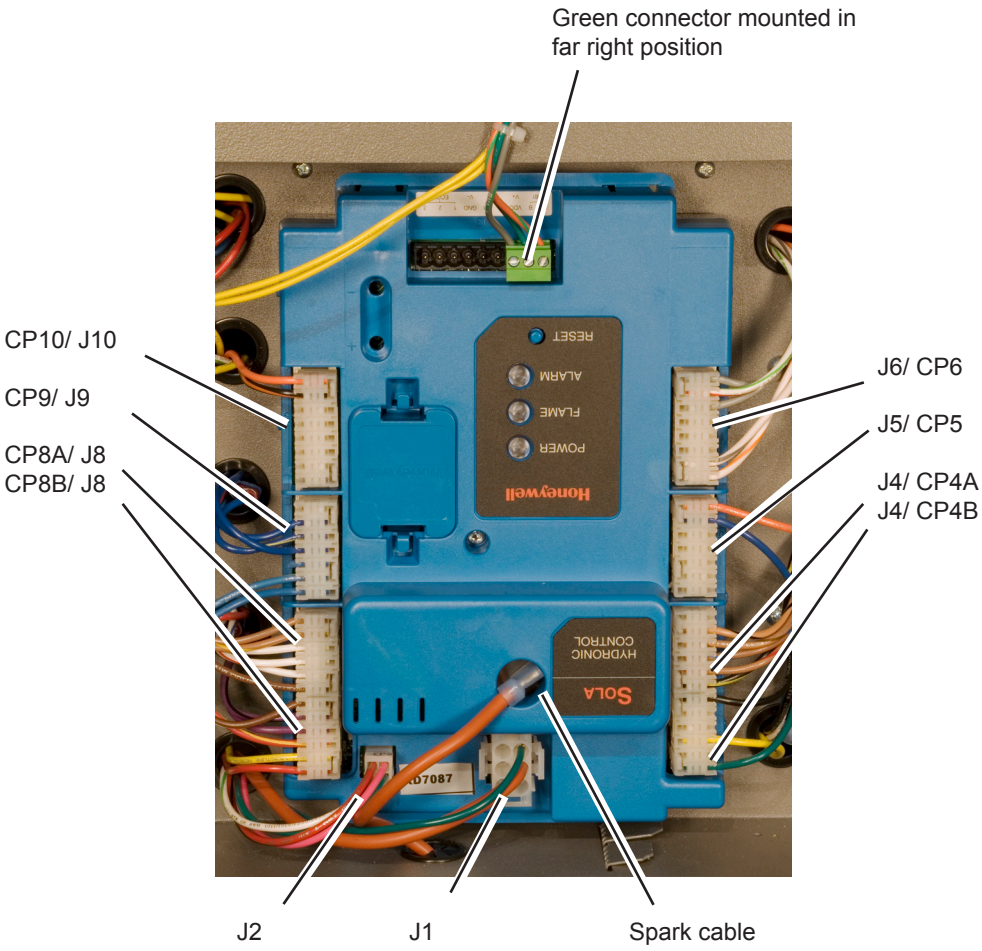


Fig. D9-2 - Connectors on the SOLA controller

Appendix 1 - Error Codes

App1

This table includes a listing of the faults that might be generated by the controllers, and displayed on the Operator Interface. Some of these can be corrected by an installer changing a parameter, while other conditions are more complicated, and will require a service technician.

The first column lists the code number that will appear at the beginning of the Lockout or Hold message in the orange bar at the bottom of the screen. The second column lists the text as it will appear on the Operator Interface. The third column shows whether the condition will cause a Hold, or Lockout, or both. The fourth column lists some suggestions for corrective action.

Code	Description	L or H	Procedure
1	Unconfigured safety data	L	1. New device, complete device configuration and safety verification. 2. If fault repeats, replace module.
2	Waiting for safety data verification	L	1. Device in Configuration mode and safety parameters need verification and a device needs reset to complete verification. 2. Configuration ended without verification, re- enter configuration, verify safety parameters and reset device to complete verification. 3. If fault repeats, replace module.
3	Internal fault: Hardware fault	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
4	Internal fault: Safety relay key feedback error	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
5	Internal fault: Unstable power (DC) output	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
6	Internal fault: Invalid processor clock	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
7	Internal fault: Safety relay drive error	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
8	Internal fault: Zero crossing not detected	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
9	Internal fault: Flame bias out of range	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
10	Internal fault: Invalid burner control state	L	Internal fault 1. Reset module 2. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
11	Internal fault: Invalid burner control state flag	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
12	Internal fault: Safety relay drive cap short	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
13	Internal fault: PII (Pre-Ignition Interlock) shorted to ILK (Interlock)	H or L	Internal fault 1. Reset module 2. If fault repeats, replace module.
15	Internal fault: Safety relay test failed due to feedback on	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
16	Internal fault: Safety relay test failed due to safety relay off	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
17	Internal fault: Safety relay test failed due to safety relay not off	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
18	Internal fault: Safety relay test failed due to feedback not on	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
19	Internal fault: Safety RAM write	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
20	Internal fault: Flame ripple and overflow	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
21	Internal fault: Flame number of sample mismatch	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
22	Internal fault: Flame bias out of range	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
23	Internal fault: Bias changed since heating cycle starts	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
24	Internal fault: Spark voltage stuck low or high	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
25	Internal fault: Spark voltage changed too much during flame sensing time	H	Internal fault 1. Reset module 2. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
26	Internal fault: Static flame ripple	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
27	Internal fault: Flame rod short to ground detected	H	Check flame rod - See Section B31. Internal fault in SOLA controller: 1. Reset module 2. If fault repeats, replace module.
28	Internal fault: A/D linearity test fails	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
29	Internal fault: Flame bias cannot be set in range	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
30	Internal fault: Flame bias shorted to adjacent pin	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
31	Internal fault: SOLA electronics unknown error	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
32-46	Internal fault: Safety key 0 through 14	L	Internal fault 1. Reset module 2. If fault repeats, replace module.
47	Flame rod to ground leakage	H	Check flame rod - See Section B31. Internal fault in SOLA controller: Internal fault 1. Reset module 2. If fault repeats, replace module.
48	Static flame (not flickering)	H	Internal fault 1. Reset module 2. If fault repeats, replace module.
49	24 VAC voltage low/high	H	1. Check the module and display connections. 2. Check the module power supply and make sure that frequency, voltage and VA meet the specifications. See Section B2.
50	Modulation fault	H	Internal sub-system fault. 1. Review alert messages for possible trends. 2. Correct possible problems.
51	Pump fault	H	Internal sub-system fault. 1. Review alert messages for possible trends. 2. Correct possible problems.
52	Motor tachometer fault	H	Check the blower. See Section B18. Internal sub-system fault in SOLA controller: 1. Review alert messages for possible trends. 2. Correct possible problems.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
53	AC input phases reversed	L	1. Check the module and display connections. 2. Check the module power supply and make sure that both frequency and voltage meet the specifications. 3. On 24 VAC applications, assure that J4 terminal 10 and J8 terminal 2 are connected together.
59	Internal fault: Mux pin shorted	L	Internal fault. 1. Reset module. 2. If fault repeats, replace module.
61	Anti short cycle	H	Will not be a lockout fault. Hold only. See Section A9.
62	Fan speed not proved	H	Will not be a lockout fault. Hold only. It is normal to see this during startup only.
63	LCI (Limit Control Input) off Problem with safety interlock chain	H	1. See Section A8 . Check wiring and correct any faults. Check Interlocks connected to the LCI to assure proper function. 2. Reset and sequence the module; monitor the LCI status. 3. If code persists, replace the module
64	PII (Pre-Ignition Interlock) off	H or L	1. Check wiring and correct any faults. 2. Check preignition interlock switches to assure proper functioning. 3. Check the valve operation. 4. Reset and sequence the module; monitor the PII status. 5. If code persists, replace the module.
67	ILK (Interlock) off	H or L	1. Check wiring and correct any possible shorts. 2. Check Interlock (ILK) switches to assure proper function. 3. Verify voltage through the interlock string to the interlock input with a voltmeter. 4. If steps 1-3 are correct and the fault persists, replace the module.
68	ILK (Interlock) on	H or L	1. Check wiring and correct any possible shorts. 2. Check Interlock (ILK) switches to assure proper function. 3. Verify voltage through the interlock string to the interlock input with a voltmeter. 4. If steps 1-3 are correct and the fault persists, replace the module.
70	Wait for leakage test completion	H	1. Internal fault. Reset module. 2. If fault repeats, replace module.
78	Demand lost in run	H	1. Check wiring and correct any possible errors. 2. If previous steps are correct and fault persists, replace the module.

Code	Description	L or H	Procedure
79	Outlet high limit	H or L	1. Check wiring and correct any possible errors. See Section B7. 2. Replace the outlet high limit. 3. If previous steps are correct and fault persists, replace the module.
80	DHW (Domestic Hot Water) high limit	H or L	1. Check wiring and correct any possible errors. 2. Replace the DHW high limit. 3. If previous steps are correct and fault persists, replace the module.
81	Delta T limit	H or L	1. Check inlet and outlet sensors and pump circuits for proper operation. 2. Recheck the Delta T Limit to confirm proper setting. 3. If previous steps are correct and fault persists, replace the module.
82	Stack limit	H or L	1. See Section B20. 2. Check wiring and correct any possible errors. 3. Replace the stack high limit switch. 4. If previous steps are correct and fault persists, replace the module.
91	Inlet sensor fault	H	1. Check wiring and correct any possible errors. See Section B24. 2. Replace the Inlet sensor. 3. If previous steps are correct and fault persists, replace the module.
92	Outlet sensor fault	H	1. Check wiring and correct any possible errors. See Section B26. 2. Replace the outlet sensor. 3. If previous steps are correct and fault persists, replace the module.
93	DHW (Domestic Hot Water) sensor fault	H	1. Check wiring and correct any possible errors. See Section B23. 2. Replace the DHW sensor. 3. If previous steps are correct and fault persists, replace the module.
94	Header sensor fault	H	1. Check wiring and correct any possible errors. 2. Replace the header sensor. 3. If previous steps are correct and fault persists, replace the module.
95	Stack sensor fault	H	1. Check wiring and correct any possible errors. See Section B20. 2. Replace the stack sensor. 3. If previous steps are correct and fault persists, replace the module.
96	Outdoor sensor fault	H	1. Check wiring and correct any possible errors. See Section B29. 2. Replace the outdoor sensor. 3. If previous steps are correct and fault persists, replace the module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
97	Internal fault: A2D mismatch.	L	Internal Fault. 1. Reset module. 2. If fault repeats, replace module.
98	Internal fault: Exceeded VSNSR voltage tolerance	L	Internal Fault. 1. Reset module. 2. If fault repeats, replace module.
99	Internal fault: Exceeded 28V voltage tolerance	L	Internal Fault. 1. Reset module. 2. If fault repeats, replace module.
100	Pressure sensor fault	H	1. Verify the pressure sensor is a 4-20 ma source. 2. Check wiring and correct any possible errors. 3. Test the pressure sensor for correct operation. 4. Replace the pressure sensor. 5. If previous steps are correct and fault persists, replace the module.
105	Flame detected out of sequence	H or L	1. Check that flame is not present in the combustion chamber. Correct any errors. 2. Make sure that the flame detector is wired to the correct terminal. 3. Make sure the flame and ground wires are protected from stray noise pickup. 4. Reset and sequence the module, if code reappears, replace the flame detector. 5. Reset and sequence the module, if code reappears, replace the module.
106	Flame lost in MFEP (Main Flame Establishing Period)	L	1. Check main valve wiring and operation - correct any errors. 2. Check the fuel supply. 3. Check fuel pressure and repeat turndown tests. 4. Check ignition transformer electrode, flame detector, flame detector siting and flame rod position. 5. If steps 1 through 4 are correct and the fault persists, replace the module.
107	Flame lost early in run	L	1. Check main valve wiring and operation - correct any errors. 2. Check the fuel supply. 3. Check fuel pressure and repeat turndown tests. 4. Check ignition transformer electrode, flame detector, flame detector siting or flame rod position. 5. If steps 1 through 4 are correct and the fault persists, replace the module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
108	Flame lost in run	L	1. Check main valve wiring and operation - correct any errors. 2. Check the fuel supply. 3. Check fuel pressure and repeat turndown tests. 4. Check ignition transformer electrode, flame detector, flame detector siting or flame rod position. 5. If steps 1 through 4 are correct and the fault persists, replace the module.
109	Ignition failed	L	1. Check main valve wiring and operation - correct any errors. 2. Check the fuel supply. 3. Check fuel pressure and repeat turndown tests. 4. Check ignition transformer electrode, flame detector, flame detector siting or flame rod position. 5. If steps 1 through 4 are correct and the fault persists, replace the module.
110	Ignition failure occurred	H	Hold time of recycle and hold option. Will not be a lockout fault. Hold only. Internal hardware test. Not a lockout.
111	Flame current lower than weak threshold	H	Hold time of recycle and hold option. Will not be a lockout fault. Hold only. Internal hardware test. Not a lockout.
113	Flame circuit timeout	L	Flame sensed during initiate or off cycle, hold 240 seconds, if present after 240 seconds, system will lockout.
119	Control Interaction fault	H	Flap valve identifications configured incorrectly.
122	Lightoff rate proving failed	L	1. Check wiring and correct any potential wiring errors. 2. Check VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
123	Purge rate proving failed	L	1. Check wiring and correct any potential wiring errors. 2. Check VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
128	Fan speed failed during prepurge	H or L	1. Check wiring and correct any potential wiring errors. 2. Check the VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
129	Fan speed failed during preignition	H or L	1. Check wiring and correct any potential wiring errors. See Section B18. 2. Check the VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
130	Fan speed failed during ignition	H or L	1. Check wiring and correct any potential wiring errors. See Section B18. 2. Check the VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
131	Fan movement detected during standby	H	1. Check wiring and correct any potential wiring errors. See Section B18. 2. Check the VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
132	Fan speed failed during run	H	1. Check wiring and correct any potential wiring errors. See Section B18. 2. Check the VFD's (Variable-speed Fan Drive) ability to change speeds. 3. Change the VFD 4. If the fault persists, replace the module.
137	ILK (Interlock) failed to close	H	1. Check wiring and correct any possible shorts. 2. Check interlock (ILK) switches to assure proper function. 3. Verify voltage through the interlock string to the interlock input with a voltmeter. 4. If steps 1-3 are correct and the fault persists, replace the module.
149	Flame detected	H or L	Holds if flame detected during safe start check up to flame establishing period.
150	Flame not detected	H	Sequence returns to standby and restarts sequence at the beginning of purge after the HF switch opens if flame detected during safe start check up to flame establishing period.
152	Combustion pressure on	H or L	1. Check wiring and correct any errors. 2. Inspect the combustion pressure switch to make sure it is working correctly. 3. Reset and sequence the relay module. 4. During standby and prepurge measure the voltage between J6 terminal 5 and L2 (N). Supply voltage should be present. If not, the lockout switch is defective and needs replacing. 5. If the fault persists, replace the relay module.

Code	Description	L or H	Procedure
153	Combustion pressure off	H or L	1. Check wiring and correct any errors. 2. Inspect the combustion pressure switch to make sure it is working correctly. 3. Reset and sequence the relay module. 4. During standyby and prepurge, measure the voltage between J6 terminal 5 and L2 (N). Supply voltage should be present. If not, the lockout switch is defective and needs replacing. 5. If the fault persists, replace the relay module.
154	Purge fan switch on	H or L	1. Purge fan switch is on when it should be off. 2. Check wiring and correct any errors. 3. Inspect the purge fan switch J6 terminal 3 and its connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If the fault persists, replace the relay module.
155	Purge fan switch off	H or L	1. Purge fan switch is off when it should be on. 2. Check wiring and correct any errors. 3. Inspect the purge fan switch J6 terminal 3 and its connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If the fault persists, replace the relay module.
156	Combustion pressure and flame on	H or L	1. Check that flame is not present in the combustion chamber. Correct any errors. 2. Make sure that the flame detector is wired to the correct terminal. 3. Make sure the flame and ground wires are protected from stray noise pickup. 4. Reset and sequence the module, if code reappears, replace the flame detector. 5. Reset and sequence the module, if code reappears, replace the module.
157	Combustion pressure and flame off	L	1. Check that flame is not present in the combustion chamber. Correct any errors. 2. Make sure that the flame detector is wired to the correct terminal. 3. Make sure the F & G wires are protected from stray noise pickup. 4. Reset and sequence the module, if code reappears, replace the flame detector. 5. Reset and sequence the module, if code reappears, replace the module.
158	Main valve on	L	1. Check the main valve terminal wiring and correct any errors. 2. Reset and sequence the module. If fault persists, replace the module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
159	Main valve off	L	1. Check the main valve terminal wiring and correct any errors. Be sure the On/Off switch on the bottom of the valve is On. See Fig. B11-9 2. Reset and sequence the module. If fault persists, replace the module.
160	Ignition on	L	1. Check ignition terminal wiring and correct any errors. 2. Reset and sequence the module. If fault persists, replace the module.
161	Ignition off	L	1. Check ignition terminal wiring and correct any errors. 2. Reset and sequence the module. If fault persists, replace the module.
164	Block intake on	L	1. Check wiring and correct any errors. 2. Inspect the block intake switch to make sure it is working correctly. 3. Reset and sequence the module. 4. During standby and purge, measure the voltage across the switch. Supply voltage should be present. If not, the block intake switch is defective and needs replacing. 5. If the fault persists, replace the relay module.
165	Block intake off	L	1. Check wiring and correct any errors. 2. Inspect the block intake switch to make sure it is working correctly. 3. Reset and sequence the module. 4. During standby and purge, measure the voltage across the switch. Supply voltage should be present. If not, the block intake switch is defective and needs replacing. 5. If the fault persists, replace the relay module.
172	Main relay feedback incorrect	L	Internal fault. 1. Reset module. 2. If fault repeats, replace module.
174	Safety relay feedback incorrect	L	Internal Fault. 1. Reset module. 2. If fault repeats, replace module.
175	Safety relay open	L	Internal fault. 1. Reset module. 2. If fault repeats, replace module.
176	Main relay on at safe start check	L	Internal fault. 1. Reset Module. 2. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
178	Safety relay on at safe start check	L	Internal fault. 1. Reset module. 2. If fault repeats, replace module.
184	Invalid blower/ HSI output setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
185	Invalid Delta T limit enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
186	Invalid Delta T limit response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
187	Invalid DHW (Domestic Hot Water) high limit enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
188	Invalid DHW (Domestic Hot Water) high limit response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
189	Invalid flame sensor type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
192	Invalid igniter on during setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
193	Invalid ignite failure delay setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
194	Invalid ignite failure response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.\
195	Invalid ignite failure retries setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
196	Invalid ignition source setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
197	Invalid interlock open response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
198	Invalid interlock start check setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
199	Invalid LCI (Limit Control Input) enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
200	Invalid lightoff rate setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
201	Invalid lightoff rate proving setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
202	Invalid MFEP (Main Flame Establishing Period) time setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
203	Invalid MFEP (Main Flame Establishing Period) flame failure response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
204	Invalid NTC sensor type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
205	Invalid outlet high limit response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
207	Invalid PII (Pre-Ignition Interlock) enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
210	Invalid postpurge time setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
211	Invalid power up with lockout setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
212	Invalid preignition time setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
213	Invalid prepurge rate setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
214	Invalid prepurge time setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
215	Invalid purge rate proving setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
216	Invalid run flame failure response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
217	Invalid run stabilization time setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
218	Invalid stack limit enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
219	Invalid stack limit response setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
220	Unconfigured Delta T limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
221	Unconfigured DHW (Domestic Hot Water) high limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
222	Unconfigured outlet high limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
223	Unconfigured stack limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
224	Invalid DHW (Domestic Hot Water) demand source setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
225	Invalid flame threshold setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
226	Invalid outlet high limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
227	Invalid DHW (Domestic Hot Water) high limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
228	Invalid stack limit setpoint setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
229	Invalid modulation output setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
230	Invalid CH (Central Heat) demand source setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
231	Invalid Delta T limit delay setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.

Appendix 1 - Error Codes (continued)

Code	Description	L or H	Procedure
232	Invalid pressure sensor type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
234	Invalid outlet high limit enable setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
235	Invalid outlet connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
236	Invalid inlet connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
237	Invalid DHW (Domestic Hot Water) connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
238	Invalid stack connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
239	Invalid header connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.
240	Invalid outdoor connector type setting	L	1. Return to configuration mode and recheck selected parameters, reverify and reset module. 2. If fault repeats, verify electrical grounding. 3. If fault repeats, replace module.

App2 Appendix 2 - Ignition and Firing Sequence

This is the basic operating sequence of the appliance whether there is a DHW, or hydronic call for heat.

1. The unit receives a call for heat.
2. The controller does a check of the safety interlock chain.
3. The blower starts and the controller waits until it achieves prepurge RPM.
4. The prepurge timer is started once the prepurge RPM is achieved.
5. The controller waits through a pre-ignition time of two seconds to check the flame sensor operation and status. During this period an intermittent spark can be seen.
6. The controller waits through a trial for ignition period of four seconds. The direct spark ignition switches to constant spark for three seconds, during which time the gas valve is open. For the last second of the ignition period, direct spark is de-energized and the flame sensor checks for established flame. If a flame is sensed, the control enters “Run” to satisfy the demand. If flame is not established, the control enters a retry, starting from step 2. If the flame has not been established in the appropriate number of retries, the control will lockout with a 109 error code.
7. The call for heat input disappears.
8. The gas valve shuts off.
9. The blower and pump continue to run through the overrun times to purge the system.

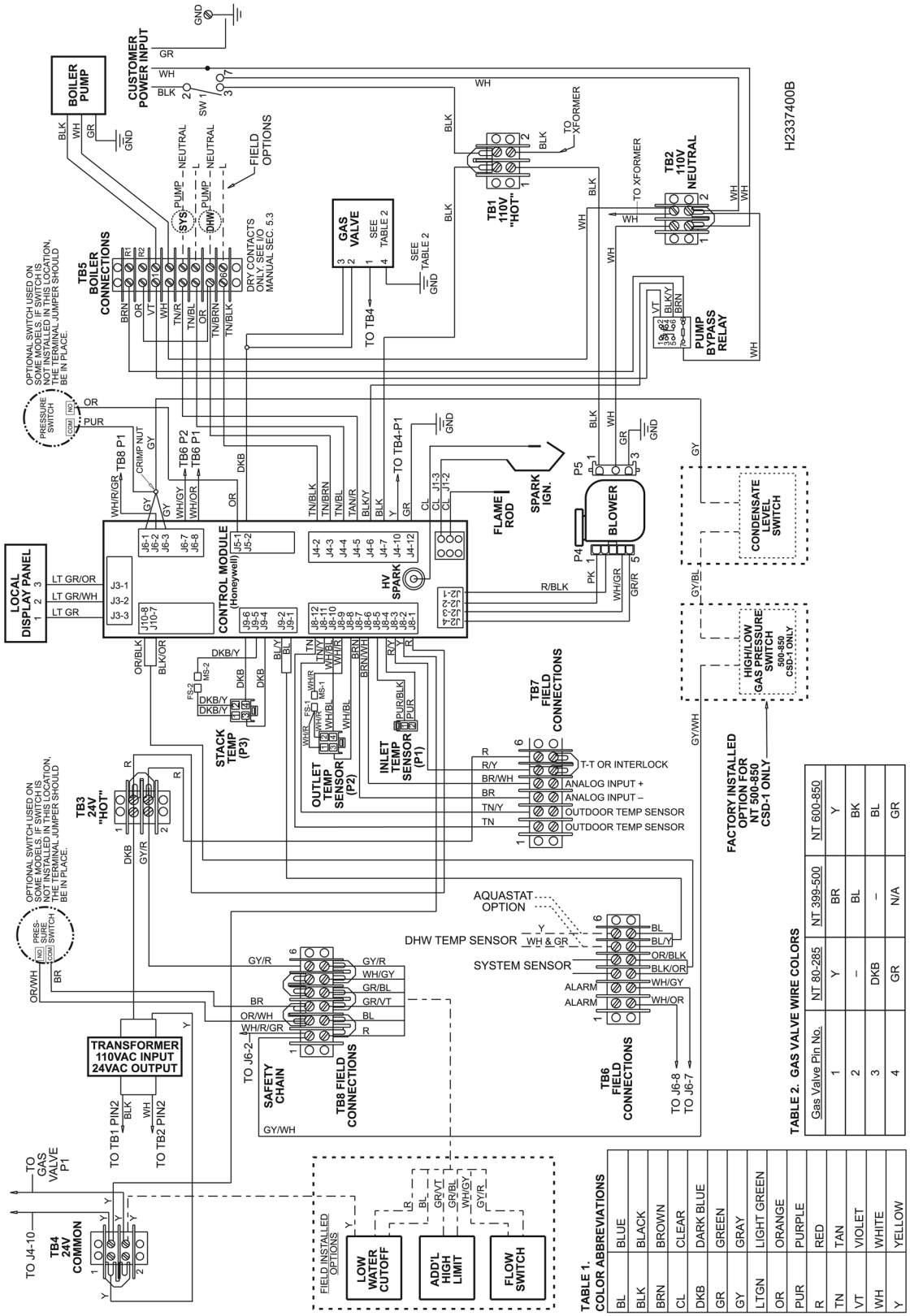
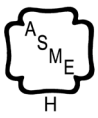


TABLE 1. COLOR ABBREVIATIONS

BL	BLUE
BLK	BLACK
BRN	BROWN
CL	CLEAR
DKB	DARK BLUE
GR	GREEN
GY	GRAY
LTGN	LIGHT GREEN
OR	ORANGE
PUR	PURPLE
R	RED
TN	TAN
VT	VIOLET
WH	WHITE
Y	YELLOW

TABLE 2. GAS VALVE WIRE COLORS

Gas Valve Pin No.	NT 80-285	NT 399-500	NT 600-850
1	Y	BR	Y
2	–	BL	BK
3	DKB	–	BL
4	GR	N/A	GR

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Heating Systems Company
A subsidiary of **BRADFORD WHITE**® Corporation

Customer Service and Product Support: **800.900.9276 • Fax 800.559.1583**
Headquarters: **20 Industrial Way, Rochester, NH 03867 • 603.335.6300 • Fax 603.335.3355**
1869 Sismet Road, Mississauga, Ontario, Canada L4W 1W8 • 905.238.0100 • Fax 905.366.0130
www.Laars.com