

Installation and Operation Instructions for

NeoTherm[®]

Modulating Boiler Model NTH

Sizes 080–500 MBTU/h

FOR YOUR SAFETY: This product must be installed and serviced by a professional service technician, qualified in hot water boiler and heater installation and maintenance. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

⚠️ WARNING

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

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

- Do not try to light any appliance.
- Do not touch any electrical 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.

Installation and service must be performed by a qualified installer, service agency, or gas supplier.

⚠️ AVERTISSEMENT

Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort.

Ne pas entreposer ni utiliser d'essence ni d'autres vapeurs ou liquides inflammables dans le voisinage de cet appareil ou de tout autre appareil.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareils.
- Ne touchez à aucun interrupteur. Ne pas vous servir des téléphones dans le bâtiment où vous vous trouvez.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur de gaz, appelez le service des incendies.

L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.

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SECTION 1. General Information

WARNING

The NeoTherm hydronic boiler **must** be installed in accordance with the procedures detailed in this manual, or the LAARS Heating Systems warranty will be voided. The installation must conform to the requirements of the local jurisdiction having authority, and, in the United States, to the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA54. In Canada, the installation must conform to the latest edition of CSA B149.1 Natural Gas and Propane Gas Installation Code, and/or local codes. Where required by the authority having jurisdiction, the installation of NeoTherm boilers must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1. Any modifications to the boiler, its gas controls, or wiring may void the warranty. If field conditions require modifications, consult the factory representative before initiating such modifications.

1.1 Introduction

This manual provides information necessary for the installation, operation, and maintenance of LAARS Heating Systems NeoTherm appliances. Read it carefully before installation.

All application and installation procedures should be reviewed completely before proceeding with the installation. Consult the LAARS Heating Systems factory, or local factory representative, with any problems or questions regarding this equipment. Experience has shown that most operating problems are caused by improper installation.

The NeoTherm appliance is protected against over pressurization. A pressure relief valve is fitted to all appliances. It is installed inside the jacket (see Section 4 for instructions on how to pipe the relief valve outlet).

IMPORTANT: The inlet gas pressure to the appliance must not exceed 13" W.C. (3.2kPa).

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 herein.

All electrical wiring is to be done in accordance with the 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.

1.2 Model Identification

Consult the rating plate on the unit. The following information describes the model number structure.

- (1-2) **Model Series Designation**
N T = NeoTherm
- (3) **Usage**
H = Hydronic
- (4-6) **Size**
0 8 0 = 80,000 BTU/hr input
1 0 5 = 105,000 BTU/hr input
1 5 0 = 150,000 BTU/hr input
2 1 0 = 210,000 BTU/hr input
2 8 5 = 285,000 BTU/hr input
3 9 9 = 399,000 BTU/hr input
5 0 0 = 500,000 BTU/hr input
- (7) **Fuel**
N = Natural Gas
P = LP Gas
- (8) **Options Code**
X = Standard Unit
J = CSD-1, FM, GAP, IL Code (size 500 only)
- (9) **Pump Options**
N = Factory-mounted pump (standard)
X = No pump
- (10) **Revision**
1 = First version

1.3 Appliance Overview

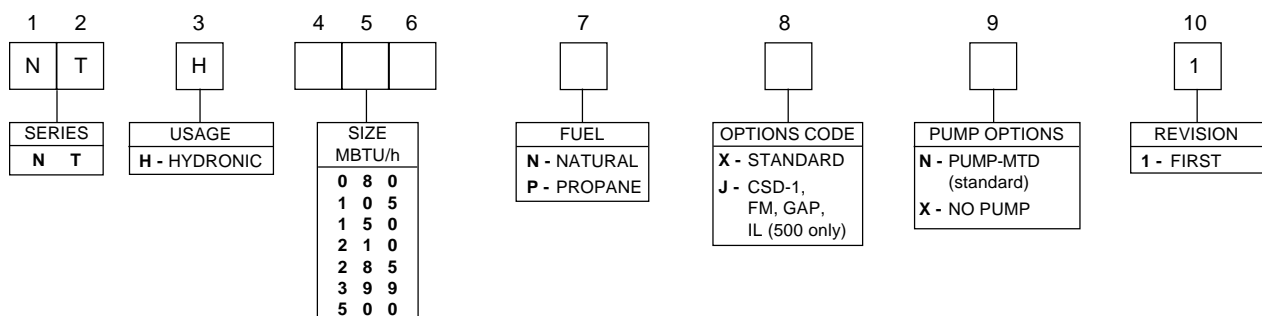
See Figures 2 through 6.

1.4 Warranty

LAARS Heating Systems' NeoTherm appliances are covered by a limited warranty. The owner should complete the warranty registration at www.Laars.com.

All warranty claims must be made to an authorized LAARS Heating Systems representative. Claims must

Model Nomenclature



include the serial number and model (this information can be found on the rating plate), installation date, and name of the installer. Shipping costs are not included in the warranty coverage.

Some accessory items may be shipped in separate packages. Verify receipt of all packages listed on the packing slip. Inspect everything for damage immediately upon delivery, and advise the carrier of any shortages or damage. Any such claims should be filed with the carrier. **The carrier, not the shipper, is responsible for shortages and damage to the shipment whether visible or concealed.**

1.5 Unpacking

The NeoTherm is shipped in a single crate with the following standard components packed on top of the appliance (see Figure 1):

- A. exhaust terminal C. temperature/pressure gauge
- B. intake terminal D. alternate terminal screens

1. Remove all packing and tie-down materials.
2. Check contents of the carton against items shown.

1.6 Dimensions

Dimensions are shown in Figure 7.

1.7 Locating the Appliance

The NeoTherm is for indoor installations only.

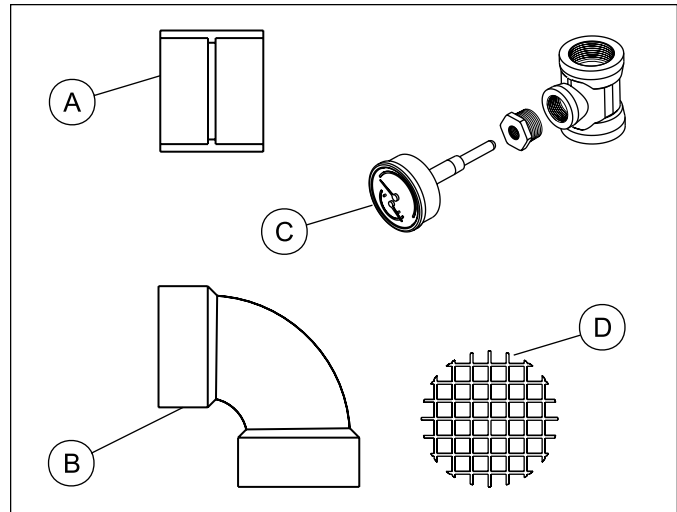


Figure 1. Contents of Shipping Package.

The appliance should be located to provide clearances on all sides for maintenance and inspection. It should not be located in an area where leakage of any connections will result in damage to the area adjacent to the appliance or to lower floors of the structure.

When such a location is not available, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance.

The appliance is design certified by CSA-International for installation on combustible flooring; in basements; in closets, utility rooms or alcoves.

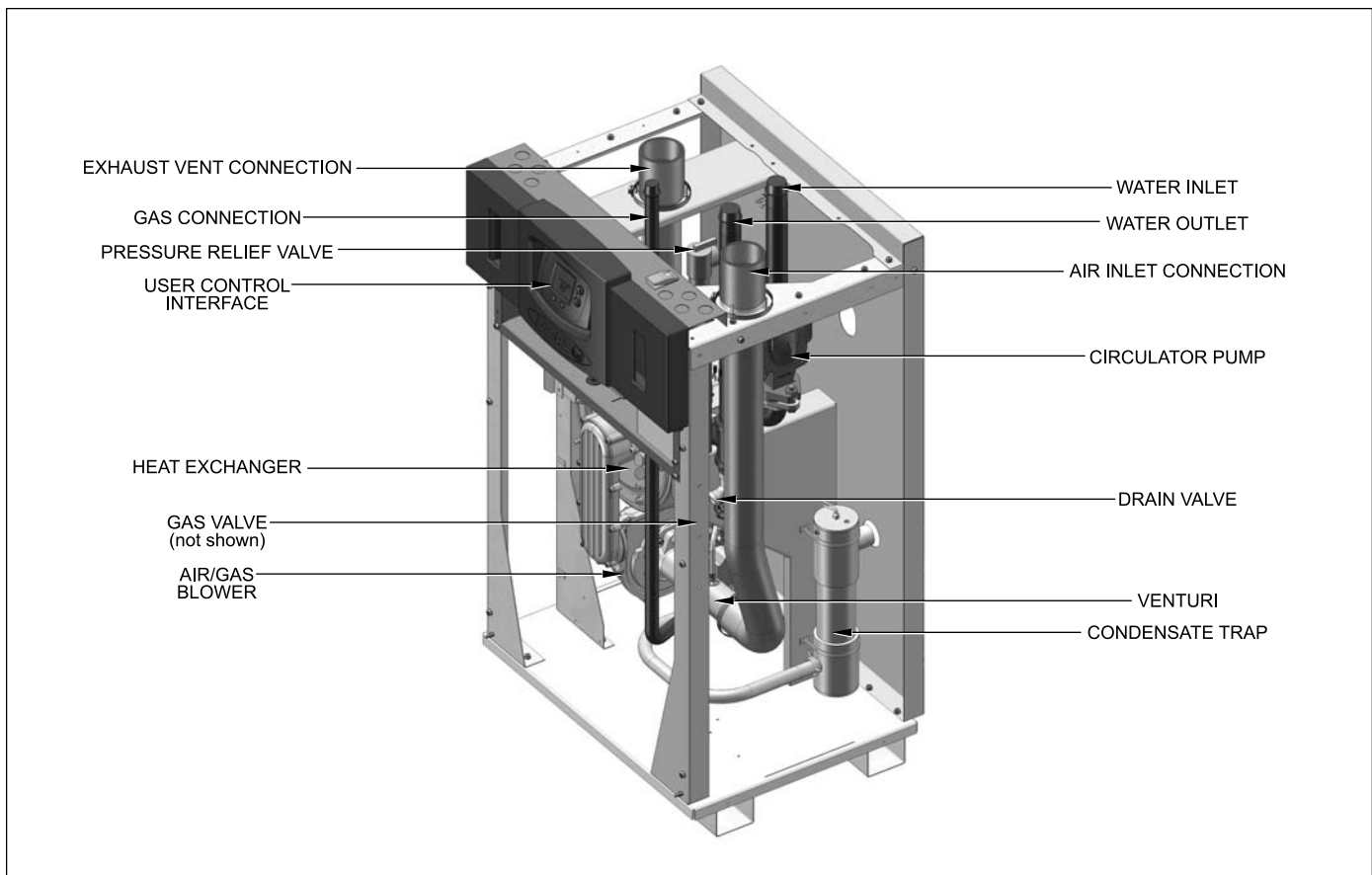


Figure 2. Location of Components, Sizes 80-105.

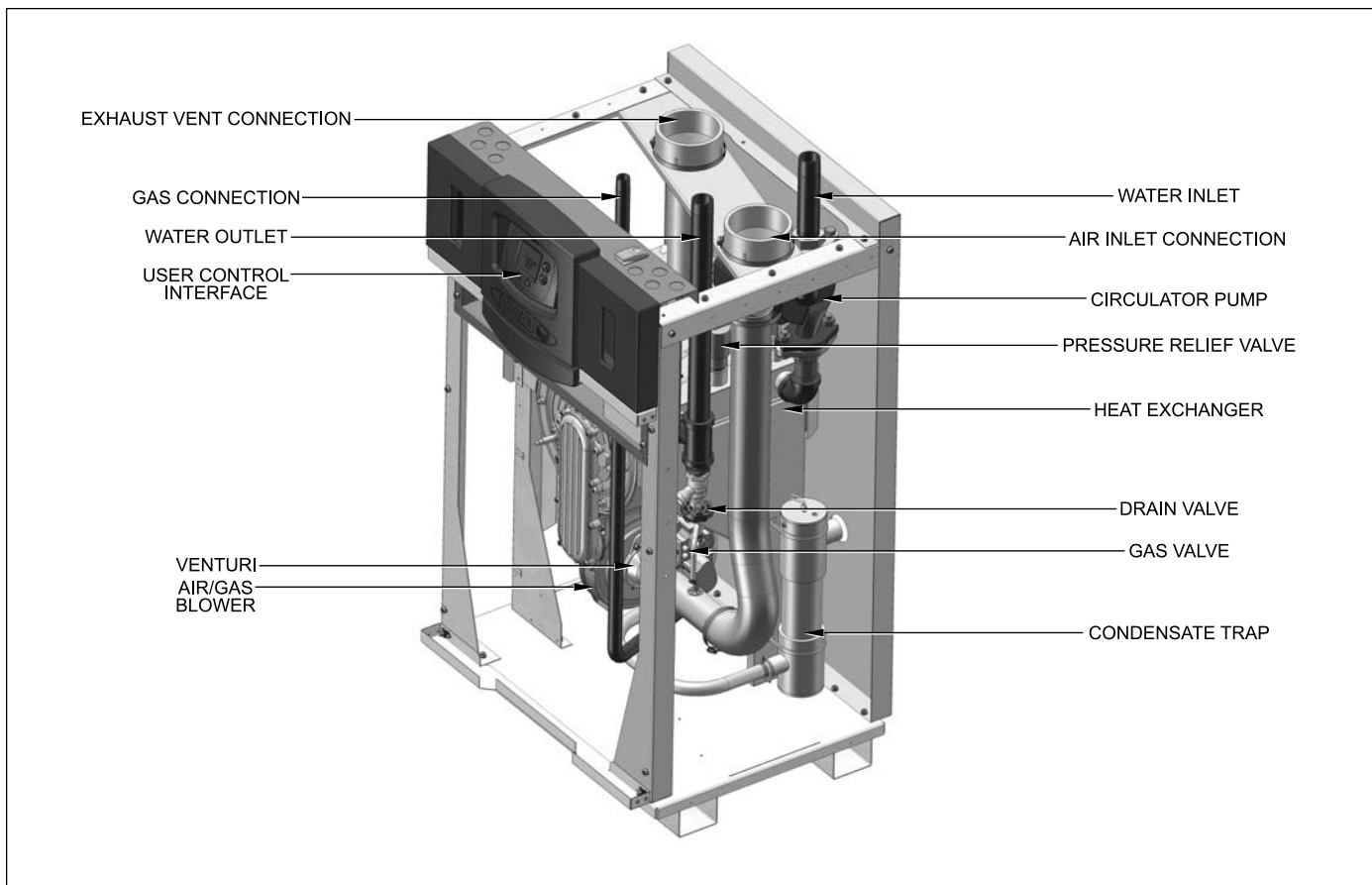


Figure 3. Location of Components, Sizes 150–210.

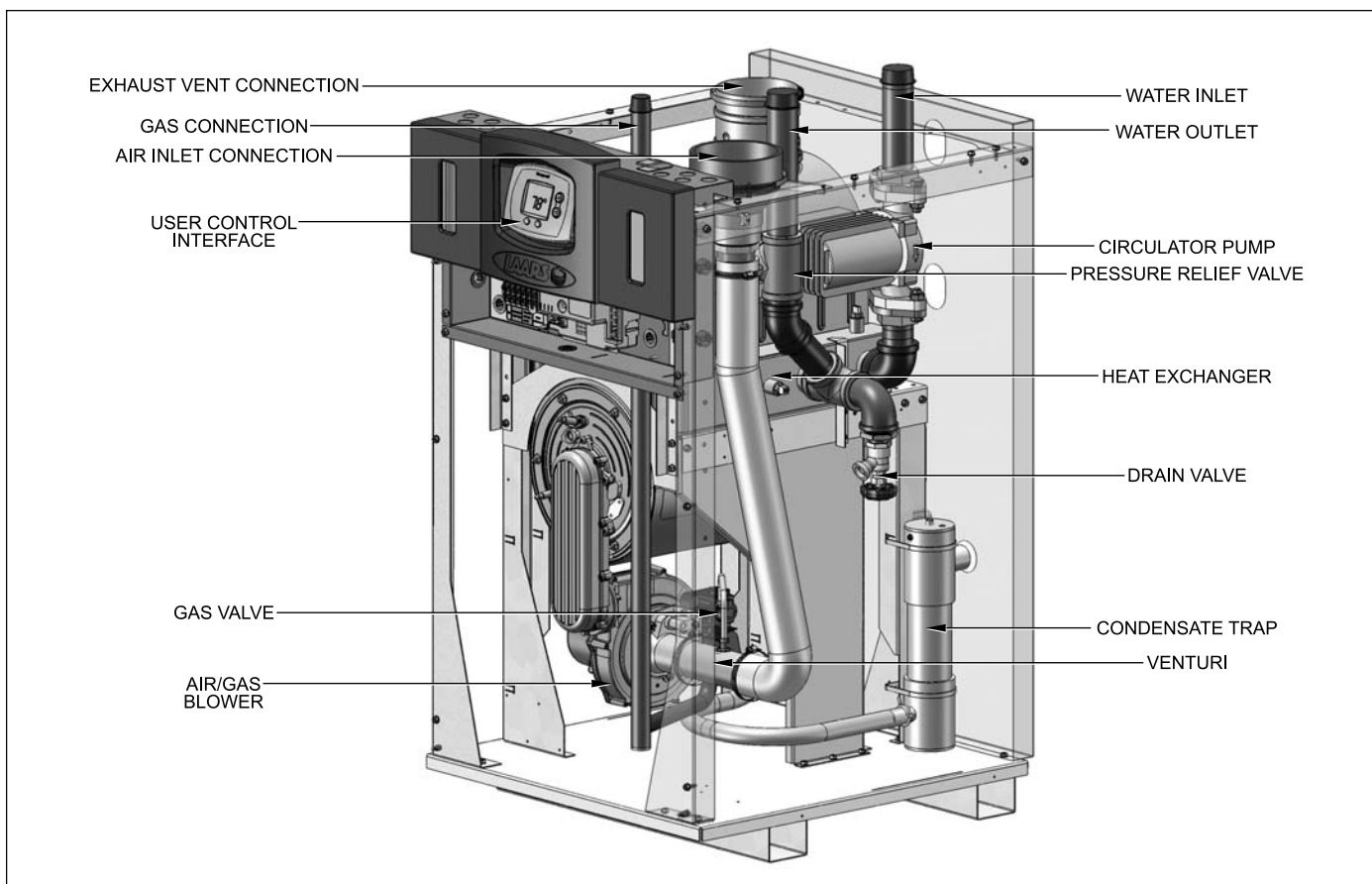


Figure 4. Location of Components, Size 285.

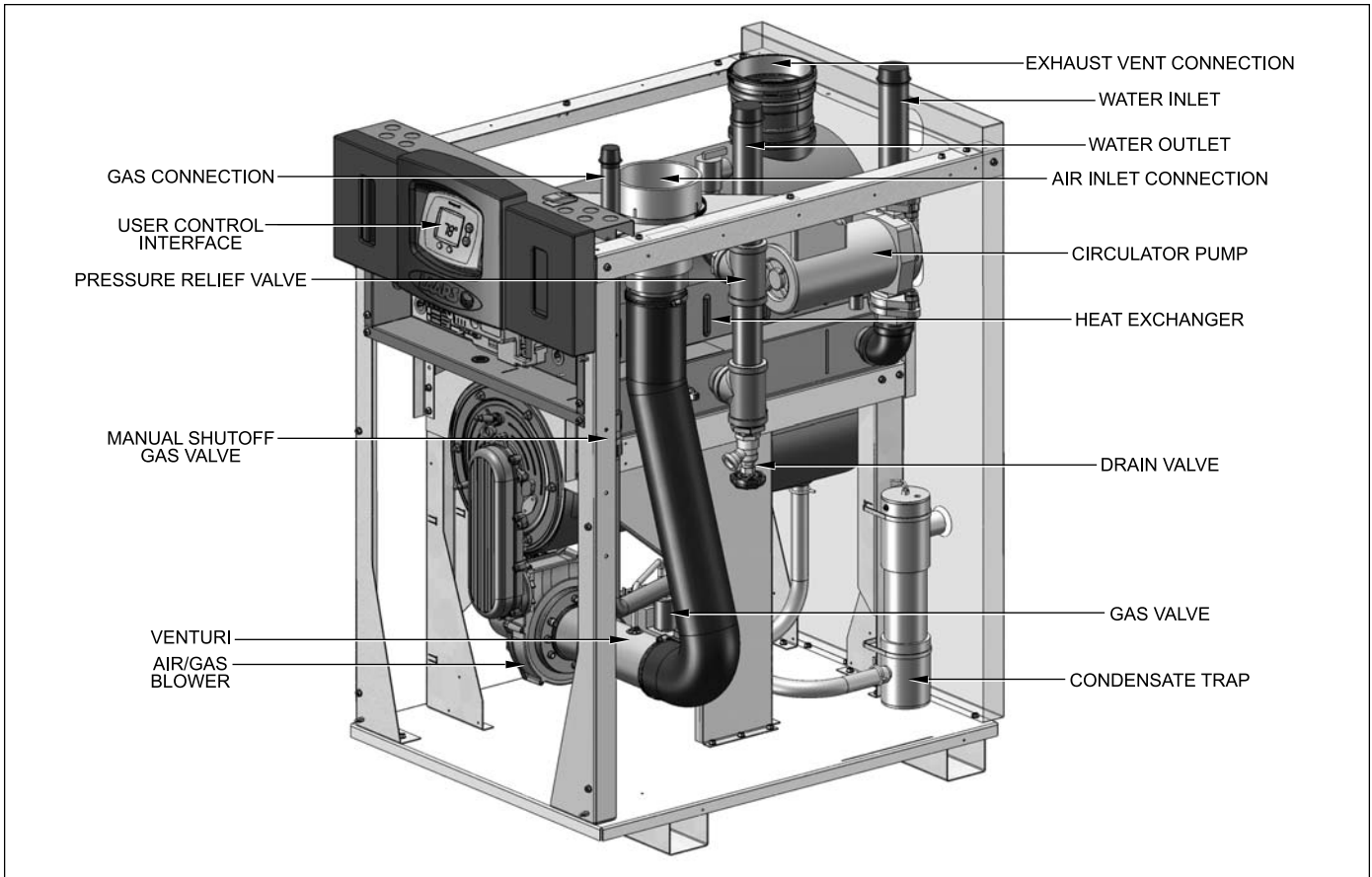


Figure 5. Location of Components, Size 399.

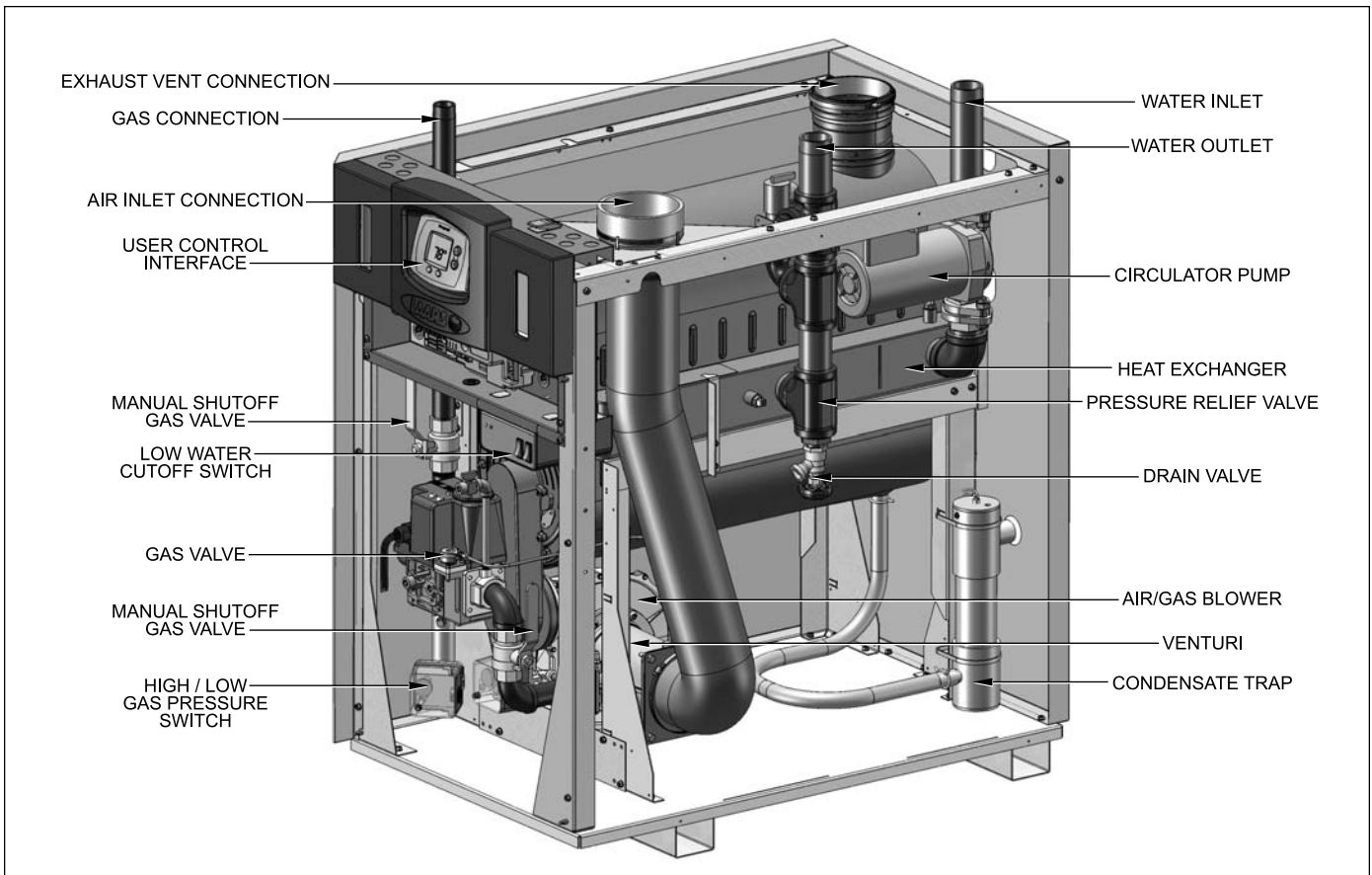


Figure 6. Location of Components, Size 500.

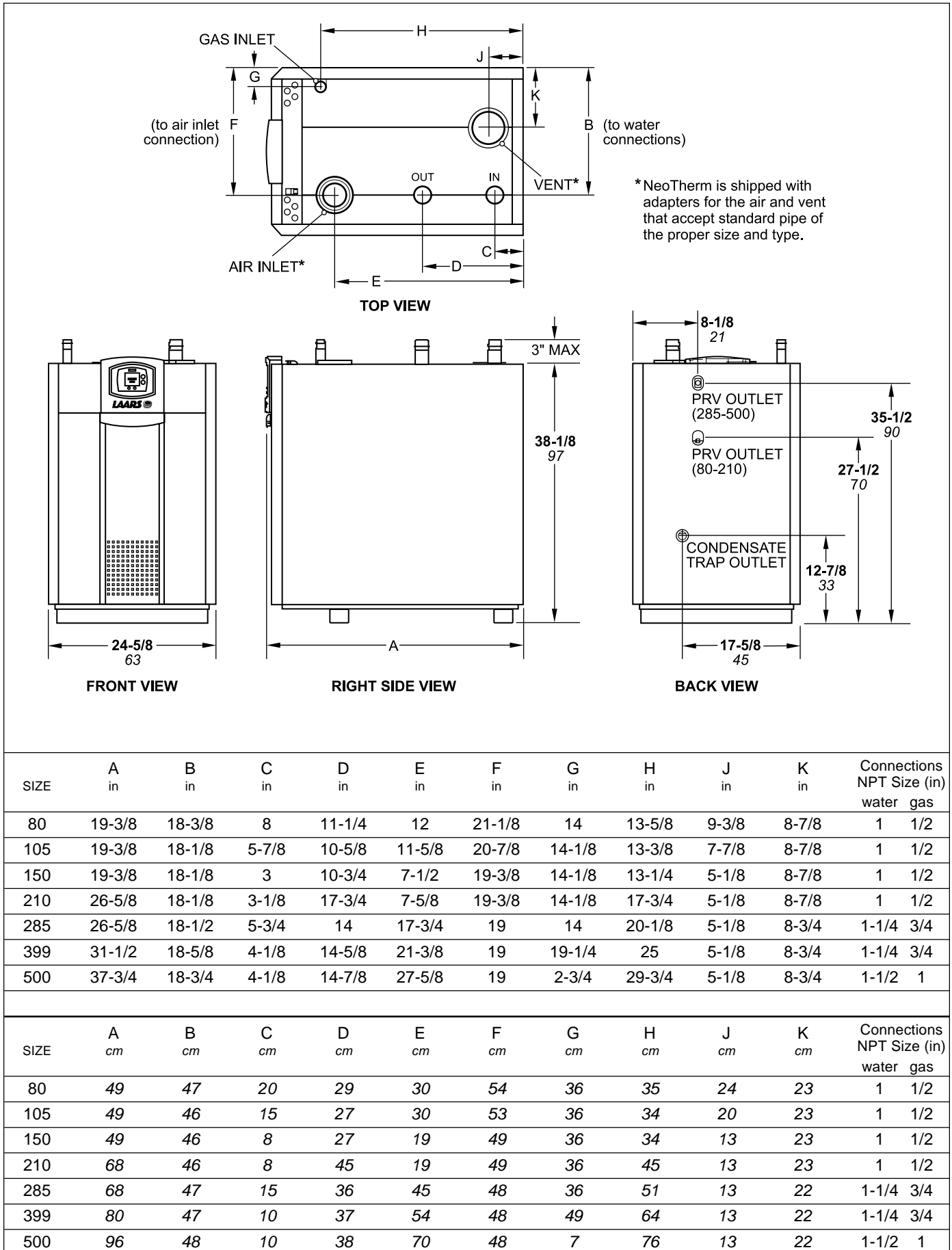


Figure 7. Dimensional Drawing.

NeoTherm Boilers must never be installed on carpeting. The location for the appliance should be chosen with regard to the vent pipe lengths and external plumbing. The unit shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, control replacement, etc.). When vented vertically, the NeoTherm must be located as close as practical to the vertical section of the vent. If the vent terminal and/or combustion air terminal terminate through a wall, and there is potential for snow accumulation in the local area, both terminals should be installed at an appropriate level above grade or the maximum expected snow line.

The dimensions and requirements that are shown in Table 1 should be met when choosing the locations for the appliance.

1.8 Locating Appliance for Correct Vent Distance from Outside Wall or Roof Termination

The forced draft combustion air blower in the appliance has sufficient power to vent properly when the guidelines in Table 2 are followed.

NOTE: When located on the same wall, the NeoTherm combustion air intake terminal must be installed a minimum of 12" (30cm) below the exhaust vent terminal.

For concentric vent terminal kit (optional), follow installation instructions included with the kit.

APPLIANCE SURFACE	REQUIRED CLEARANCE FROM COMBUSTIBLE MATERIAL		SUGGESTED SERVICE ACCESS CLEARANCE	
	IN.	CM	IN.	CM
Left Side	1	2.5	1	2.5
Right Side	1	2.5	12	31
Top	1	2.5	24	61
Back	1	2.5	6	15
Closet, Front	1	2.5	6	15
Alcove, Front	1	2.5	24	61
Vent	0	0	-	-

Table 1. Clearances.

SIZE	MAX EQUIVALENT* VENT LENGTH PVC/CPVC (EACH INTAKE AND EACH EXHAUST)		
	2" DIA / 5.1CM	3" DIA / 7/6CM	4" DIA / 10.2CM
80	40 ft 6.1M	100 ft 30.5M	n/a
105	40 ft 6.1M	100 ft 30.5M	n/a
150	n/a	100 ft 30.5M	n/a
210	n/a	100 ft 30.5M	n/a
285	n/a	20 ft 6.1M	100 ft 30.5M
399	n/a	n/a	100 ft 30.5M
500	n/a	n/a	100 ft 30.5M

* Each 90° fitting = 5 equivalent feet 1.5M

Table 2. Vent / Air Pipe Sizes.

SECTION 2. Venting and Combustion Air

2.1 Combustion Air

NeoTherm boilers and water heaters must have provisions for combustion and ventilation air in accordance with the applicable requirements for Combustion Air Supply and Ventilation in the National Fuel Gas Code, ANSI Z223.1; or in Canada, the Natural Gas and Propane Installation Code, CSA B149.1. All applicable provisions of local building codes must also be adhered to.

A NeoTherm unit can take combustion air from the space in which it is installed, or the combustion air can be ducted directly to the unit. Ventilation air must be provided in either case.

2.1.1 Combustion Air From Room

In the United States, the most common requirements specify that the space shall communicate with the outdoors in accordance with method 1 or 2, which follow. Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

Method 1: Two permanent openings, one commencing within 12" (300mm) of the top and one commencing within 12" (300mm) of the bottom, of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors. When directly communicating with the outdoors, or when communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4000 Btu/hr (550 square mm/kW) of total input rating of all equipment in the enclosure. When communicating to the outdoors through horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2000 Btu/hr (1100 square mm/kW) of total input rating of all equipment in the enclosure.

Method 2: One permanent opening, commencing within 12" (300mm) of the top of the enclosure, shall be permitted. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that directly communicate with the outdoors and shall have a minimum free area of 1 square inch per 3000 Btu/hr (734 square mm/kW) of the total input rating of all equipment located in the enclosure. This opening must not be less than the sum of the areas of all vent connectors in the confined space.

Other methods of introducing combustion and ventilation air are acceptable, providing they conform to the requirements in the applicable codes listed above.

In Canada, consult local building and safety codes or, in absence of such requirements, follow CAN/CGA B149.

2.1.2 Intake Combustion Air

The combustion air can be taken through the wall, or through the roof. When taken from the wall, it must be taken from out-of-doors by means of the LAARS horizontal wall terminal, shown in Table 3. See Table 2 to select the appropriate diameter air pipe. When taken from the roof, a field-supplied rain cap or an elbow arrangement must be used to prevent entry of rain water (see Figure 8).

Use ABS, PVC, CPVC or galvanized pipe for the combustion air intake (see Table 4), sized per Section 1.7. Route the intake to the heater as directly as possible. Seal all joints. Provide adequate hangers. The unit must not support the weight of the combustion air intake pipe. Maximum linear pipe length allowed is shown in Table 2. Subtract 5 allowable linear ft. (1.5m) for every elbow used.

The connection for the intake air pipe is at the top of the unit. To aid in boiler service, a removable adapter is recommended when making the connection to the boiler.

In addition to air needed for combustion, air shall also be supplied for ventilation, including air required for comfort and proper working conditions for personnel.

2.2 Venting

WARNING

Failure to use CPVC or stainless steel venting for the first 16" of vent material or for any part of the venting that is installed inside a closet may lead to property damage, personal injury or death.

SIZE	HORIZONTAL INTAKE AND EXHAUST PVC VENT TERMINAL KITS				
	2" PVC		3" PVC		4" PVC
	Standard	Concentric CA006000	Standard CA005900	Concentric 239-44069-01	Standard
80	included	optional	optional	optional	n/a
105	included	optional	optional	optional	n/a
150	n/a	n/a	included	optional	n/a
210	n/a	n/a	included	optional	n/a
285	n/a	n/a	optional	optional	included
399	n/a	n/a	n/a	n/a	included
500	n/a	n/a	n/a	n/a	included

Table 3. PVC Vent Terminal Kits.

WARNING
Failure to use the appropriate vent material, installation techniques, glues/sealants could lead to vent failure causing property damage, personal injury or death.

WARNING
All venting must be installed according to this manual and any other applicable local codes, including but not limited to, ANSI Z223.1/NFPA 54, CSA B149.1, CSAB149.2 and ULC-S636. Failure to follow this manual and applicable codes may lead to property damage, severe injury, or death.

The NeoTherm is a Category IV appliance and may be installed with PVC and CPVC that complies with ANSI/ASTM D1785 F441, or a stainless steel

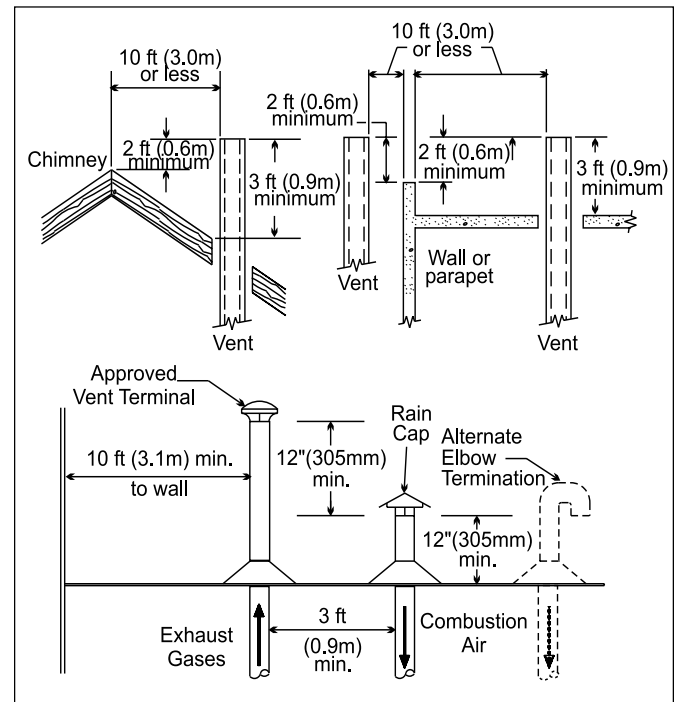


Figure 8. Combustion Air and Vent Through Roof.

MATERIAL	INSTALLATION STANDARDS	
	UNITED STATES	CANADA
ABS	ANSI/ASTM D1527	All venting must be ULC-S636 certified for use as venting material. The venting material must be chosen based upon the intended application of the boiler.
PVC, sch 40	ANSI/ASTM D1785 or D2665	
CPVC, sch 40	ANSI/ASTM F441	

Table 4. Required Combustion Air Vent Material.

MATERIAL	INSTALLATION STANDARDS	
	UNITED STATES	CANADA
Stainless Steel	UL 1738	All venting must be ULC-S636 certified for use as venting material. The venting material must be chosen based upon the intended application of the boiler.
PVC, sch 40	ANSI/ASTM D178	
CPVC, sch 40	ANSI/ASTM F441	

Table 5. Required Exhaust Vent Material.

	U.S. Installations (see note 1)	Canadian Installations (see note 2)
A= Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm) See note 6	12 inches (30 cm) See note 6
B= Clearance to window or door that may be opened	Direct vent only: 12 inches (30cm); Other than Direct vent: 4 ft (1.2m) below or to side of opening; 1 ft (30cm) above opening	36 inches (91 cm)
C= Clearance to permanently closed window	See note 4	See note 5
D= Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61cm) from the center line of the terminal	See note 4	See note 5
E= Clearance to unventilated soffit	See note 4	See note 5
F= Clearance to outside corner	See note 4	See note 5
G= Clearance to inside corner	See note 4	See note 5
H= Clearance to each side of center line extended above meter/regulator assembly	See note 4	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly
I= Clearance to service regulator vent outlet	See note 4	3 feet (91 cm)
J= Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	Direct vent only: 12 inches (30cm); Other than Direct vent: 4 ft (1.2m) below or to side of opening; 1 ft (30cm) above opening	36 inches (91 cm)
K= Clearance to a mechanical air supply inlet	3 feet (91 cm) above if within 10 feet (3 m) horizontally	6 feet (1.83 m)
L= Clearance above paved sidewalk or paved driveway located on public property	Vent termination not allowed in this location for category IV appliances.	Vent termination not allowed in this location for category IV appliances.
M= Clearance under veranda, porch, deck, or balcony	See note 4	12 inches (30 cm) (see note 3)

Notes:

1. In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code.
2. In accordance with the current CAN/CGA-B149 Installation Codes.
3. Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
4. For clearances not specified in ANSI Z223.1 / NFPA 54, clearance is in accordance with local installation codes and the requirements of the gas supplier.
5. For clearances not specified in CAN/CGA-B149, clearance is in accordance with local installation codes and the requirements of the gas supplier.
6. **IMPORTANT:** terminal must be placed such that it remains a minimum 12" above expected snow line. Local codes may have more specific requirements, and must be consulted.

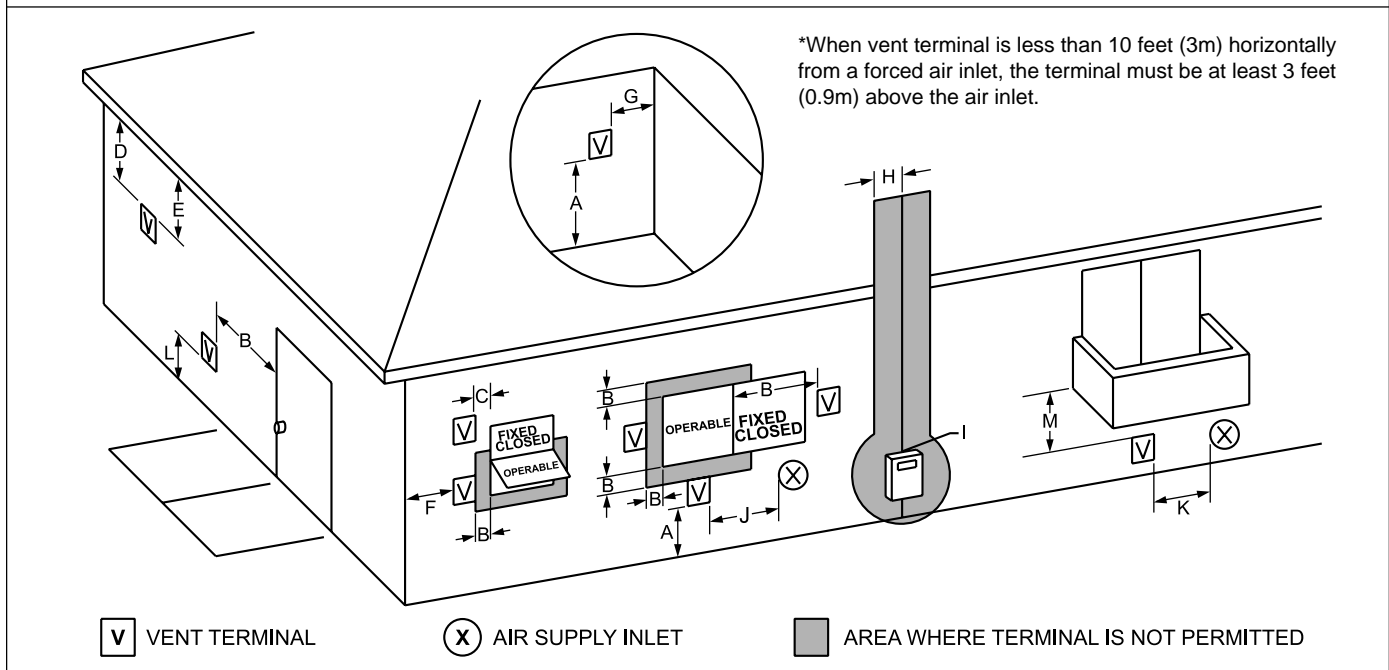


Figure 9. Combustion Air and Vent Through Side Wall.

venting system that complies with UL 1738 Standard (see Table 5).

Installations in Canada require the use of venting material certified to ULCS636. All Gas vents connected to the NeoTherm, plastic, stainless steel or otherwise must be certified to this ULC standard. Appropriate selection of vent material is very important for proper performance and safe operation of the NeoTherm. Vent material MUST be selected based upon operating conditions such as outlet water temperature and installed location.

The flue temperature of the NeoTherm changes dramatically with changes in operating water temperature. Therefore, it is necessary to assess the application of the boiler to determine the required certified vent class. If the NeoTherm is going to be installed in an application where the outlet water temperature exceeds 145F, and/or installed in a closet, class IIB or higher vent material is required. If the system temperatures are unknown at the time of installation, class IIB or higher venting material is recommended.

In Canada all venting used must meet the following requirements:

- 1. ULC-S636 certified and marked**
- 2. The first 3 feet of venting must be accessible for visual inspection.**
- 3. All components used in the vent system must be from a certified manufacturer.**
- 4. Vent system components must not be mixed with alternate manufacturers certified components and/or unlisted components.**
- 5. The venting must be installed according to the vent manufacturers installation instructions.**

The unit's vent can terminate through the roof, or through an outside wall. It can be installed through walls that are 3" (7.6cm) to 12" (30cm) in thickness.

The venting should be connected to the 16" CPVC section included with the boiler. The 16" section of CPVC must be used to make the connection to the boiler. See Table 2 to select the appropriate vent pipe diameter. The vent pipe must pitch upward, toward the vent terminal, so that condensate will run back to the NeoTherm to drain. Route the vent pipe to the heater as directly as possible. Seal all joints and provide adequate hangers as required in the venting system manufacturer's Installation Instructions. Horizontal portions of the venting system must be supported to prevent sagging and may not have any low sections that could trap condensate. The unit must not support the weight of the vent pipe. Horizontal runs must slope upwards not less than 1/4 inch per foot from the unit to the vent terminal. Up to 100 equivalent feet (30m) of pipe can be used. Subtract 5 feet (1.5m) for each elbow used.

IMPORTANT NOTE ABOUT COMMON VENTING:

A single vent that is shared by multiple NeoTherm units **MUST** be engineered by a competent venting

specialist, and involves the selection of draft inducing equipment, hardware and controls to properly balance flue gas pressures. **Do not common vent NeoTherm units unless the vent system meets this requirement. NeoTherm units are never permitted to share a vent with Category I appliances.**

A condensate drain is built into the NeoTherm. A float switch monitors the condensate trap, and will open if the condensate level gets too high. This will prevent the NeoTherm from firing if there is a blockage or overflow.

Connect a 3/4" PVC pipe between the drain connection and a floor drain (or condensate pump if a floor drain is not accessible).

The condensate drain must be installed so as to prevent accumulation of condensate. When a condensate pump is not used, the tubing must continuously slope downward toward the drain with no spiraling.

Consult local codes for disposal method.

⚠ Caution

Condensate is mildly acidic (pH≈5), and may harm some floor drains and/or pipes, particularly those that are metal. Ensure that the drain, drainpipe, and anything that will come in contact with the condensate can withstand the acidity, or neutralize the condensate before disposal. **Damage caused by failure to install a neutralizer kit or to adequately treat condensate will not be the manufacturer's responsibility.**

2.3 Locating Vent & Combustion Air Terminals

2.3.1 Side Wall Vent Terminal

The appropriate Laars side wall vent terminal must be used, and is listed in this installation and operation manual. The terminal must be located in accordance with ANSI Z223.1/NFPA 54 and applicable local codes. In Canada, the installation must be in accordance with CSA B149.1 or .2 and local applicable codes. Consider the following when installing the terminal:

1. Figure 9 shows the requirements for mechanical vent terminal clearances for the U.S. and Canada.
2. Vent terminals for condensing appliances or appliances with condensing vents are **not** permitted to terminate above a public walkway, or over an area where condensate or vapor could create a nuisance or hazard.
3. Locate the vent terminal so that vent gases cannot be drawn into air conditioning system inlets.
4. Locate the vent terminal so that vent gases cannot enter the building through doors, windows, gravity inlets or other openings. Whenever possible, avoid locations under windows or near doors.

5. **Locate the vent terminal so that it cannot be blocked by snow. The installer may determine that a vent terminal must be higher than the minimum shown in codes, depending upon local conditions.**
6. Locate the terminal so the vent exhaust does not settle on building surfaces or other nearby objects. Vent products may damage surfaces or objects.
7. If the boiler or water heater uses ducted combustion air from an intake terminal located on the same wall, locate the vent terminal at least 1 foot (0.3m) above the combustion air terminal.

2.3.2 Side Wall Combustion Air Terminal

The LAARS side wall combustion air terminal, or concentric terminal (see Table 3), must be used when the heater takes air from a side wall. Consider the following when installing the terminal:

1. Do not locate the air inlet terminal near a source of corrosive chemical fumes (e.g., cleaning fluid, chlorine compounds, etc.)
2. Locate the terminal so that it will not be subject to damage by accident or vandalism. It must be at least 7 feet (2.1m) above a public walkway.
3. Locate the combustion air terminal so that it cannot be blocked by snow. The National Fuel Gas Code requires that it be at least 12 inches (30cm) above grade, but the installer may determine it should be higher, depending upon local conditions.
4. If the NeoTherm is side-wall vented to the same wall, locate the vent terminal at least 1 foot (0.3m) above the combustion air terminal.

2.3.3 Vertical Vent Terminal

When the unit is vented through the roof, the vent must extend at least 3 feet (0.9m) above the point at which it penetrates the roof. It must extend at least 2 feet (0.6m) higher than any portion of a building within a horizontal distance of 10 feet (3.0m), and high enough above the roof line to prevent blockage from snow. When the combustion air is taken from the roof, the combustion air must terminate at least 12" (30cm) below the vent terminal (see Figure 8).

2.3.4 Vertical Combustion Air Terminal

When combustion air is taken from the roof, a field-supplied rain cap or an elbow arrangement must be used to prevent entry of rain water (see Figure 8). The opening on the end of the terminal must be at least 12" (30cm) above the point at which it penetrates the roof, and high enough above the roof line to prevent blockage from snow. When the vent terminates on the roof, the combustion air must terminate at least 12" (30cm) below the vent terminal.

2.3.5 Installations in the Commonwealth of Massachusetts

In Massachusetts the following items are required if the side-wall exhaust vent termination is less than seven (7)

feet above finished grade in the area of the venting, including but not limited to decks and porches. From Massachusetts Rules and regulations 248 CMR 5.08

1. **Installation of Carbon Monoxide Detectors**

At the time of installation of the side wall vented gas fueled appliance, the installing plumber or gasfitter shall observe that a hard-wired carbon monoxide detector with an alarm battery back-up is installed on the floor level where the gas appliance is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard-wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side-wall horizontally vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for installation of hard-wired carbon monoxide detectors.

a. In the event that the side-wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard-wired carbon monoxide with alarm and battery back-up may be installed on the next adjacent floor level.

b. In the event that the requirements of the subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements, provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm be installed.

2. **Approved Carbon Monoxide Detectors**

Each carbon monoxide detector shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. **Signage**

A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print no less than one-half (1/2) inch in size: "GAS VENT DIRECTLY BELOW, KEEP CLEAR OF ALL OBSTRUCTIONS".

4. **Inspection**

The state or local gas inspector of the side-wall horizontally vented gas fueled appliance shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1-4.

2.4 Common Vent Test

NOTE: This section does not describe a method for

common venting NeoTherm units. It describes what must be done when a unit is removed from a common vent system. NeoTherm units require special vent systems and fans for common vent. Contact the factory if you have questions about common venting NeoTherm units.

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as it is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so the appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.
7. Any improper operation of the common venting system should be corrected so that the installation conforms to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Installation Codes. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables and guidelines in the National Fuel Gas Code, ANSI Z223.1 NFPA 54 and/or CSA B149.1, Installation Codes.

SECTION 3. Gas Supply and Piping

3.1 Gas Supply and Piping

Gas piping should be supported by suitable hangers or floor stands, not the appliance.

Review the following instructions before proceeding with the installation.

1. Verify that the appliance is fitted for the proper type of gas by checking the rating plate. NeoTherm will function properly without the use of high altitude modification at elevations up to 10,000 feet (3050 m).
2. The maximum inlet gas pressure must not exceed 13" W.C. (3.2kPa). The minimum inlet gas pressure is 4" W.C. (1.0kPa).
3. Refer to Table 6A, 6B and 6C to size piping.
4. Run gas supply line in accordance with all applicable codes.
5. Locate and install manual shutoff valves in accordance with state and local requirements.
6. A sediment trap must be provided upstream of the gas controls.
7. All threaded joints should be coated with piping

NEOTHERM NATURAL GAS REQUIRED	
SIZE	CU FT / HR.
80	80
105	105
150	150
210	210
285	285
399	399
500	500

Table 6A.

TO SIZE PIPING:

Measure linear distance from meter outlet to last boiler. Add total input of all boilers and divide by 1000 to obtain cu ft / hr required. Add total equivalent length of fittings used according to Table 6B. Align total length (pipe and fittings) on left side column of Table 6C with highest cubic feet of gas required.

Notes:

Consult and confirm with Applicable Fuel Gas Code before beginning work. For LP installations, consult gas supplier for pipe sizing. Verify gas inlet pressure is between 13 and 4 in W.C. before starting boiler.

EQUIVALENT LENGTHS OF STRAIGHT PIPE FOR TYPICAL SCH 40 FITTINGS						
NOMINAL PIPE SIZE						
FITTING	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
LINEAR FEET						
90° ELBOW	3.6	4.4	5.2	6.6	7.4	8.5
TEE	4.2	5.3	6.6	8.7	9.9	12

Table 6B.

SCH 40 METAL PIPE CAPACITY FOR 0.60 SPECIFIC GRAVITY NATURAL GAS						
NOMINAL PIPE SIZE @ 0.30" W.C. PRESSURE DROP						
LENGTH	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
FT	CUBIC FEET OF GAS PER HOUR					
20	92	190	350	730	1100	2100
40		130	245	500	760	1450
60		105	195	400	610	1150
80		90	170	350	530	990
100			150	305	460	870

Table 6C.

- compound resistant to action of liquefied petroleum gas.
8. The appliance and its individual shutoff valve must be disconnected from the gas supply piping during any pressure testing of that system at test pressures in excess of 1/2 PSIG (3.45kPa).
 9. The unit must be isolated from the gas supply system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.45kPa).
 10. The appliance and its gas connection must be leak tested before placing it in operation.
 11. Purge all air from gas lines.

⚠ WARNING:

Open flame can cause gas to ignite and result in property damage, severe injury, or loss of life.

NOTE: The NeoTherm appliance and all other gas appliances sharing the gas supply line must be firing at maximum capacity to properly measure the inlet supply pressure. The pressure can be measured at the supply pressure port on the gas valve. Low gas pressure could be an indication of an undersized gas meter, undersized gas supply lines and/or an obstructed gas supply line. Some NeoTherm units are equipped with low and high gas pressure switches that are integrally vent limited. These types of devices do not require venting to atmosphere.

SECTION 4. Water Connections

4.1 Heating System Piping: Hot Supply Connections

NOTE: This appliance must be installed in a closed pressure system with a minimum of 12 psi (82.7kPa) static pressure at the boiler.

Hot water piping should be supported by suitable hangers or floor stands. Do not support piping with this appliance. Due to expansion and contraction of copper pipe, consideration should be given to the type of hangers used. Rigid hangers may transmit noise through the system resulting from the piping sliding in the hangers. It is recommended that padding be used when rigid hangers are installed. Maintain 1" (2.5cm) clearance to combustibles for hot water pipes.

Pipe the discharge of the relief valve (full size) to a drain or in a manner to prevent injury in the event of pressure relief. Install an air purger, an air vent, a diaphragm-type expansion tank, and a hydronic flow check in the system supply loop. Minimum fill pressure must be 12psig (82.7kPa). Install shutoff valves where

required by code.

Suggested piping diagrams are shown in Figures 10 through 15. These diagrams are meant only as a guide. Components required by local codes must be properly installed. **The NeoTherm boiler's efficiency is higher with lower return water temperatures.** Therefore, to get the most of low return temperature with multiple boilers, pipe as shown in Figure 13.

All NeoTherm models are built standard with a pump mounted inside the jacket. Sizes 399 and 500 can be ordered without the pump, as an option. If the boiler is a size 399 or 500, it is important to know whether there is an internal pump in the unit or not.

NeoTherm boilers that are pump-mounted MUST be piped in a primary-secondary fashion (using either piping or a hydraulic separator) such that the pump that is mounted on the boiler ONLY serves the boiler.

For best results, the NeoTherm boiler should be located within 15 feet (4.6m) of the supply and return header (or the hydraulic separator). The pump is sized for a maximum of 30 feet (9.1m) of piping and the headloss of the boiler only (see Table 7).

If a pump-mounted boiler must be installed with longer piping runs, then larger diameter tubing may be used. Consult the Applications Engineering Department at the factory for assistance.

Models 399 and 500 can be ordered without a mounted pump. If ordered without the pump, a field-supplied pump should be chosen to supply the boiler only. Primary/secondary piping methods should still be used, to ensure proper water flow through the unit.

4.2 Cold Water Make-Up

1. Connect the cold water supply to the inlet connection of an automatic fill valve.
2. Install a suitable back flow preventer between the automatic fill valve and the cold water supply.
3. Install shut off valves where required.

NOTE: The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

The boiler piping system of a hot water heating boiler connected to heating coils located in air handling appliances where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

A boiler installed above radiation level, or as required by the authority having jurisdiction, must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation.

4.3 Freeze Protection

NeoTherm units are certified for indoor use only, and are not design-certified for placement outdoors.

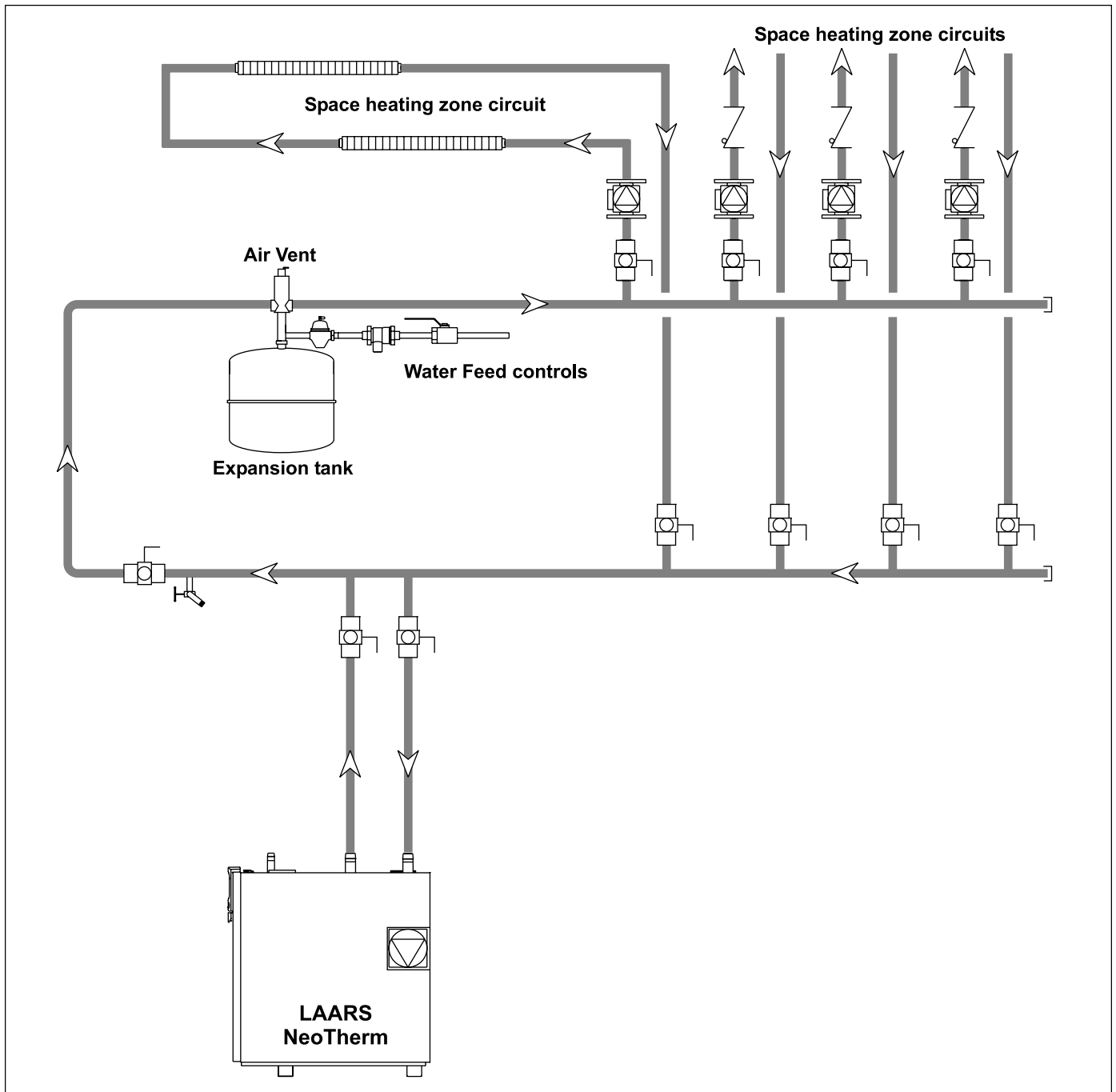


Figure 10. Hydronic Piping — Single Boiler (zoning with circulators).

Proper precautions for freeze protection are recommended for boiler installations in areas where the danger of freezing exists.

Power outage, interruption of gas supply, failure of system components, activation of safety devices, etc., may prevent a boiler from firing. **Any time a boiler is subjected to freezing conditions, and the boiler is not able to fire, and/or the water is not able to circulate, there is a risk of freezing in the boiler or in the pipes in the system.** When water freezes, it expands which may result in bursting of pipes, or damage to the boiler, which could result in leaking or flooding conditions.

Do not use automotive anti-freeze. Laars recommends a mixture of minimum 70% water and maximum 30% of inhibited HVAC glycol solution, which contains an anti-foaming agent, as the preferred method of freeze protection for NeoTherm boilers. **Percentage of glycol used in the NeoTherm boiler must not exceed 30%.** Typically, this mixture will serve as burst protection for temperatures down to approximately -35°F (-30°C).

IMPORTANT NOTES: Different glycol products may provide varying degrees of protection. Glycol products must be maintained properly in a heating system, or they

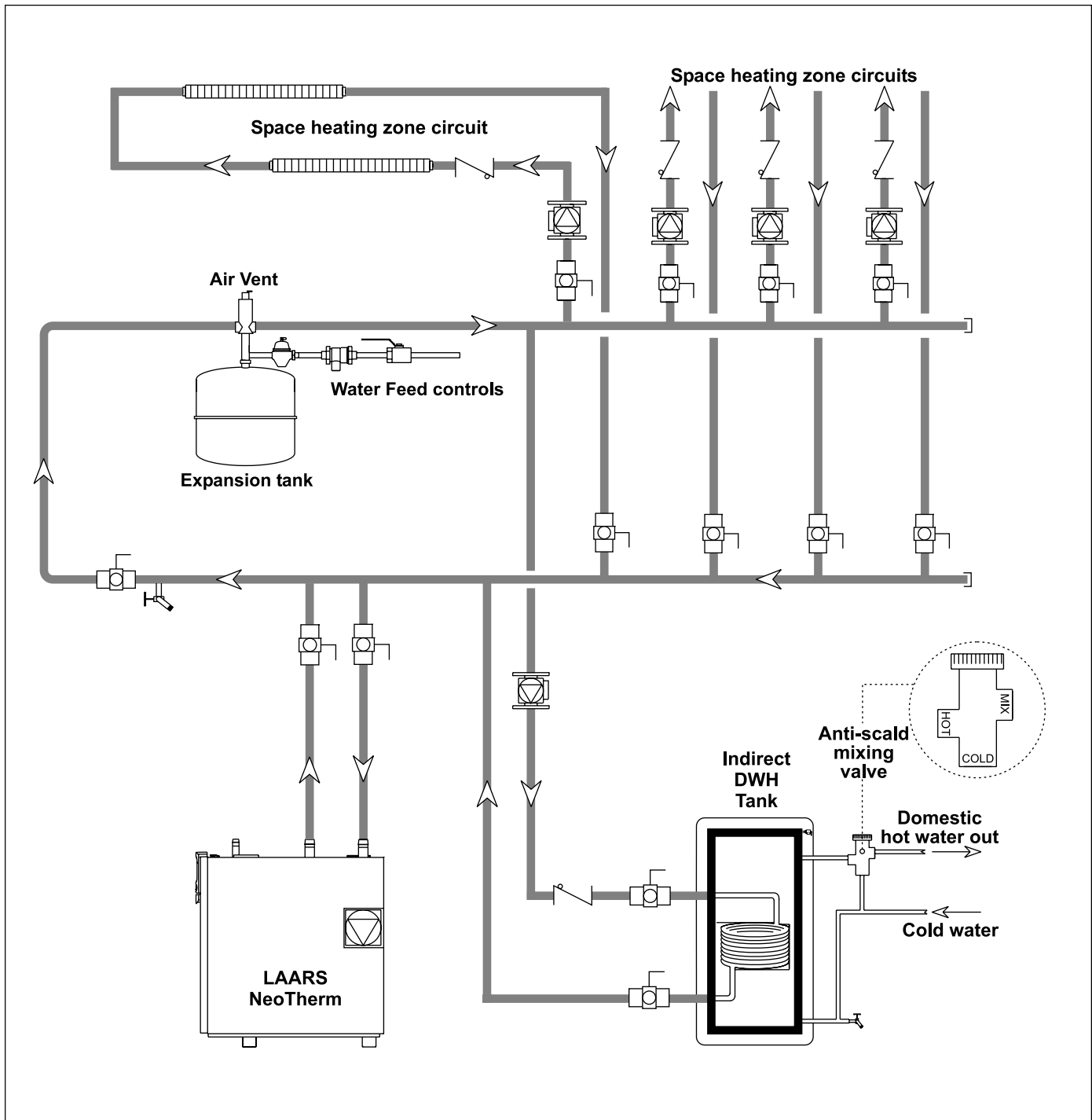


Figure 11. Hydronic Piping — Single Boiler with Indirect DWH Tank (zoning with circulators)..

may become ineffective. Consult the glycol specifications, or the glycol manufacturer, for information about specific products, maintenance of solutions, and set up according to your particular conditions.

4.4 Recognized Chemicals

The following manufacturers offer glycols, inhibitors, and anti foamants that are suitable for use in the NeoTherm. Please refer to the manufacturers instructions for proper selection and application.

1. Sentinel Performance Solutions Group
2. Hercules Chemical Company
3. Dow Chemical Company

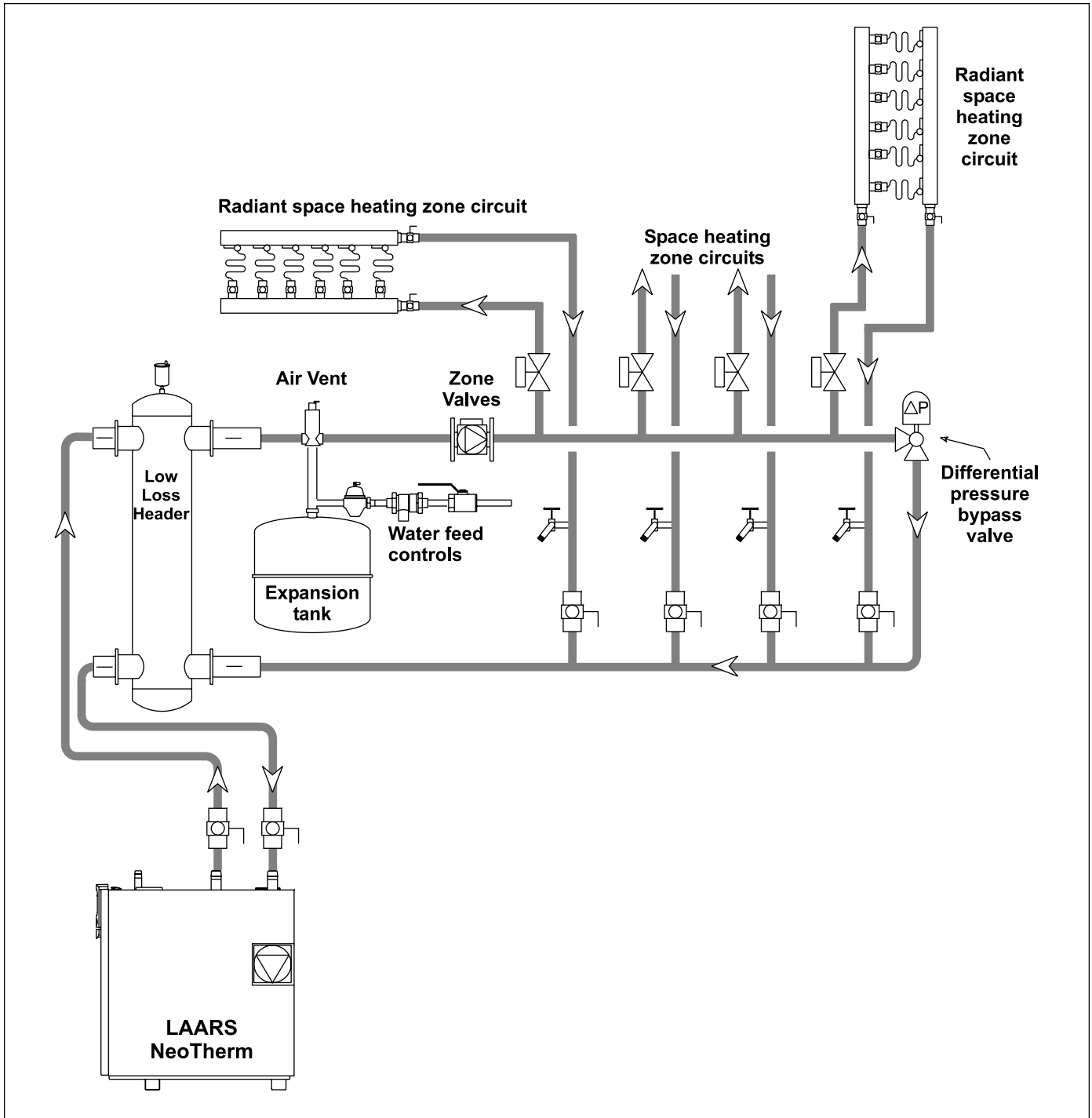


Figure 12. Hydronic Piping — Single Boiler, Low Temp Radiant Space Heating using Low Loss Header and Zone Valves.

SIZE	BOILER HEAD (FT) AT TEMP RISE			PUMP MODEL INCL.
	20°F	25°F	30°F	
80	14.9	10.1	7.1	008
105	23.1	17	12.4	0011
150	28.5	19	13.6	0011
210	24.1	16.7	11.6	0013
285	25.5	17.5	14	0013
399	28	20	14.5	1400-45
500	24	18	12	1400-45

Table 7. NeoTherm Pump Data.

Pre-mounted pumps are sized for:
 a) 25-30°F Temp Rise with;
 b) 30 feet external boiler loop piping, and;
 c) 6 elbows (90°).

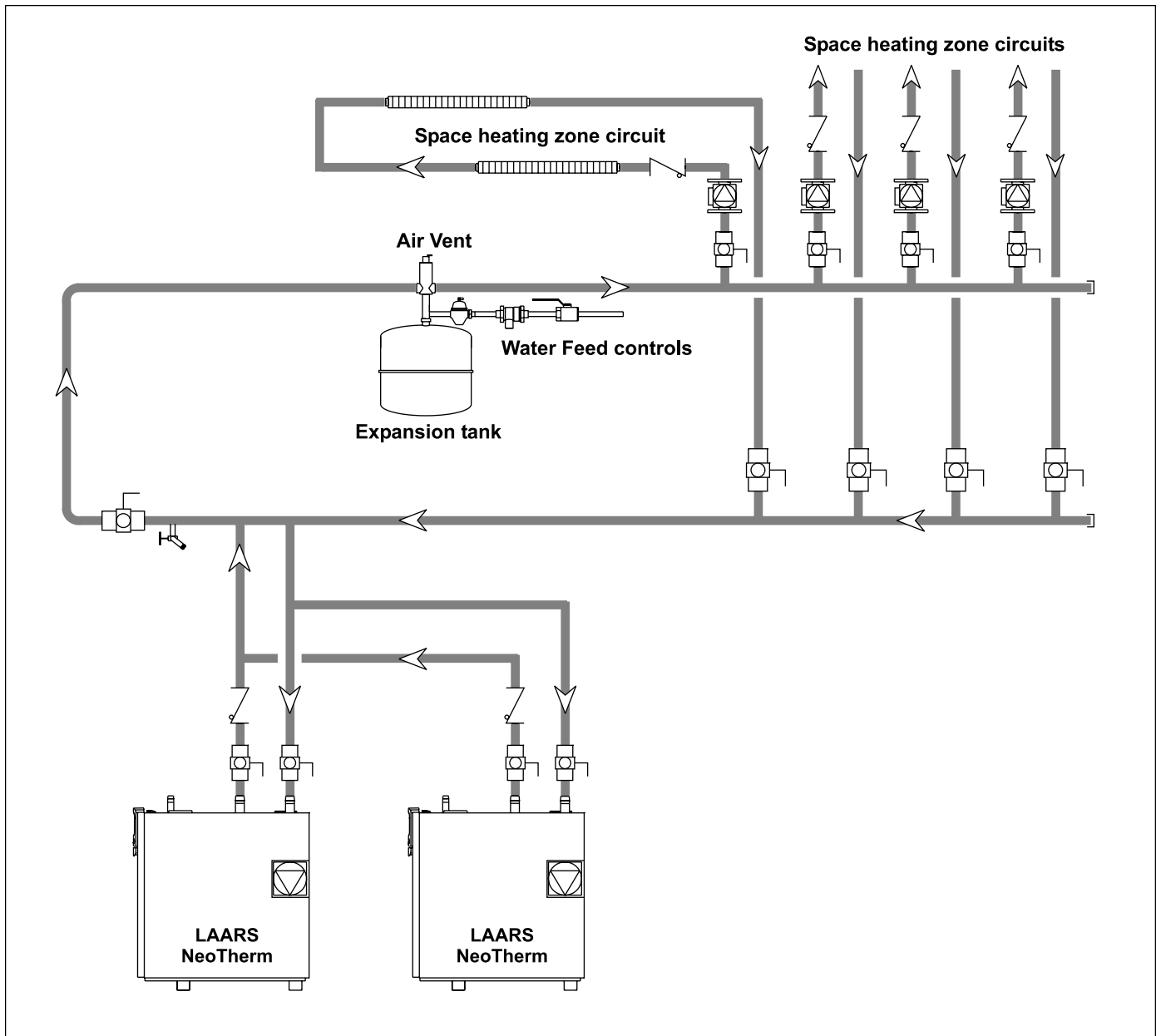


Figure 13. Hydronic Piping — Multiple Boilers (zoning with circulators).

Size	Temperature Rise in °F					
	20°F		25°F		30°F	
	Flow gpm	H/L feet	Flow gpm	H/L feet	Flow gpm	H/L feet
80	7.6	14.9	6.1	10.1	5.1	7.1
105	10.0	23.1	8.0	17.0	6.7	12.4
150	14.3	28.5	11.4	19.0	9.5	13.6
210	20.0	24.1	16.0	16.7	13.4	11.6

Size	Temperature Rise in °C					
	11°C		14°C		17°C	
	Flow lpm	H/L m	Flow lpm	H/L m	Flow lpm	H/L m
80	7.6	14.9	6.1	10.1	5.1	7.1
105	10.0	23.1	8.0	17.0	6.7	12.4
150	14.3	28.5	11.4	19.0	9.5	13.6
210	20.0	24.1	16.0	16.7	13.4	11.6

Table 8. Water Flow Requirements, Sizes 80-210.

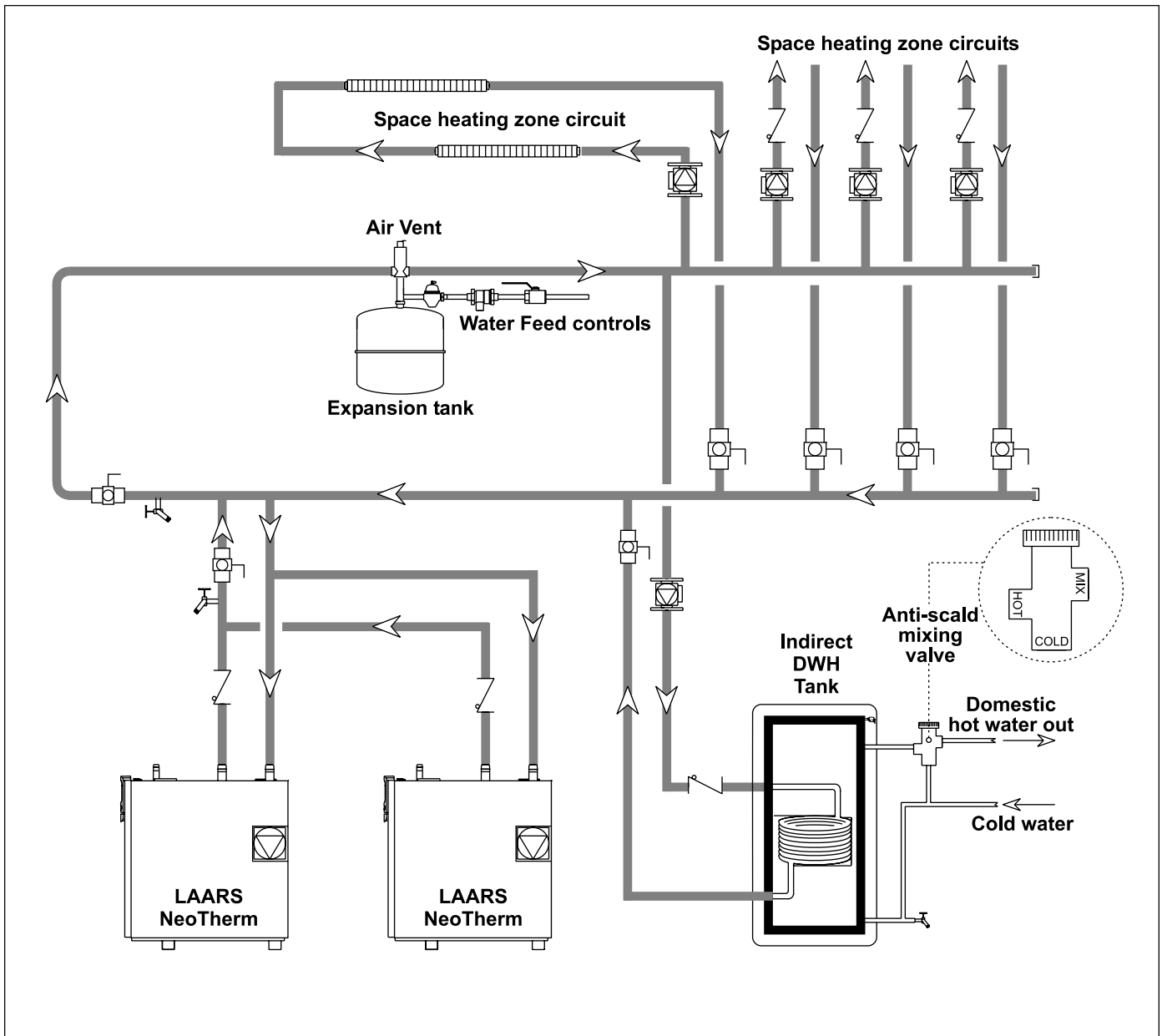


Figure 14. Hydronic Piping — Multiple Boilers with Indirect DWH Tank (zoning with circulators).

		Temperature Rise in °F									
		20°F		25°F		30°F		35°F		40°F	
Size		Flow gpm	H/L feet	Flow gpm	H/L feet	Flow gpm	H/L feet	Flow gpm	H/L feet	Flow gpm	H/L feet
285		27	25.5	22	17.5	18	14	15	10.5	13	8
399		38	28	31	20	25	14.5	22	11	19	9
500		47	24	38	16	32	12	27	9	24	8

		Temperature Rise in °C									
		11°C		14°C		17°C		19°C		22°C	
Size		Flow lpm	H/L m	Flow lpm	H/L m	Flow lpm	H/L m	Flow lpm	H/L m	Flow lpm	H/L m
285		102	7.8	81	5.3	68	4.3	58	3.2	51	2.4
399		145	8.5	116	6.1	96	4.4	83	3.4	72	2.7
500		179	7.3	143	4.9	119	3.7	102	2.7	89	2.4

Table 9. Water Flow Requirements, Sizes 285-500.

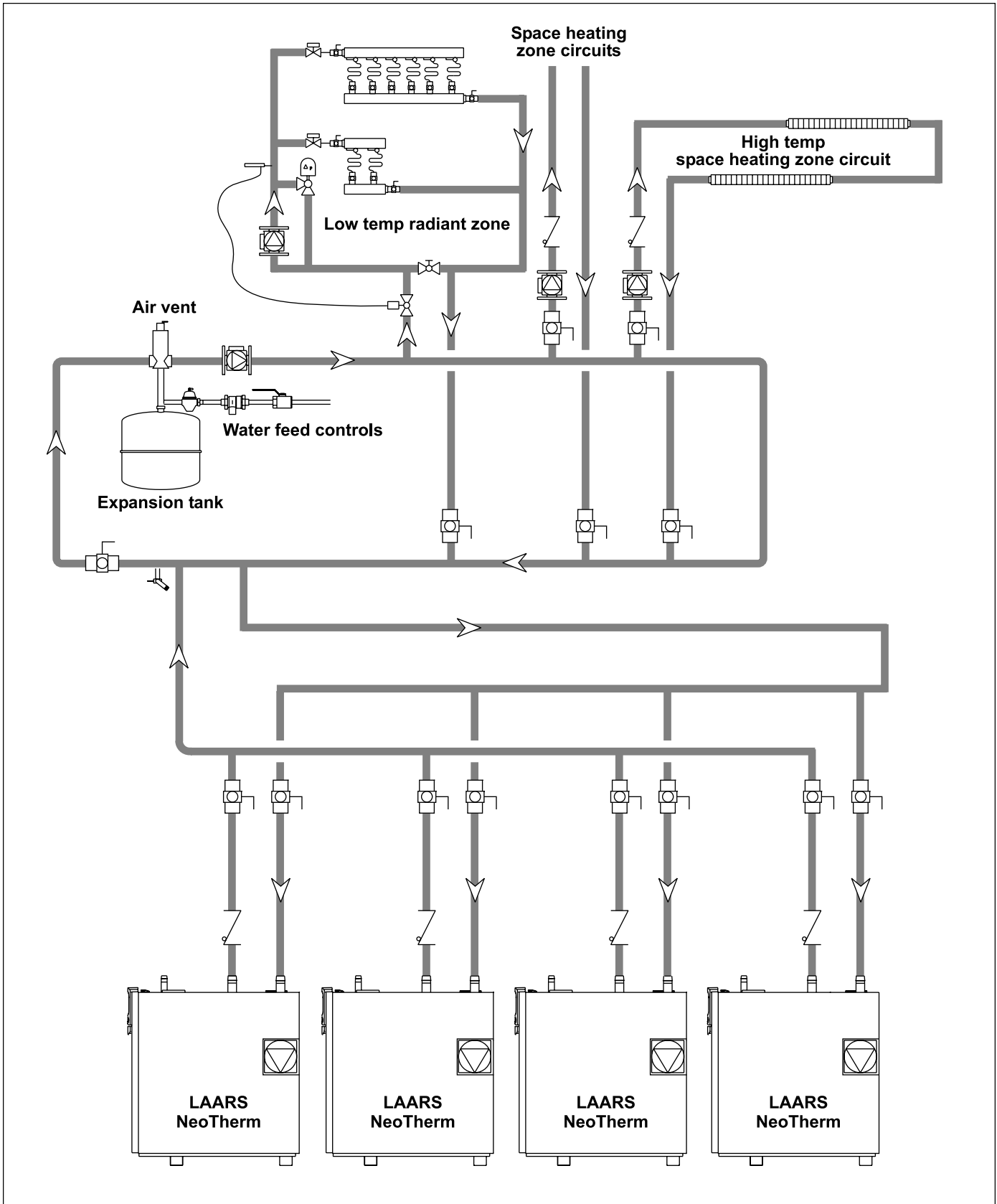


Figure 15. Hydronic Piping — Multiple Boilers, Reverse Return, Multi-Temp Zones (zoning with circulators).

SECTION 5. Electrical Connections

⚠ WARNING

The appliance must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the latest edition of the National Electrical Code, ANSI/NFPA 70, in the U.S. and with latest edition of CSA C22.1 Canadian Electrical Code, Part 1, in Canada. Do not rely on the gas or water piping to ground the metal parts of the boiler. Plastic pipe or dielectric unions may isolate the boiler electrically. Service and maintenance personnel, who work on or around the boiler, may be standing on wet floors and could be electrocuted by an ungrounded boiler. Electrocution can result in severe injury or death.

Single pole switches, including those of safety controls and protective devices must not be wired in a grounded line.

All electrical connections are made on the terminal blocks that are located inside the control panel.

NOTE: All internal electrical components have been prewired. No attempt should be made to connect electrical wires to any other location except the terminal blocks.

Wiring connections are shown in Figure 20.

5.1 Main Power

Connect a minimum 15A fused, 120-volt supply to the main power switch (hot leg is connected directly to switch). Neutral leg is connected directly to the white wire. Ground wire can be connected to the grounding lug in the box.

5.2 Control Features

The NeoTherm boiler control is a versatile control that interfaces with a user display. The user display allows access to many features of the control for setup, diagnostics and operation. There are three menu

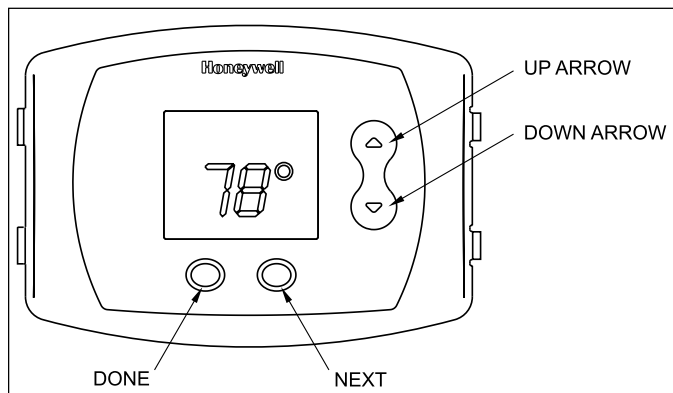


Figure 16. Control Buttons on User Interface.

structures to choose from, **USER** mode, **SETUP** mode, and **DIAGNOSTIC** mode. Each mode will give the user access to different types of information. The menus are accessed by using the buttons located on the display.

5.2.1 User Mode

USER mode is the home screen shown on the control. To navigate from item to item within **USER** mode press the **NEXT** button. If a menu that is user adjustable is selected, such as outlet or DHW the **UP** or **DOWN** arrows can be used to adjust the temperature setpoint. Once the correct value is selected the **DONE** button can be pressed to select the adjusted values. The **USER** mode menu structure and information that is available is shown in Table 10.

5.2.1.1 Temperature Control Point Adjustment

To adjust the temperature control point, confirm the display is in **USER** mode and the outlet temperature is being displayed. Press the **UP** or **DOWN** arrow to adjust the control point temperature. The control point temperature is measured at the outlet of the heat exchanger. When making adjustments make sure the control point is set far enough away from the high limit to keep the temperature rise of the heat exchanger from causing nuisance high limit tripping problems.

5.2.1.2 Domestic Hot Water Control Point Adjustment

To adjust the DHW temperature control point, confirm the display is in **USER** mode. Scroll through the menu structure using the **NEXT** button until the current DHW temperature is being displayed. Use the **UP** or **DOWN** arrow to adjust the setpoint to the desired value. Press the **DONE** button when complete.

5.2.2 Setup Mode

SETUP mode is accessed by holding the **UP** and **DOWN** arrow keys simultaneously for 3 seconds. **SETUP** mode allows the parameters listed in Table 11 to be adjusted by using the **NEXT** button to select the

MENU ITEM	
Outlet water temperature	Displays the current outlet water temperature and allows the setpoint to be adjusted.
Inlet water temperature	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
Stack Temperature	Displays the current stack temperature
Outdoor Temperature	Displays the current Outdoor air temperature
Firing Rate	Displays an indicator of the current firing rate based upon fan RPM. The actual firing rate may vary.

Table 10. User Mode Menu Structure.

parameter to be adjusted and then the **UP** or **DOWN** arrow keys to make the adjustment. When the adjustment is complete press the **DONE** (or **NEXT**) button to move to next menu item.

5.2.2.1 Adjusting the Temperature Display Units in °F or °C

Confirm the display is in **SETUP** mode. Scroll to the **F/C** menu. Press the **UP** or **DOWN** arrow to adjust between Fahrenheit and Celsius. Press the **DONE** key when complete.

5.2.2.2 Adjusting the Outdoor Reset On or Off

Confirm the display is in **SETUP** mode. Scroll to the **LBTHODLOD** menu using the **NEXT** button. Use the **UP** or **DOWN** arrows to select on or off. When outdoor reset is turned on, three new menus will be added to setup mode.

5.2.2.3 Adjusting Low Boiler Temperature Setpoint

Confirm the display is in **SETUP** mode. Scroll to the **LBT** menu. Use the **UP** or **DOWN** arrows to scroll to the minimum water temperature desired during outdoor reset.

5.2.2.4 Adjusting High Outdoor Temperature Setpoint

Confirm the display is in **SETUP** mode. Scroll to the **HOD** menu. Use the **UP** or **DOWN** arrows to scroll to the maximum outdoor temperature the reset curve will use to equate to the minimum water temperature.

5.2.2.5 Adjusting Low Outdoor Temperature Setpoint

Confirm the display is in **SETUP** mode. Scroll to the **LOD** menu. Use the **UP** or **DOWN** arrows to scroll to the minimum outdoor temperature the reset curve will use

MENU ITEM	DEFINITION
Fahrenheit / Celsius	Selects the temperature units being displayed
LBTHODLOD	Turn outdoor reset on or off
LBT	Low boiler temperature setpoint. Display and set the lowest boiler water temperature desired during outdoor reset
HOD	High outdoor temperature setpoint. Display the current setpoint and allow for adjustment of the high outdoor temperature setpoint for the reset curve.
LOD	Low outdoor temperature setpoint. Display the current setpoint and allow for adjustment of the Low outdoor temperature setpoint for the reset curve
RMT	Remote firing control. Set the Remote Firing Control ON or OFF. This allows the use of an external analog signal to control boiler modulation
RMT ADR	RMT Address. Display the current Modbus address and allows for adjustment of the address.
ASC	Anti short cycle. Display the current Anti Short cycle time and allows for adjustment using the up and down arrows.

Table 11. Setup Mode Parameters.

to equate to the maximum water temperature.

5.2.2.6 Anti Short Cycle Time

Confirm the display is in **SETUP** mode. Scroll to the **ASC** menu. Use the **UP** or **DOWN** arrows to adjust the time for the anti short cycle period. The numbers displayed are in minutes of delay. The anti short cycle time creates a delay for the specified period of time between the completion of a call for heat and when the next call for heat may occur.

5.2.3 Diagnostic Mode

DIAGNOSTIC mode is accessed by holding the **NEXT** button for 3 seconds. **DIAGNOSTIC** mode allows the user to monitor and control the items shown in Table 12. To scroll through the menu structure use the **NEXT** button. When a value that is adjustable has been selected the **UP** or **DOWN** arrow keys may be used to adjust the setpoint. When adjustments are complete press the **DONE** button.

5.2.3.1 High Limit Setting

The appliance high limit sensor is located on the outlet of the boiler. The sensor is a dual element sensor that is limit rated. This sensor must be replaced with Laars original equipment parts only. The high limit set point is not adjustable.

5.2.3.2 DHW Limit Setting

The DHW maximum temperature setting has been adjusted at the factory, and can be viewed by entering the **DIAGNOSTIC** mode and scrolling to the **DHW** menu. Once in the **DHW** menu, the maximum temperature will be displayed.

⚠ WARNING

The DHW sensor is NOT a limit rated device. An anti-scald device **MUST** be installed to prevent excessively hot water from reaching the end user. Failure to install an anti-scald device may lead to property damage, personal injury or death.

MENU ITEM	DESCRIPTION
mA	Display the flame sense signal
Alert codes	Displays the current alert code
Lockout code	Displays the current lockout code
Outlet Limit	Displays outlet temperature limit
DHW limit	Displays Domestic Hot Water limit setting
Stack Limit	Displays 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 a indicator of the firing rate based off of the fan RPM. Actual firing rate may vary depending upon setup.

Table 12. Diagnostic Mode Menu Structure.

5.3 Pump Connections

The boiler pump is wired at the factory (pump mounted models only). The NeoTherm Control energizes the pump upon a call for heat. Once the call for heat is satisfied the pump will remain on for the defined pump overrun time.

The system pump connections are located on Terminal Block 5 in the control panel (see Figure 17). The system pump contacts are rated for 120Vac, 7.4 amps. To use the contacts power must be supplied on one terminal. The other terminal wired to the pump or a contact controlling the pump.

The DHW pump connections are located on Terminal Block 5 in the control panel. The DHW pump contacts are rated for 120Vac, 7.4 amps. To use the contacts power must be supplied on one terminal. The other terminal wired to the pump or a contact controlling the pump.

5.4 Temperature Control

The NeoTherm temperature control measures the temperature on the outlet sensor, measuring the supply water temperature. Set the control setpoint for the desired supply temperature.

The manual reset high limit is located on the outlet of the NeoTherm. The manual reset limit temperature must be set a minimum of 10° higher than the control point to avoid nuisance high limit tripping issues.

5.5 Temperature Control - Indirect Tank

For indirect domestic hot water applications a DHW sensor or mechanical aquastat may be used to determine the domestic load call. To do this, the sensor or aquastat should be connected to Terminal block 6

connections labeled "DHW temp sensor". The sensor is a dual element sensor. The Laars sensor is the only sensor that can be used with this controller. To connect an aquastat use the middle and far right connector on Terminal block 6, connections labeled "DHW temp sensor". Once a sensor or switch is installed, the call should be "Audodetected" by the control.

5.6 Outdoor Reset Operation

Outdoor reset varies the control point setpoint based on the outdoor temperature. The reset function works as shown in Figure 18. When the Outdoor air temperature reaches the High Outdoor temperature setpoint (HOD), the control point is adjusted to the Low Boiler temperature setpoint (LBT). When the outdoor air temperature reaches the Low Outdoor temperature (LOD) setpoint, the control setpoint is adjusted to the CH setpoint temperature. To access the LOD, HOD and LBT variables, refer to Sections 5.2.2.3 through 5.2.2.5. To access CH setpoint, refer to Section 5.2.1.1.

The outdoor air temperature sensor must be connected to terminal block 7 in the control panel. The connection points are labeled "outdoor temp sen." The sensor is not polarity sensitive, so the wires may be connected to either terminal.

5.7 External Control Connections

NeoTherm units are built with a terminal strip to allow the NeoTherm to receive a 4-20mA modulating signal from an external controller (such as a building automation system or multiple boiler control).

When a 4-20mA signal is supplied to NeoTherm, it will modulate according to the signal supplied.

The Brown/White wire is for signal (+) and the

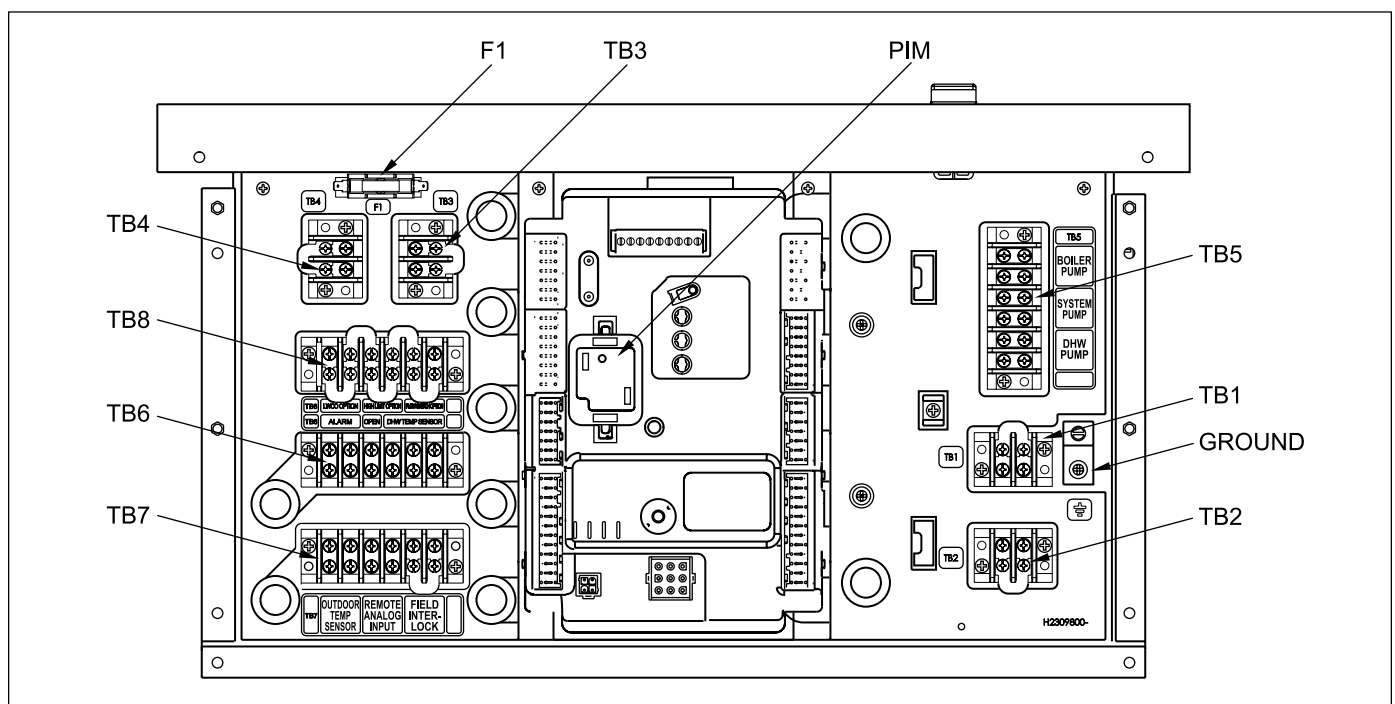


Figure 17. Control Panel Layout.

Brown wire is for signal (-).

A call for heat signal **MUST** also be connected to the field interlock terminal strip on the NeoTherm (shown in Figures 17 and 20).

The NeoTherm unit will modulate between 4mA and 20mA (for 20% and 100%, respectively).

Important Note: DO NOT MAKE/BREAK NEOTHERM LINE VOLTAGE TO SIGNAL CALL FOR HEAT. A "call for heat / end call for heat" **MUST** be connected to the field interlock terminals. The NeoTherm does not recognize 4mA as a signal to shut off. If the call for heat is not connected between the field interlock terminals, the NeoTherm will remain in low fire when it sees 4mA as a modulating signal.

Caution

NeoTherm supply voltage must not be disengaged, except for service or isolation, or unless otherwise instructed by procedures outlined in this manual. To signal a call for heat, use the 24V field-interlock, as shown in the wiring diagram(s).

Some NeoTherm components are designed to have constant voltage during normal operation. If the NeoTherm's supply voltage is toggled as a call for heat signal, premature failure of these components may result.

5.8 Wiring Diagram (see Figures 19 and 20)

Caution

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing

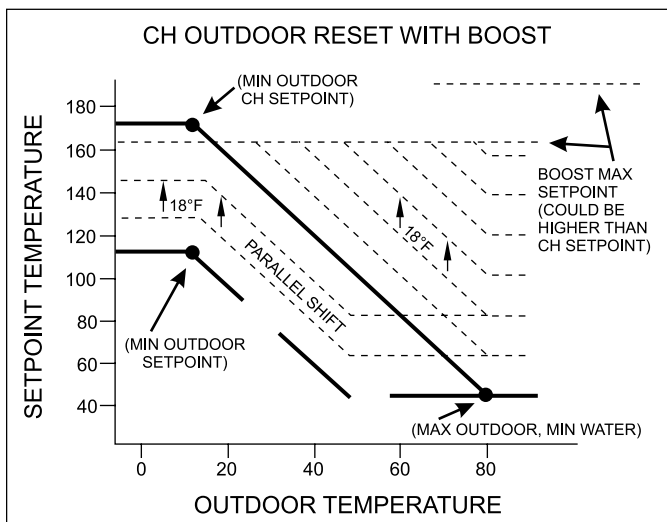


Figure 18. Outdoor Reset Setpoint Temperatures.

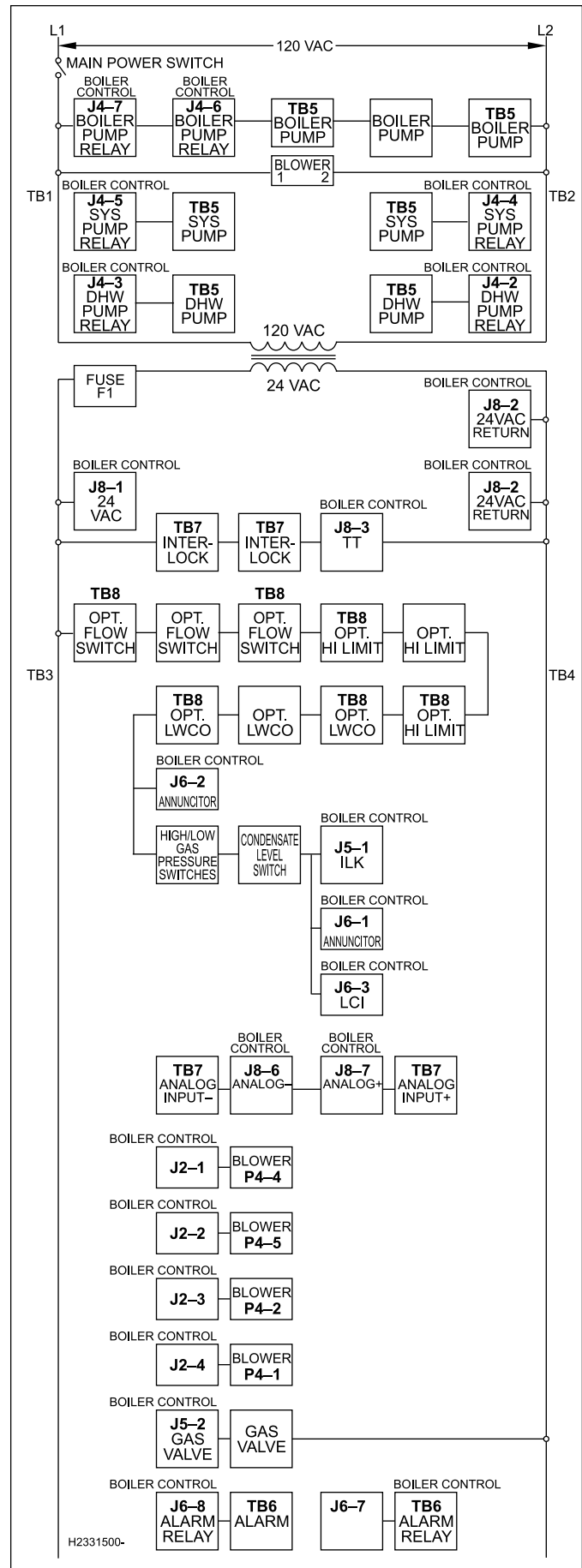


Figure 19. Ladder Diagram.

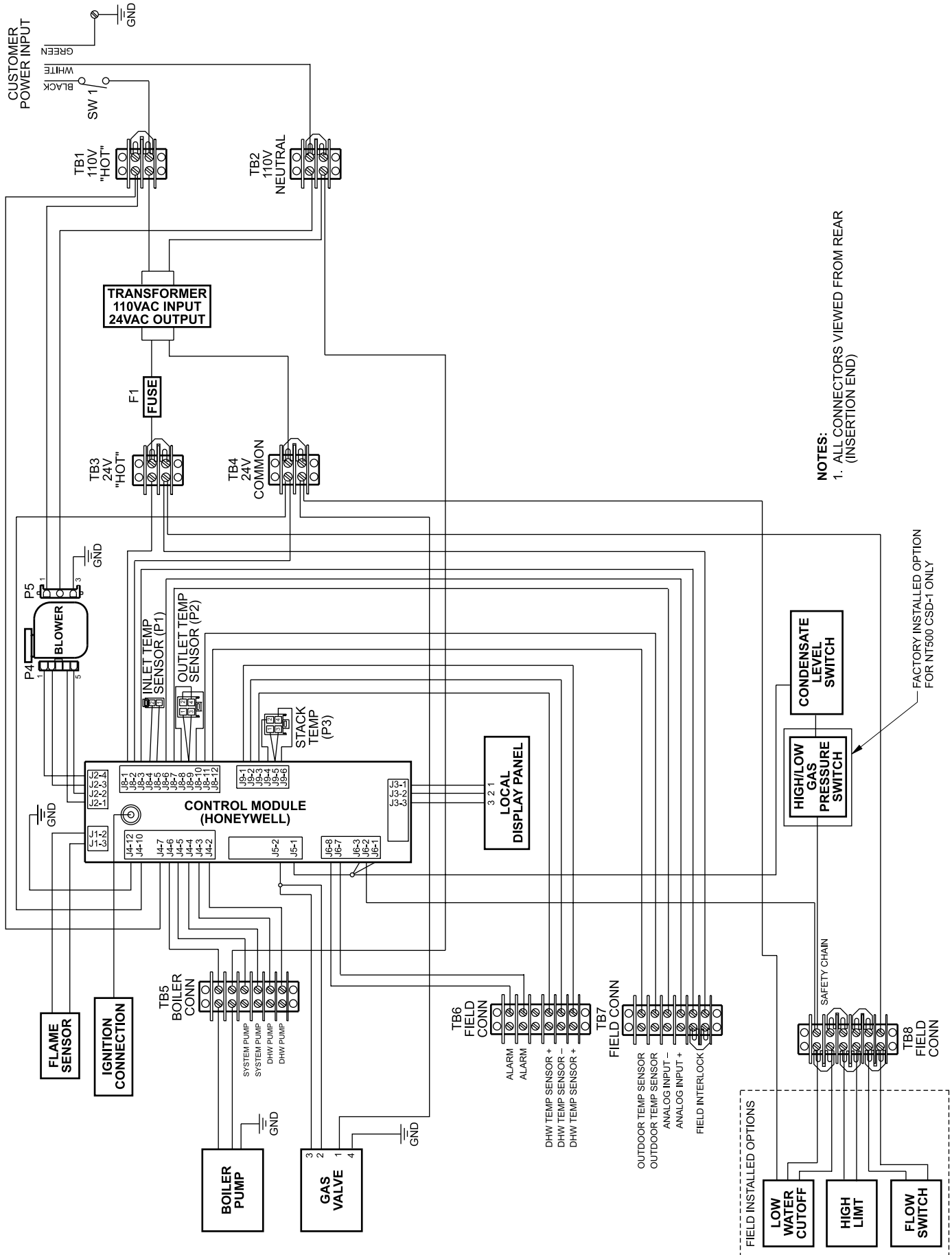


Figure 20. Wiring Diagram (all sizes).

SECTION 6. Operating Instructions

6.1 Filling the Boiler System

1. Ensure the system is fully connected. Close all bleeding devices and open make-up water valve. Allow system to fill slowly.
2. If make-up water pump is employed, adjust pressure switch on pumping system to provide a minimum of 12 psi (81.8 kPa) at the highest point in the heating loop.
3. If a water pressure regulator is provided on the make-up water line, adjust the pressure regulator to provide at least 12 psi (81.8 kPa) at the highest point in the heating loop.
4. Open bleeding devices on all radiation units at the high points in the piping throughout the system, unless automatic air bleeders are provided at such points.
Note that there is an air bleed located on the left side of the unit, on top of the water manifold.
5. Cycle the boiler pump on and off 10 times, 10 seconds on and 10 seconds off to remove all air from the heat exchanger. Then run system and appliance pump for a minimum of 30 minutes with the gas shut off.

WARNING

Failure to remove all air from the heat exchanger could lead to property damage, severe injury or death.

6. Open all strainers in the circulating system, check flow switch operation (if equipped), and check for debris. If debris is present, clean out to ensure proper circulation.
7. Recheck all air bleeders as described in Step 4.
8. Check liquid level in expansion tank. With the system full of water and under normal operating pressure, the level of water in the expansion tank should not exceed $\frac{1}{4}$ of the total, with the balance filled with air.
9. Start up boiler according to the procedure in this manual. Operate the entire system, including the pump, boiler, and radiation units for one (1) hour.
10. Recheck the water level in the expansion tank. If the water level exceeds $\frac{1}{4}$ of the volume of the expansion tank, open the tank drain, and drain to that level.
11. Shut down the entire system and vent all radiation units and high points in the system piping, as described in Step 4.
12. Close make-up water valve and check strainer in pressure reducing valve for sediment or debris from the make-up water line. Reopen make-up

water valve.

13. Check gauge for correct water pressure and also check water level in the system. If the height indicated above the boiler insures that water is at the highest point in the circulating loop, then the system is ready for operation.
14. Refer to local codes and the make-up water valve manufacturer's instructions as to whether the make-up water valve should be left open or closed.
15. After placing the unit in operation, the ignition system safety shutoff device must be tested. First, shut off the manual gas valve, and call the unit for heat. Main gas terminals will be energized, attempting to light, for four (4) seconds, and then will de-energize. The unit will go into lockout after the required number of trial for ignition periods. Second, turn the power off, press the manual reset button on the boiler control, or the user display, open the manual gas valve and allow the unit to light. While the unit is operating, close the manual gas valve and ensure that power to the main gas valve has been cut.
16. Within three (3) days of start-up, recheck all air bleeders and the expansion tank as described in Steps 4 and 8 above.

Important Note: The installer is responsible for identifying to the owner/operator the location of all emergency shutoff devices.

WARNING

Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control that may have been under water.

6.2 Operating the Burner and Set Up

The NeoTherm modulating appliance utilizes an advanced, state-of-the-art design. The setup must be checked before the unit is put in operation. Problems such as failure to start, rough ignition, strong exhaust odors, etc. can be due to improper setup. Damage to the boiler resulting from improper setup is not covered by the limited warranty.

6.2.1 Burner Operation

REQUIRED TOOLS: differential pressure gauge capable of reading negative 0.01 inches W.C. (0.002kPa), screw drivers, torx bits, combustible analyzer.

1. Using this manual, make sure the installation is complete and in full compliance with the instructions and all local codes.
2. Determine that the appliance and system are filled with water and all air has been bled from both.

- Open all valves.
3. Observe all warnings on the Operating Instructions label and turn on gas and electrical power to appliance.
4. The NeoTherm will enter the start sequence. The blower and pump will energize for pre-purge, then the ignition sequence starts. After all safety devices are verified, the gas valve opens. If ignition doesn't occur, turn off the NeoTherm, check that there is proper gas supply. Wait 5 minutes and start the unit again.
5. Turn the NeoTherm on.
6. **After placing the appliance in operation, the Burner Safety Shutoff Device must be tested.**
To test:
 - (a) Close gas shutoff valve with burner operating.
 - (b) The flame will go out and blower will continue to run for the post purge cycle. One or three additional attempts to light will follow including pre-purge, ignitor on, valve/flame on and post purge. Ignition will not occur as the gas is off. The ignition control will lockout.
 - (c) Open gas shutoff valve. Reset the boiler control by pressing the **RESET** button on the control or on the display. Restart the appliance. The ignition sequence will start again and the burner will start. The appliance will return to its previous mode of operation.

⚠ Caution

Should any odor of gas be detected, or if the gas burner does not appear to be functioning in a normal manner, CLOSE MAIN SHUTOFF VALVE. Do not shut off switch. Contact your heating contractor, gas company, or factory representative.

6.2.2 Boiler Setup and Adjustment

1. Connect a manometer capable of reading $-.005''\text{wc}$ to the gas valve locations shown in Figure 21. The positive side of the manometer should be connected to the location labeled "air pressure tap." The negative side of the manometer should be connected to the location labeled "gas pressure tap." This differential pressure should be slightly negative (see Table 13).
2. Measure the CO_2/O_2 in the flue products at high

	CO ₂ HIGH FIRE	CO ₂ LOW FIRE
Natural Gas	8.8 – 9.5%	8.0 – 8.8%
Propane Gas	9.7 – 10.2%	9.0 – 9.7%
Differential Pressure	$-.005$ to $-.015$	$-.001$ to $-.015$

Table 13. CO₂ Range and Pressure Differential.

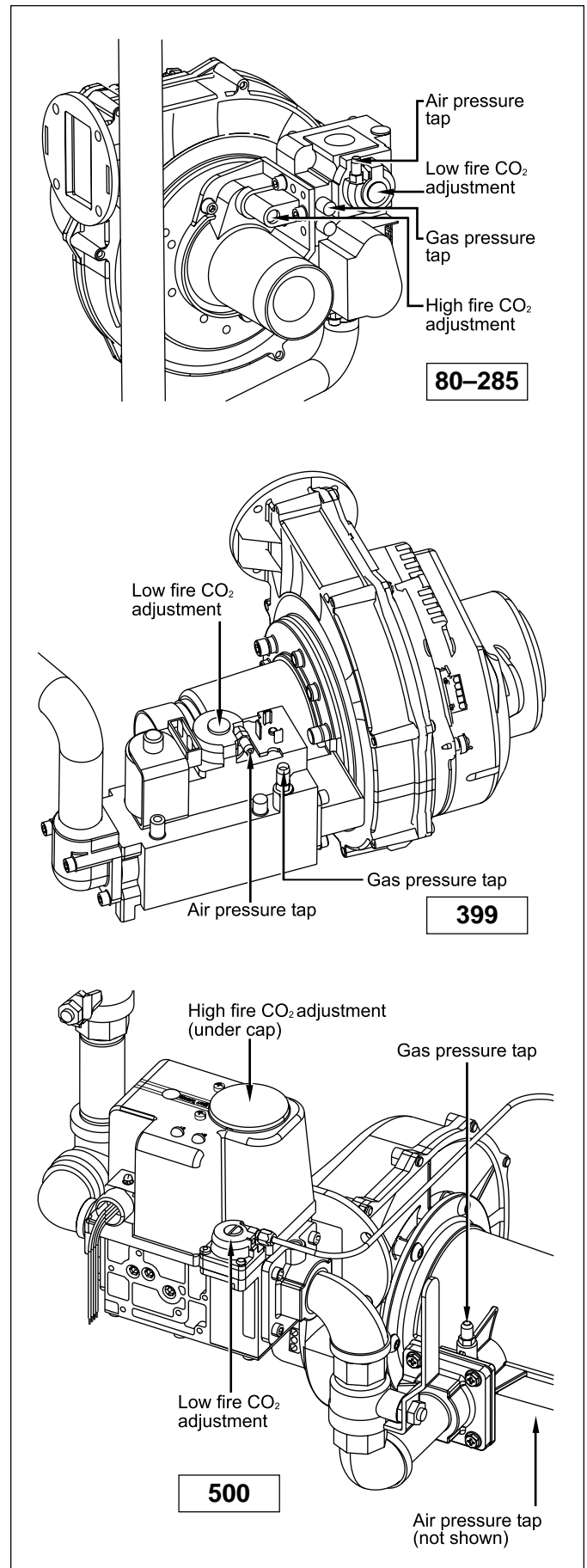


Figure 21. NeoTherm Gas Valves (285, 399 and 500).

fire. The NeoTherm can be forced to high fire to allow for easier setup. Refer to Section 5.2.3 for instructions on how to access the forced rate menu. The CO₂ readings should be between the values shown in Table 13. If the CO₂ is not within the range shown, adjustments may be made. To adjust the high fire CO₂, locate the high fire adjuster screw according to the appropriate figure. Slowly make adjustments in 1/16 of a revolution increments until the CO₂ is within the range identified.

NOTE: NeoTherm 399 does not have a high fire adjustment.

3. Measure the CO₂/O₂ in the flue products at low fire. The NeoTherm can be forced to low fire to allow for easier setup. Refer to Section 5.2.3 for instructions on how to access the forced rate menu. The CO₂ readings should be between the values shown in Table 13. If the CO₂ is not within the range shown, adjustments may be made. To adjust the low fire CO₂, locate the low fire adjuster screw according to the appropriate figure. Slowly make adjustments in 1/16 of a revolution increments until the CO₂ is within the range identified.
4. Repeat steps 2 and 3 to confirm that the CO₂ ranges are within the required ranges. Adjust if necessary.
5. Confirm that the differential pressure is still within the appropriate range.
6. If any of the measurements cannot be adjusted to the specified ranges or the CO levels are above 150ppm when adjusted please consult the factory for further information.
7. Remove the differential pressure gauge from the air and gas pressure taps making sure to close all ports after the gauge has been removed.

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.

6.3 Shutting Down the NeoTherm

1. Turn off the main electrical disconnect switch.
2. Close all manual gas valves.
3. If freezing is anticipated, drain the NeoTherm and be sure to also protect building piping from freezing. All water must be removed from heat exchanger or damage from freezing may occur.

This step to be performed by a qualified service person.

6.4 To Restart the NeoTherm

If drained, follow Section 6.1 in this manual for proper filling and purging.

1. Turn off the main electrical disconnect switch.

2. Close all manual gas valves.
3. **WAIT FIVE (5) MINUTES.**
4. Set the aquastat or thermostat to its lowest setting.
5. Open all manual gas valves.
6. Reset all safety switches (pressure switch, manual reset high limit, etc.).
7. Set the temperature controller to the desired temperature setting and switch on electrical power.
8. Burner will go through a prepurge period and ignitor warm-up period, followed by ignition.

SECTION 7. Maintenance

WARNING

Disconnect all power to the appliance before attempting any service to the appliance. Contact with electricity can result in severe injury or death.

7.1 System Maintenance

1. Lubricate the system water-circulating pump, if required, per the instructions on the pump.
2. If a strainer is employed in a pressure reducing valve or the piping, clean it every six months.
3. Inspect the venting system for obstruction or leakage at least once a year. Periodically clean the screens in the vent terminal and combustion air terminal (when used).
4. Keep the appliance area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
5. If the appliance is not going to be used for extended periods in locations where freezing normally occurs, it should be isolated from the system and completely drained of all water.
6. Low water cutoffs, if installed, should be checked every 6 months. Float type low water cutoffs should be flushed periodically.
7. Inspect and clean the condensate collection, float switch and disposal system yearly.
8. When a means is provided to neutralize condensate, ensure that the condensate is being neutralized properly.
9. Inspect flue passages, and clean with brushes/vacuums, if necessary. Sooting in flue passages indicates improper combustion. Determine the cause and correct.
10. Inspect the vent system and air intake system, and ensure that all joints are sealed properly. If joints need to be resealed, completely remove existing sealing material, and clean with alcohol. Apply new sealing material, and re-assemble.

7.2 Appliance Maintenance and Component Description

Use only genuine LAARS replacement parts.

Caution

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

The gas and electric controls on the appliance are engineered for long life and dependable operation, but the safety of the equipment depends on their proper functioning. It is strongly recommended that a qualified service technician inspect the basic items listed below every year.

- a. Appliance control
- b. Automatic gas valve
- c. Pressure switches
- d. Blower

- e. Pump
- f. Flow switch
- g. Low water cutoff

7.2.1 Burner

Check the burner for debris. Remove the blower arm assembly to access the burner. Remove the 4 bolts connecting the blower to the arm (see Figure 22). Remove the 5 bolts, which hold the burner arm in place. Pull burner up and out. Clean burner, if necessary, by blowing compressed air from the outside of the burner into the center of the burner, and wipe the inside of the burner clean with glass cleaner. A dirty burner may be an indication of improper combustion or dirty combustion air. Determine the cause, and correct. If damaged, replace the burner gasket when replacing the burner.

NOTE: When installing the burner, make sure the flange is aligned with the mating surface, as each is keyed to control fit.

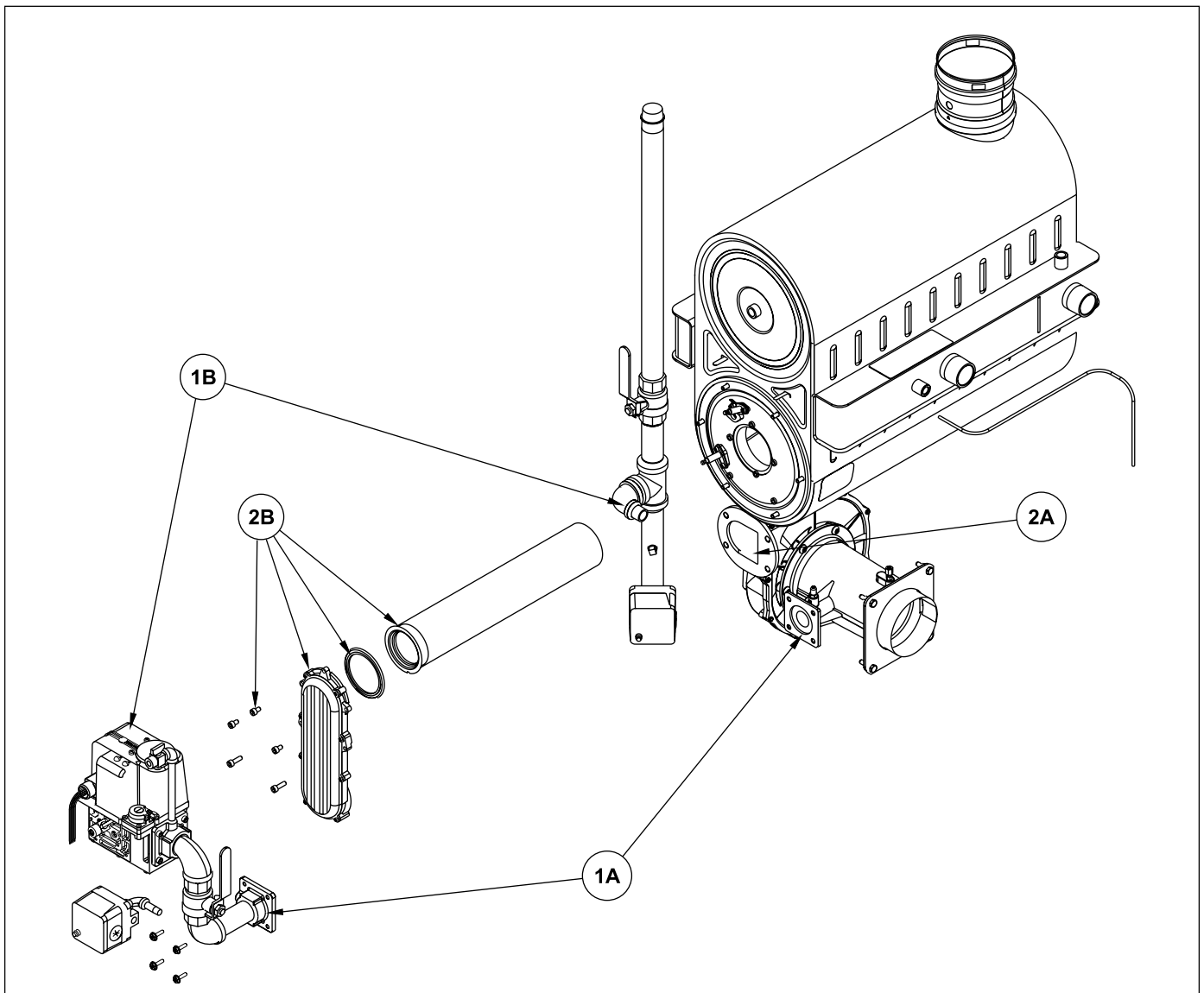


Figure 22. Burner Service.

7.2.2 Modulating Gas Valve / Venturi

The modulating gas valve consists of a valve body that incorporates the ON/OFF gas flow control and a negative pressure regulator. It provides the air/gas ratio control in combination with the venturi to the unit. It is designed to operate with gas supply pressure between 4 and 13 inches w.c.. To remove the gas valve and or venturi. Shut off the 120 Volt power supply to the boiler. Turn off all manual gas valves connecting the boiler to the main gas supply line. Remove the front door of the boiler to gain access to the gas valve and venturi. Disconnect the four (4) flange bolts connecting the gas manifold pipe to the gas valve. Remove the electrical connections to the gas valve. Remove the bolts connecting the venturi flange to the blower. This allows the entire gas valve/venturi assembly to be removed as an assembly to facilitate inspection and cleaning.

After the valve has been removed, reassemble in reverse order making sure to include all gaskets and O-rings. Turn on the manual gas valves and check for gas leaks. Turn on the 120 Volt power. Place the unit in operation following the instructions in Section 6.2. Once the boiler is operating check for leaks again and confirm all fasteners are tight.

Check appliance setup according to Section 6.2.

7.2.3 Appliance Control

The NeoTherm appliance control is an integrated control that incorporates the manual reset high limit control, the operating temperature control, modulating control, ignition control, outdoor reset control, pump control and many other features. If any of these features are thought to be defective, please consult the factory for proper trouble shooting practices prior to replacing the control. If control replacement is required, turn off all power to the appliance. Shut all manual gas valves to the appliance. Remove the front door to the appliance and the control panel plastic bezel. Remove all wire connections from the control board. The control board connections are keyed to only allow connection in the proper location, but proper handling techniques should be used to avoid damage to the wiring or connectors. To remove the control push in on the two tabs on the left side of the board to unlatch the clips from the control panel. Rotate the control around the fastening points on the right side of the control to remove the hooks from the control panel. To replace the control repeat the steps above in the reverse order making sure to connect all wires in the proper location. Place the appliance in operation following the steps outlined in Section 6.2.

7.2.4 Ignitor Assembly

The ignitor assembly is a two rod system that consists of a ground rod and a sense rod. To remove the ignitor assembly, shut off the 120 Volt power supply to the appliance. Turn off all manual gas valves connecting the appliance to the main gas supply line. Remove the front door of the boiler to gain access to the ignitor

assembly. Remove the two wires connected to the assembly. Then remove the two bolts connecting the ignitor assembly to the burner door. Remove and replace the old ignitor assembly gasket. Reinstall a new ignitor assembly in the reverse order if the old assembly is determined defective. Replace gasket if necessary.

7.2.5 Flame Sensor

The flame sensor is a single rod system. To replace the flame sensor electrode, shut off the 120 Volt power supply to the boiler. Turn off all manual gas valves connecting the boiler to the main gas supply line. Remove the front door of the boiler to gain access to the flame sensor electrode. Remove the flame sensor wire from the electrode. Remove the two bolts fastening the electrode to the burner doors. Remove and replace the old flame sensor gasket. Reinstall a new flame sensor electrode in the reverse order if the old electrode is determined defective.



Caution

Igniters and sensors get hot and can cause burns or injury.

7.2.6 Transformers

There are various transformers used on the NeoTherm units. Be sure to replace the transformers with factory parts. These transformers are not capable of supplying control voltage for external devices such as zone valves, which must have their own separate power supply. Should a transformer need replacing, shut off the 120 Volt power. Unplug the transformer wires, remove the mounting screws and remove the transformer. Replace transformer in the reverse order.

7.2.7 Blower

The combustion air blower is a high-pressure centrifugal blower with a variable speed motor. The speed of the motor is determined by the control logic. The 120 Volt current remains on to the blower at all times. If a blower change is required, turn off the 120 Volt power and gas supply to the unit. Take the front panel off. Disconnect the 120 Volt and control signal connections from the blower. Disconnect the bolts connecting the venturi to the blower housing. Disconnect the fan outlet bolts from the burner door blower arm. If the fan is determined to be defective replace the existing fan with a new one reversing the steps above. Make sure to install all of the required O-rings and gaskets between the blower arm and the blower and blower face and venturi flange.

7.2.8 Heat Exchanger Coils

Black carbon soot buildup on the external surfaces of the heat exchanger is caused by one or more of the following; incomplete combustion, combustion air

problems, venting problems and heater short cycling. Soot buildup or other debris on the heat exchanger may restrict the flue passages.

If black carbon soot buildup on the heat exchanger is suspected, disconnect electrical supply to the unit, and turn off the gas supply by closing the manual gas valve on the unit. Access the heat exchanger through the burner door at the front of the boiler, and inspect the tubing using a flashlight. If there is a buildup of black carbon soot or other debris on the heat exchanger, clean per the following:

Caution

Black carbon soot buildup on a dirty heat exchanger can be ignited by a random spark or flame. To prevent this from happening, dampen the soot deposits with a wet brush or fine water spray before servicing the heat exchanger.

1. Shut off the 120 Volt power supply to the boiler
2. Turn off all manual gas valves connecting the boiler to the main gas supply line.
3. For NT 500 models only (*all other sizes please skip to step four*). NT 500 models will require the gas valve to be removed in order to remove the burner door. To do this, remove the wire connections from the gas valve. Remove the flange bolts from the gas supply pipe connected to the gas valve (1B). Remove the flange bolts connecting the gas train to the venturi (1A). Remove the gas train assembly keeping gaskets and o-rings.
4. Remove the four bolts connecting the blower flange to the burner door arm.
5. Remove the nuts located on the outside diameter of the burner door to the heat exchanger.
6. Remove the burner door/burner assembly from the heat exchanger.
7. Disconnect the condensate drain line.
8. Attach a longer hose to drain and run to a bucket.
9. Clean the heat exchanger by brushing light accumulations of soot and debris. Use a brush with soft bristle (non metal) to avoid damaging the surface of the heat exchanger tubes.
10. Once the tubes have been brushed clean rinse the tubes and combustion chamber with a small amount of water to rinse all of the debris out of the bottom of the flue collector and into the longer condensate trap line, which is being diverted into a separate container.

NOTE: The Warranty does not cover damage caused by lack of required maintenance, lack of water flow, or improper operating practices.

WARNING

Failure to rinse the debris from the heat exchanger and temporary drain line may lead to clogged

condensate lines, traps and neutralizers. Condensate pumps (if used) may also be damaged from the debris left behind, possibly causing property damage.

11. Install all components removed in the reverse order to place the appliance back in operation. Make sure all gaskets are in place as components are installed. Replace any damaged gaskets. Do NOT reuse damaged gaskets.
12. Place the appliance in operation according to Section 6.2 checking all gas connections for leaks. Confirm all fasteners are tight.

7.2.9 Gas Pressure Switches (optional)

The high and low gas pressure switches are 24V manual reset switches that act to cut power to the gas valves if the gas pressure is too low or too high for proper operation. The gas pressure switches used are integrally vent limited, and do not require venting to atmosphere. To remove a switch, remove the screw on the plastic housing and pull the clear cover off. Disconnect the two wires from the screw terminals. Twist the switch off the pipe nipple. Reassemble in reverse order. For natural gas, set the low gas pressure switch to 3" w.c. For propane, set the low gas pressure switch to 5" w.c. For natural and propane, set the high gas pressure switch to 14".

SECTION 8. Trouble Shooting

8.1 Sequence of Operation

The NeoTherm appliance is a cold start appliance that should start only on a call for heat from a tank aquastat, room thermostat, zone valve end switch or other space temperature control device.

1. Upon a call for heat: (a) the internal pump and system pump will start; (b) the blower will begin a 30 second pre-purge.
2. Following the prepurge cycle the direct spark ignition will spark and will begin a 4 second trial for ignition. The unit is allowed one or three ignition retries.
3. The gas valve will then be energized and a reduced rate ignition will occur. The unit will remain in a reduced rate start-up period for several seconds.
4. After the reduced rate start time is over, the unit will be in normal operation. Firing rate will modulate based on the heating load via the temperature controller settings and readings.
5. When the call for heat is complete, or the unit reaches its setpoint temperature, the gas valve will close, and the fan will continue to run for its 20 second post-purge. If a pump delay time is used, the pump will continue to run for the specified amount of time (adjustable from 0.1 to 10 minutes).

8.2 Short Cycling

Because the NeoTherm is a modulating boiler, and its input will decrease when there is a reduction in heating load, short cycling is greatly reduced. If the heating load drops below the minimum input of the boiler for an extended period, the boiler will have a tendency to short cycle. This can be a symptom of improper control strategy or setpoints, or a load distribution problem. The NeoTherm control has a built-in anti-short cycle (ASC) feature. The ASC is a timed setting that will delay the boiler start for a specified time after one call for heat is completed. The ASC time may be adjusted as desired (see Sections 5.2.2 and 5.2.2.6 for more information).

8.3 Error Codes - See Table 14.

SECTION 9.

Replacement Parts

Use only genuine LAARS replacement parts.

9.1 General Information

To order or purchase parts for the LAARS NeoTherm, contact your nearest LAARS dealer or distributor. If they cannot supply you with what you need, contact Customer Service (see back cover for address, telephone and fax numbers).

CODE #	ERROR NAME	ERROR DESCRIPTION	POSSIBLE SOLUTIONS
109	Ignition failed	Failed to prove flame and proceed to RUN mode	Main gas supply off or low pressure, safety interrupt, malfunctioning gas valve
27	Internal error: flame rod short to ground	Flame rod grounded	Faulty wiring, sensor probe grounded, material build up on sensor probe
63	LCI off	Safety chain interrupt operation	Check flow switch, additional high limit, LWCO, gas pressure switches, condensate level switch for proper
137	ILK failed to close	No power at ILK	Check J5 pin 1 for power - if no power, confirm all safeties are operating correctly
69	Outlet high limit	High limit tripped.	Determine cause of high temperature limit trip. Low/no water flow, manual valves closed, improper settings
92	Outlet sensor fault	Outlet sensor error	Check wiring and sensor resistance to confirm connections and sensor operation
122	Light off proving rate failed	Fan speed at ignition out of tolerance	Consult factory
80	DHW limit	DHW high limit reached	Check pump operation and time delay, manual valves
93	DHW sensor fault	DHW sensor open or shorted	Check wiring and sensor resistance to confirm connections and sensor operation
96	OAT temperature sensor fault	Outdoor Air Temperature sensor faulty	Check wiring to sensor and sensor to determine if sensor is open or shorted

Table 14. Error Codes.

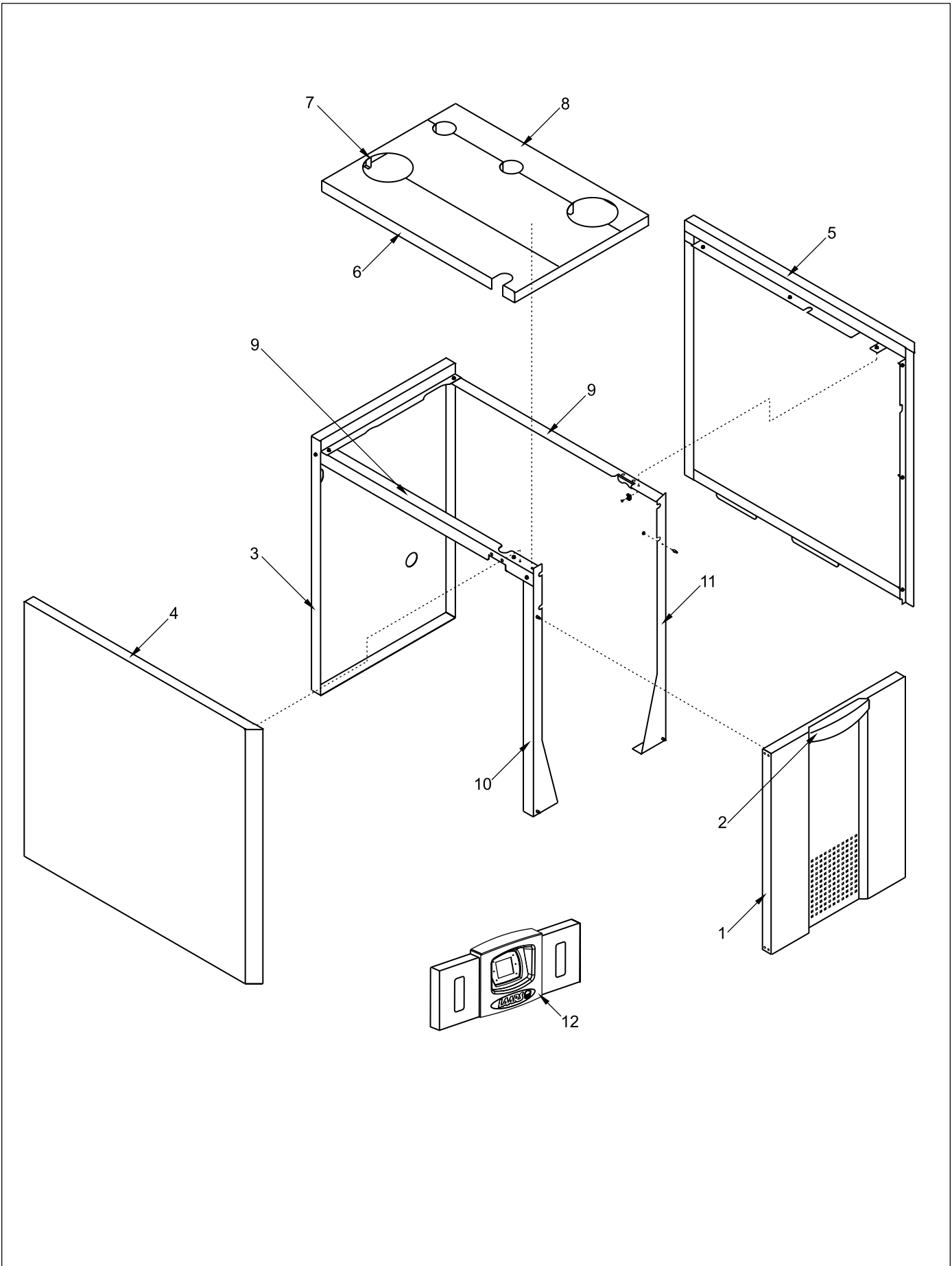


Figure 23. Jacket Components.

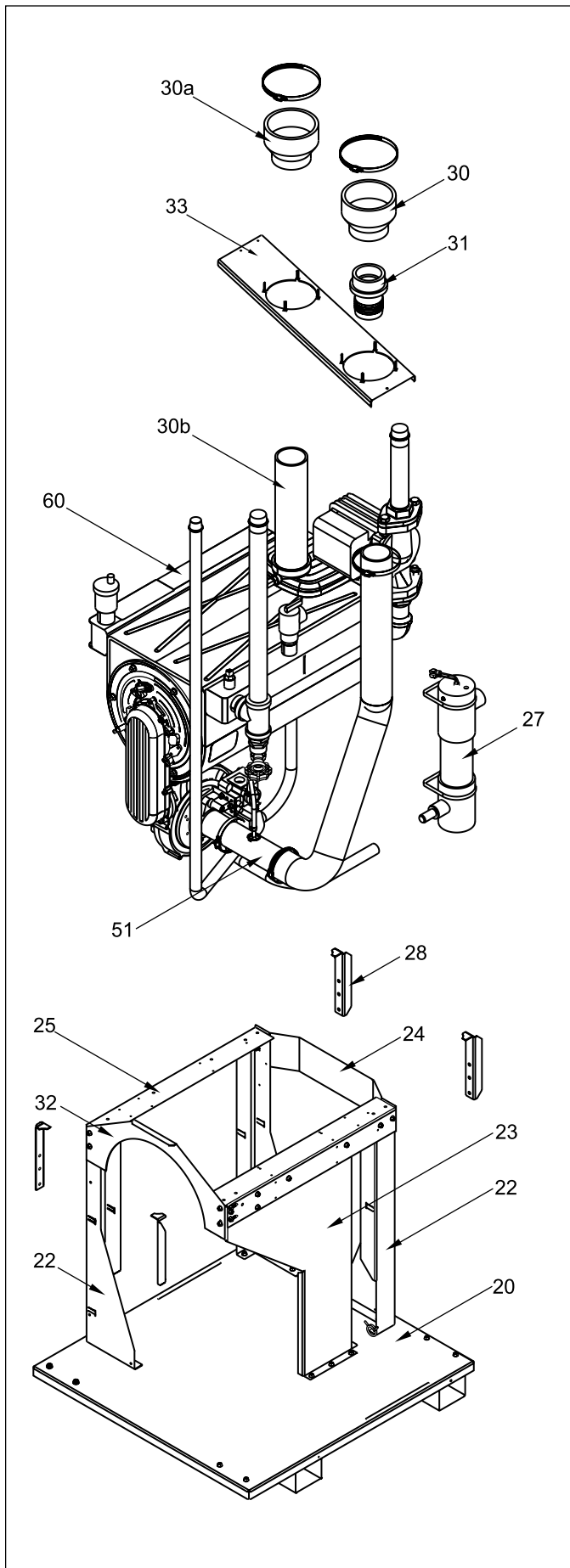


Figure 24A. Internal Components, sizes 80–210.

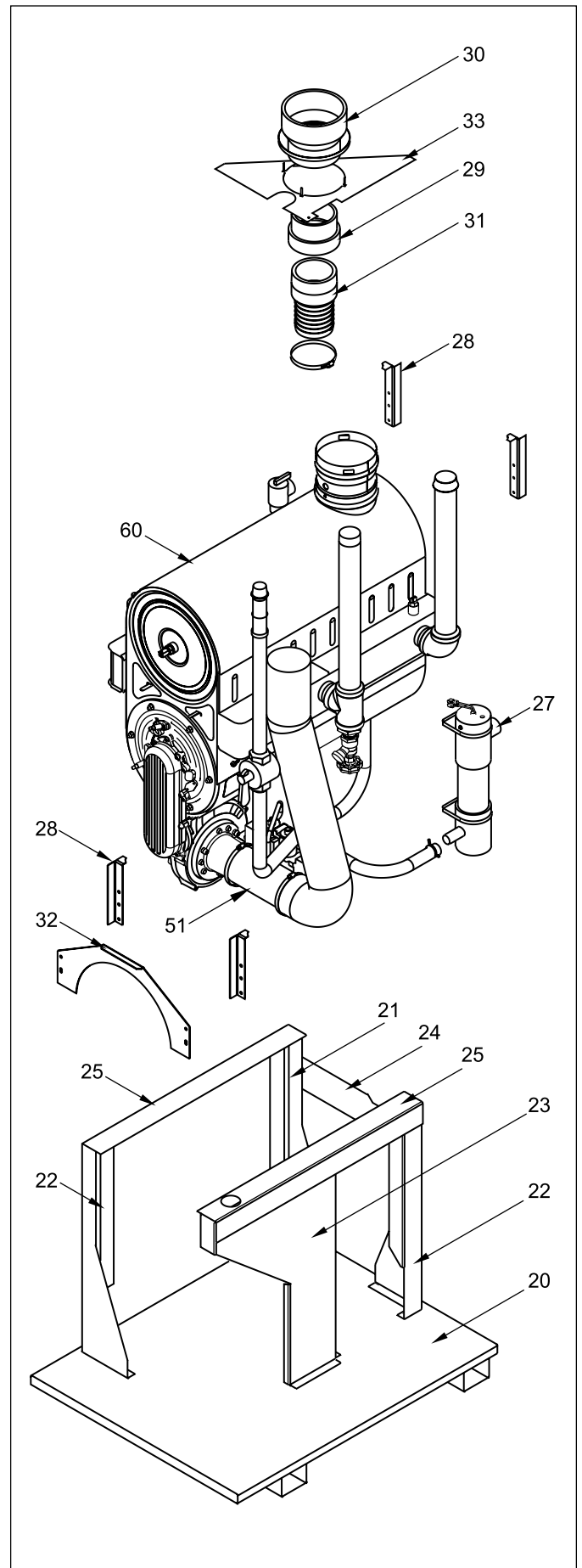


Figure 24B. Internal Components, sizes 285–500.

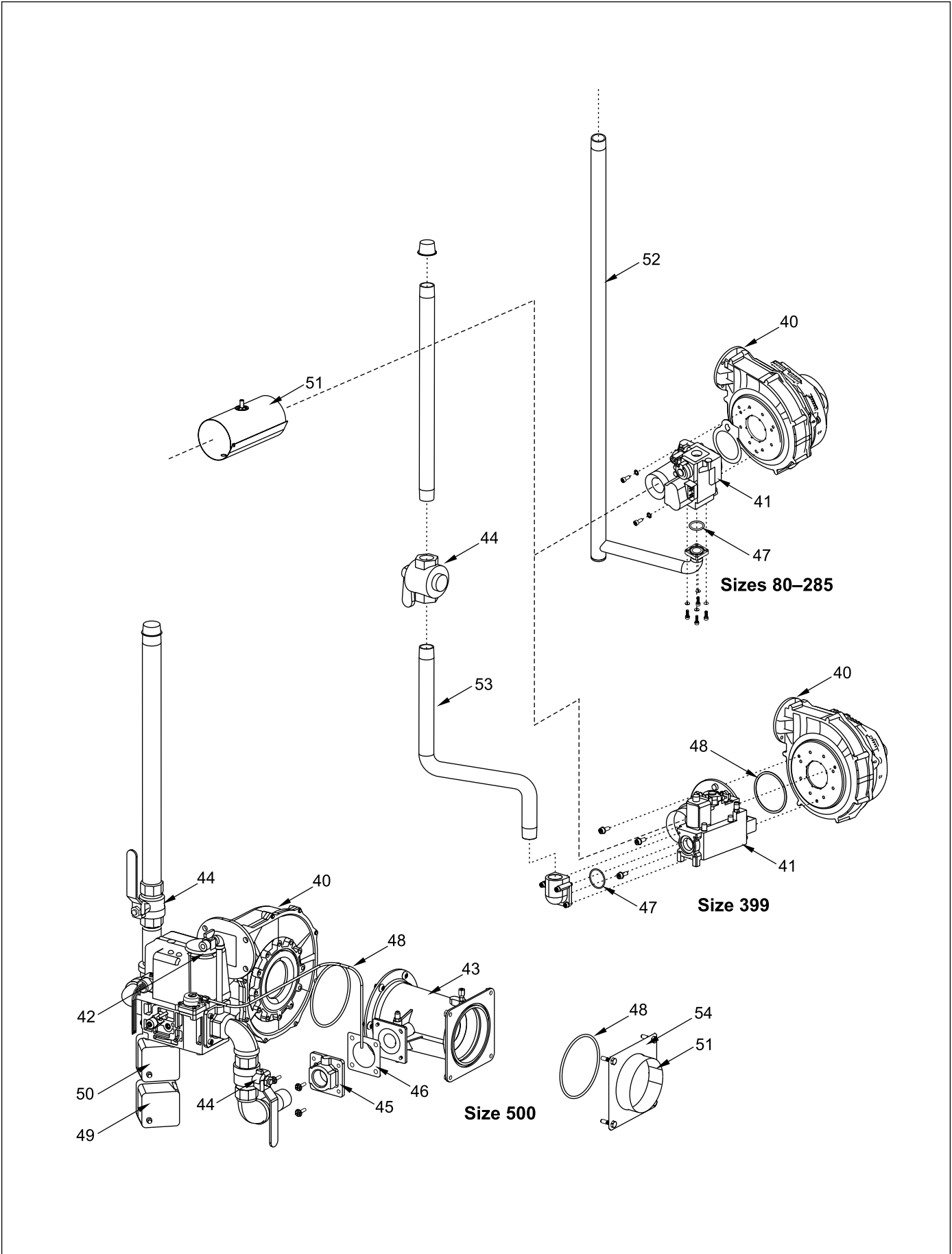


Figure 25. Gas Train Components.

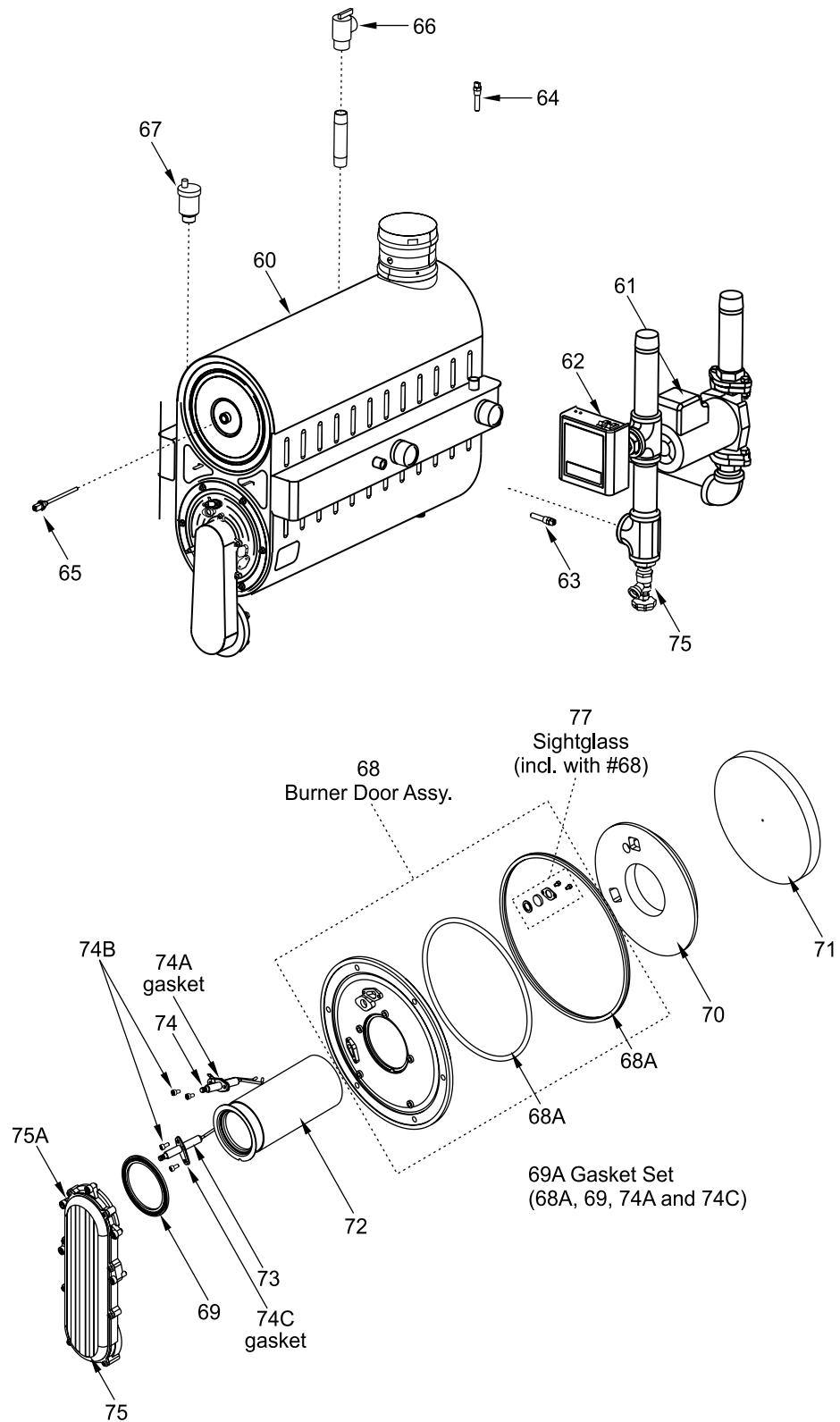


Figure 26. Heat Exchanger Components.

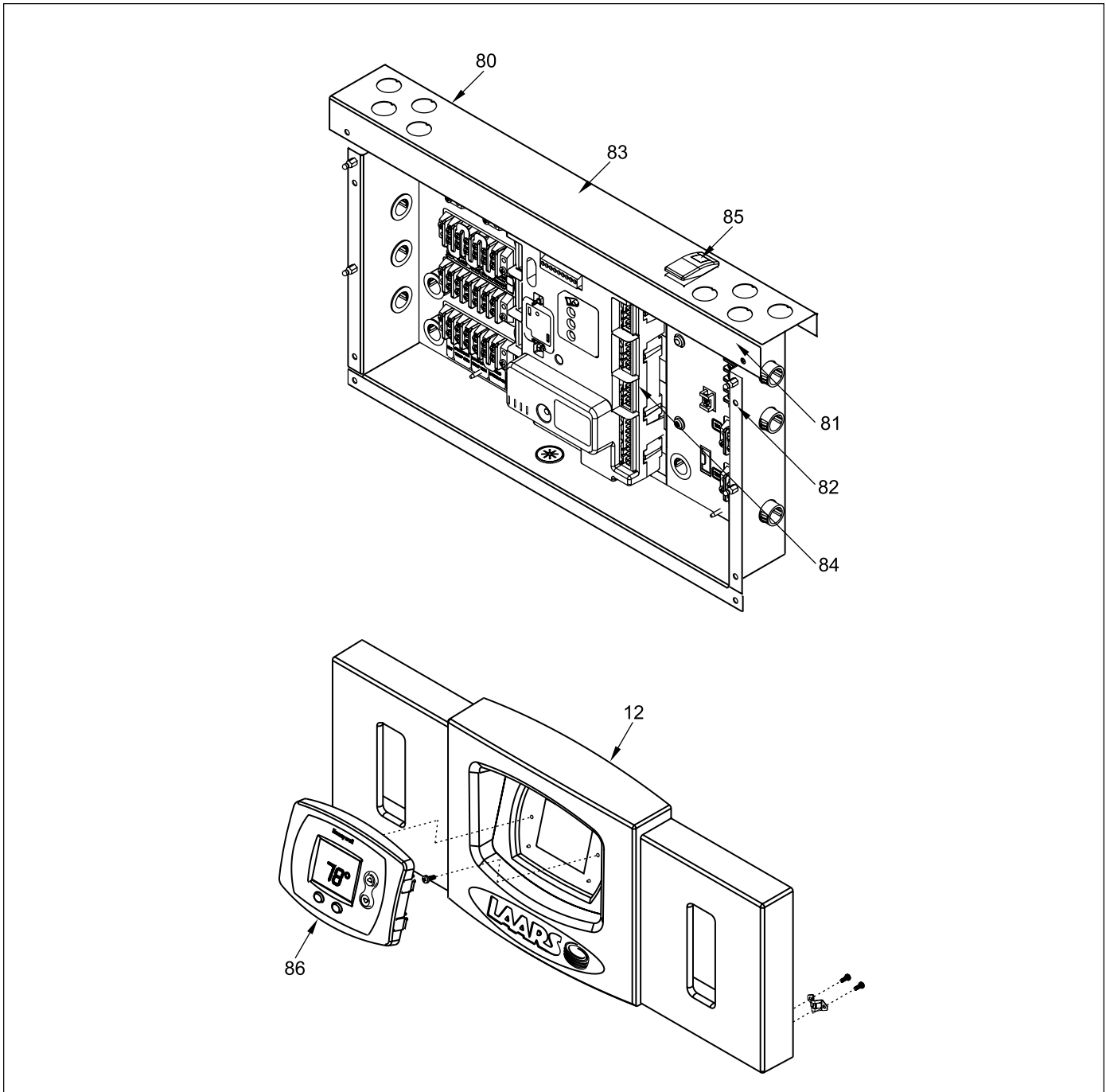


Figure 27 Electrical Components.



H2330500A