

Installation and Operation Instructions for

MASCOT® LX

Wall-Mounted, Modulating

Boiler

Model MLXH

50, 75, 100, 125, 150, 175,
& 220 MBH

Combination Boiler

Model MLXC

125, 150 and 175 MBH

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 ou ni d'autres vapeurs ou liquides inflammables dans le à proximité 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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MASCOT LX

SECTION 1. General Information

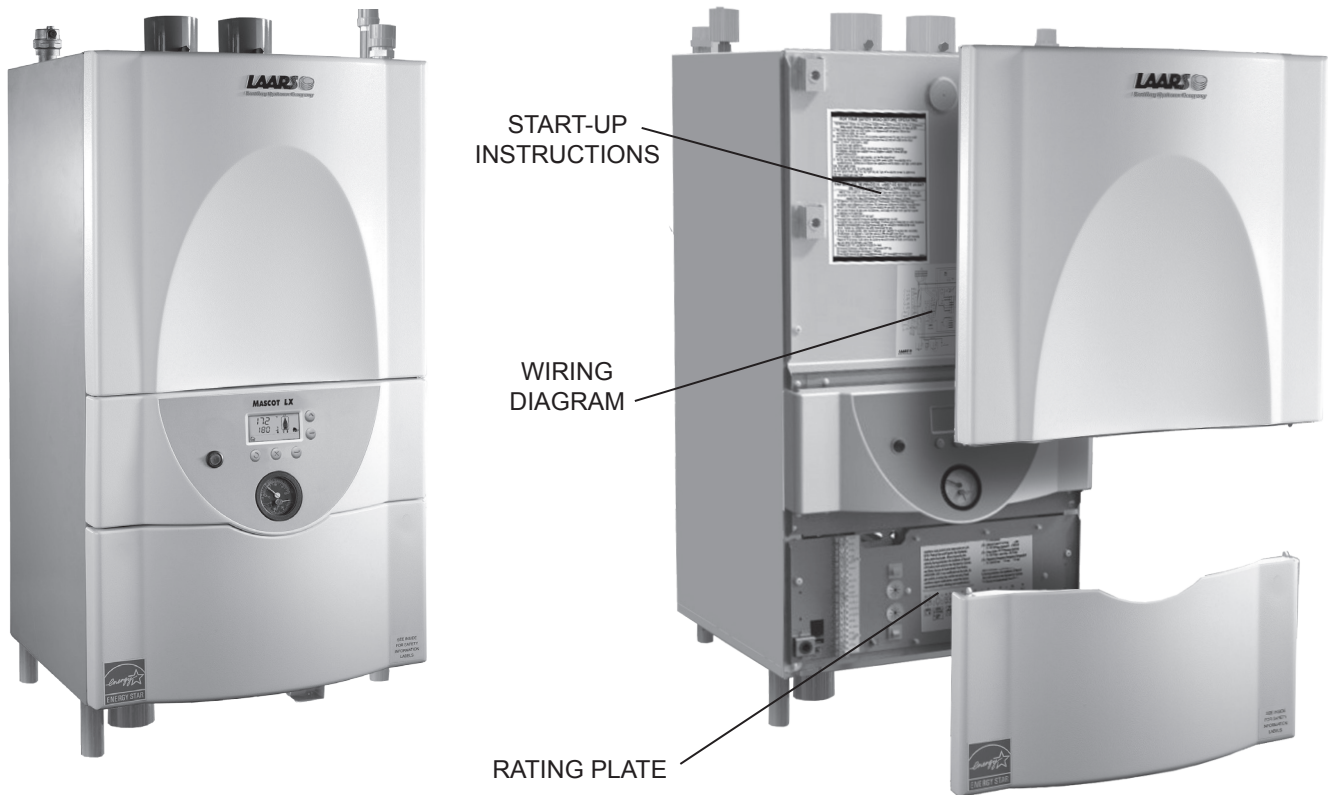


Figure 1. Opening the Mascot LX.
The top and bottom panels come off when pulled forward. This is true for all sizes.

⚠ WARNING

Mascot LX units **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 Mascot LX 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 **Mascot LX** 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.

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 To Open the Mascot LX

To open the Mascot LX for maintenance and servicing, the upper and lower plastic panels are designed to 'pop' off when they are pulled forward. See [Figure 1](#) and [Figure 3](#). This will expose the top metal panel which covers the heat exchanger, and the lower panel which holds the low voltage connections and covers the pump and other lower components.

To remove these panels for further access into your Mascot LX, there are two screws that hold each panel in place. Remove the 2 screws on the upper panel and slide the upper metal panel up and out. For the lower panel, remove the 2 screws and hinge the lower metal panel downward.

The center panel containing the On/Off Switch, Gauges, and User Interface is not removable.

1.3 Rating Plate

The Rating Plate is located on the backside of the upper plastic cover panels. It contains Model Nomenclature, Manufacture Date, Model Number, Serial Number, Output Rating, and all other information pertaining to your Mascot LX. .

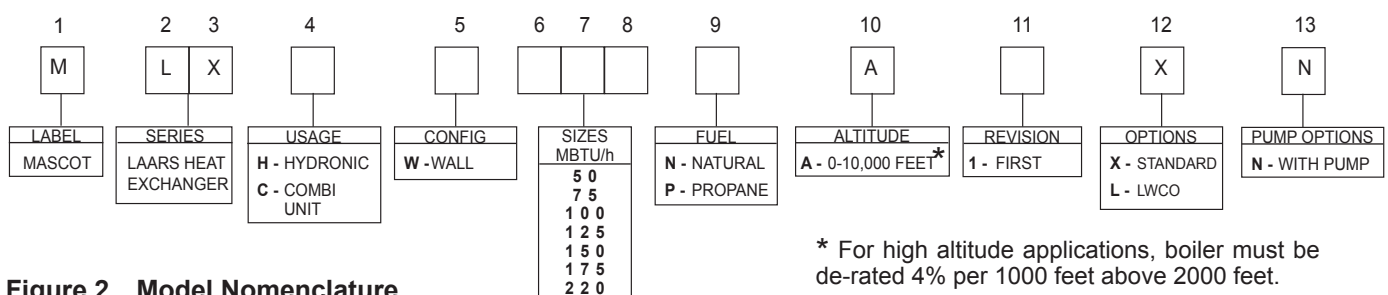
1.4 Model Nomenclature

The Model Nomenclature is shown on your Rating Plate and consists of a series of letters and numbers

(**Nomenclature**) that further identifies the characteristics of your Mascot LX. See [Figure 2](#).

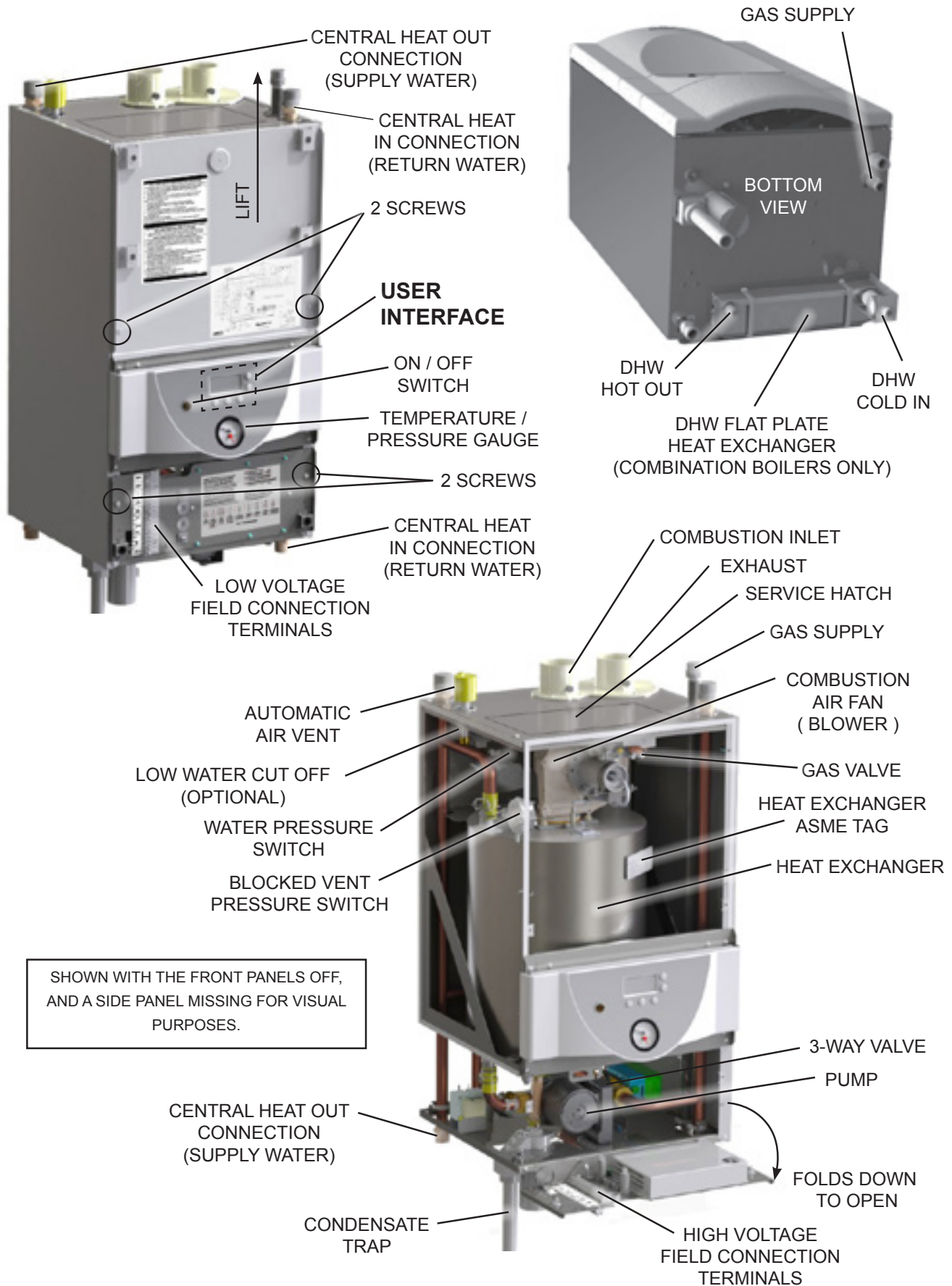
Nomenclature

- (1) **Label**
M = Mascot
- (2-3) **Series Designation**
LX = Laars Heat Exchanger
- (4) **Usage**
H = Modulating Boiler
C = Combination Boiler and Water Heater
- (5) **Configuration**
W = Wall Hung
- (6-8) **Size**
50 = 50,000 BTU/hr input
75 = 75,000 BTU/hr input
100 = 100,000 BTU/hr input
125 = 125,000 BTU/hr input
150 = 150,000 BTU/hr input
175 = 175,000 BTU/hr input
220 = 220,000 BTU/hr input
- (9) **Fuel**
N = Natural Gas
P = LP Gas (propane)
- (10) **Altitude**
A = Up to 10,000 Feet: de-rate applies*
- (11) **Revision**
1 = First version
- (12) **Options Code**
X = Standard
L = Low water cutoff
- (13) **Pump Options**
N = With Pump



* For high altitude applications, boiler must be de-rated 4% per 1000 feet above 2000 feet.

Figure 2. Model Nomenclature

1.5 Mascot LX, Overview**Figure 3. Location of Components**

1.6 Start Up / Shut Down Instructions (Decal)

The Start Up / Shut Down Instruction (Decal) can be found behind the Top Panel. See Figure 4.

This Decal is also referred to as the Operating Instructions Label and/or Warning Label.

FOR YOUR SAFETY READ BEFORE OPERATING

"WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device that automatically lights the burner.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light appliance.
- Do not touch any electric switch: do not use any phone in your building
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. 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 gas control which has been under water

D. TO TURN OFF GAS TO APPLIANCE

(1) SET SELECTOR SWITCH TO "OFF"(0) (2) Turn off all electric power to appliance
(3).Turn manual gas cock "off"

PAR MESURE DE PRUDECE, LISEZ CE QUI SUIV AVANT DE FAIRE FONCTIONNER L'APPAREIL

"MISE EN GARDE: Si vous ne suivez pas ces instructions a la lltre, un incendie ou une explosion pourrait se produire et causer des dommages materiels, des blessures personnelles ou meme la mort..

A. Cet appareil n'est pas doté d'une veilleuse. Il est équipé d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

B. AVANT D'UTILISER, vérifiez s'il n'ya pas d'odeur de gaz près de l'appareil. Vérifiez s'il n'ya pas d'odeur de gaz près du plancher, car le gaz est plus lourd que l'air et peut se déposer sur le plancher.

QUE FAIRE EN CAS D'ODEUR DE GAZ

- N'essayez pas d'allumer n'importe quel appareil que ce soit.
- Ne touchez pas a un commutateur électrique. N'utilisez pas le téléphone de votre résidence.
- Appelez immédiatement votre fournisseur de gaz en utilisant le téléphone de votre voisin. Suivez les instructions de votre fournisseur de gaz.
- Si vous ne pouvez joindre votre fournisseur de gaz, appelez le service des incendies.

C. N'utilisez pas cet appareil si l'une des pièces a été plongée sous l'eau.
Communiquez immédiatement avec un technicien de service qualifié afin qu'il inspecte l'appareil et remplace toute pièce du système de commande et toute commande de gaz qui aurait été plongée sous l'eau.

D. FERMETURE DE L'ALIMENTATION EN GAZ

(1) Poussez le bouton a bascule vers La position OFF (0).
(2) Coupez l'alimentation électrique à l'affairée.
(3) fermez le robinet de gaz manuellement vers OFF (la poignée est horizontale

H23377-

Figure 4. Start Up / Shut Down Instructions (Decal)

Found on the panel behind the top front panel See Figure 1

1.7 Dimensions, Mascot LX

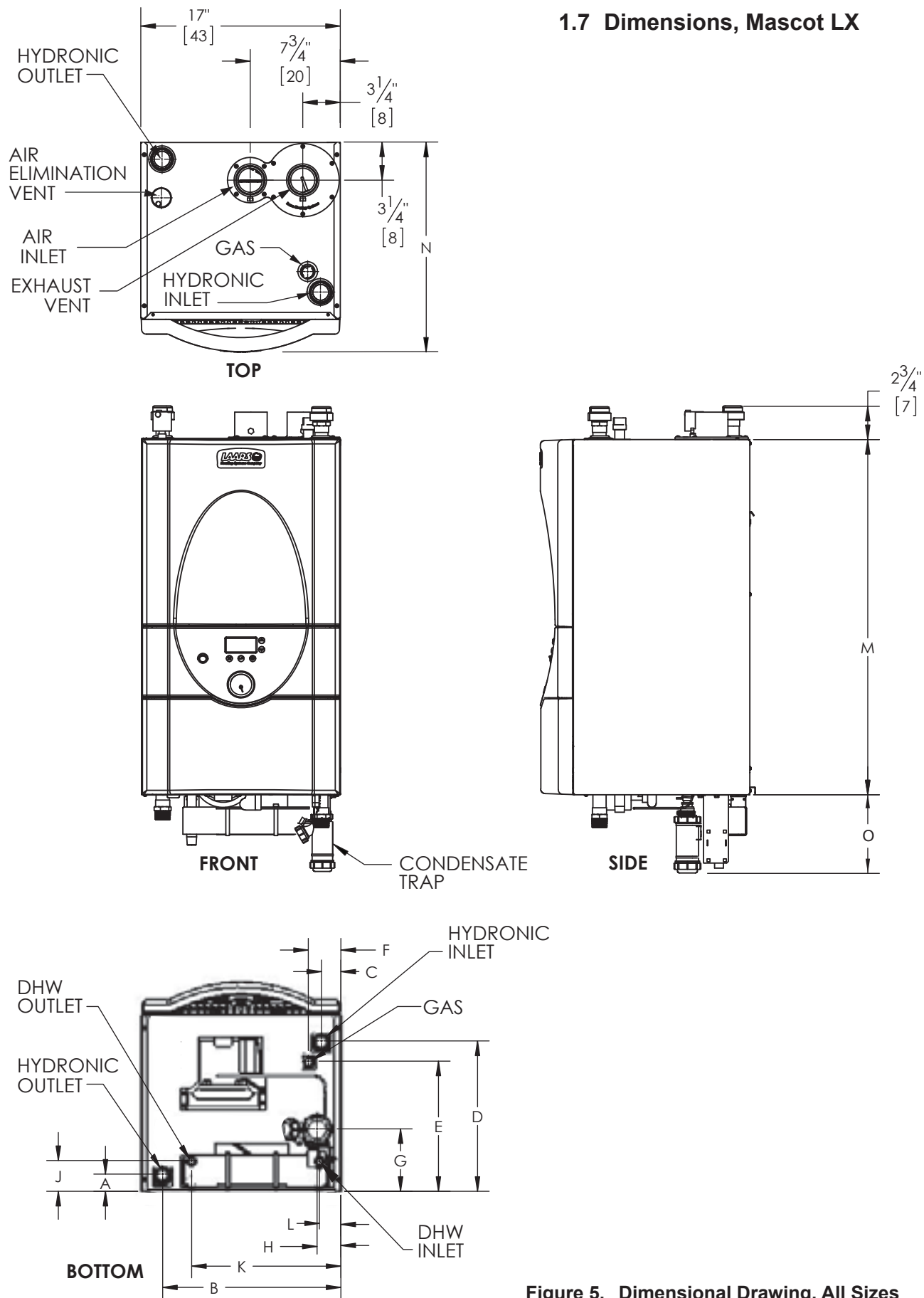


Figure 5. Dimensional Drawing, All Sizes

Model	Dimension							
	A	B	C	D	E	F	G	H
50, 75 MBH	1" (3)	15-3/4" (40)	3-3/4" (9)	9-1/4" (24)	8" (20)	1-1/2" (4)	5-3/4" (14)	15-1/2" (39)
100 MBH	1" (3)	15-1/2" (39)	1-1/4" (3)	12-3/4" (33)	11" (28)	1-1/4" (3)	9-1/2" (24)	14-3/4" (37)
125 MBH	1" (3)	15-1/2" (39)	1-1/4" (3)	12-3/4" (33)	11" (28)	1-1/4" (3)	9-1/2" (24)	14-3/4" (37)
150, 175 MBH	1-1/2" (4)	15-1/4" (39)	1-3/4" (4)	13" (33)	11-1/4" (28)	2-3/4" (7)	5-1/4" (14)	2" (5)
220 MBH	1-1/2" (4)	15-1/4" (39)	1-3/4" (4)	13" (33)	11-1/4" (28)	2-3/4" (7)	5-1/4" (14)	2" (5)

inches (cm's)

Model	J*	K	L	M	N	O
50, 75 MBH	--	--	--	30-1/2" (78)	15-1/4" (39)	4-5/8" (12)
100 MBH	--	--	--	30-1/2" (78)	18" (46)	4-5/8" (12)
125 MBH	2-3/4" (7)	12-3/4" (33)	2" (5)	30-1/2" (78)	18" (46)	4-5/8" (12)
150, 175 MBH	2-3/4" (7)	12-3/4" (33)	1-3/4" (5)	35-1/2" (90)	18" (46)	8-7/8" (23)
220 MBH	--	--	--	38-1/2" (90)	18" (46)	8-7/8" (23)

inches (cm's)

* - J dimension applies for both the DHW OUTLET and DHW INLET

Table 1. Dimensional Tables, All Sizes

Model		Input		Output		DHW Output @ 75°F Rise	AFUE	Gas Conn. Size inches	Water Conn. Size inches	DHW Conn. Size inches	Boiler Shipping Weight		Combi Shipping Weight	
		BTU/h	kW	BTU/h	kW						lbs	kg	lbs	kg
MLX	50	50,000	14.6	47,500	13.2	-	95%	1/2" NPT	3/4" NPT	-	88	40	-	-
MLX	75	75,000	21.9	71,250	20.8	-	95%	1/2" NPT	3/4" NPT	-	97	44	-	-
MLX	100	100,000	29.3	95,000	27.8	-	95%	1/2" NPT	3/4" NPT	-	112	51	-	-
MLX	125	125,000	36.6	118,750	34.8	3.1 gpm	95%	1/2" NPT	3/4" NPT	1/2" NPT	126	57	133	60
MLX	150	150,000	43.9	142,500	41.8	3.7 gpm	95%	1/2" NPT	1" NPT	1/2" NPT	140	64	148	67
MLX	175	175,000	51.6	166,250	48.7	4.3 gpm	95%	1/2" NPT	1" NPT	1/2" NPT	153	69	163	74
MLX	220	220,000	64.4	209,000	61.2	-	95%	1/2" NPT	1" NPT	-	161	73	-	-

NOTES:

1. For other boiler ratings:

 Boiler Horsepower: HP = $\frac{\text{Output}}{33,475}$ Radiation Surface: EDR sq. ft. = $\frac{\text{Output}}{150}$
Table 2. Piping Type and Sizes

1.8 Unpacking

The Mascot LX is shipped in a single crate with the standard components packed with the appliance. See **Figure 6**:

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

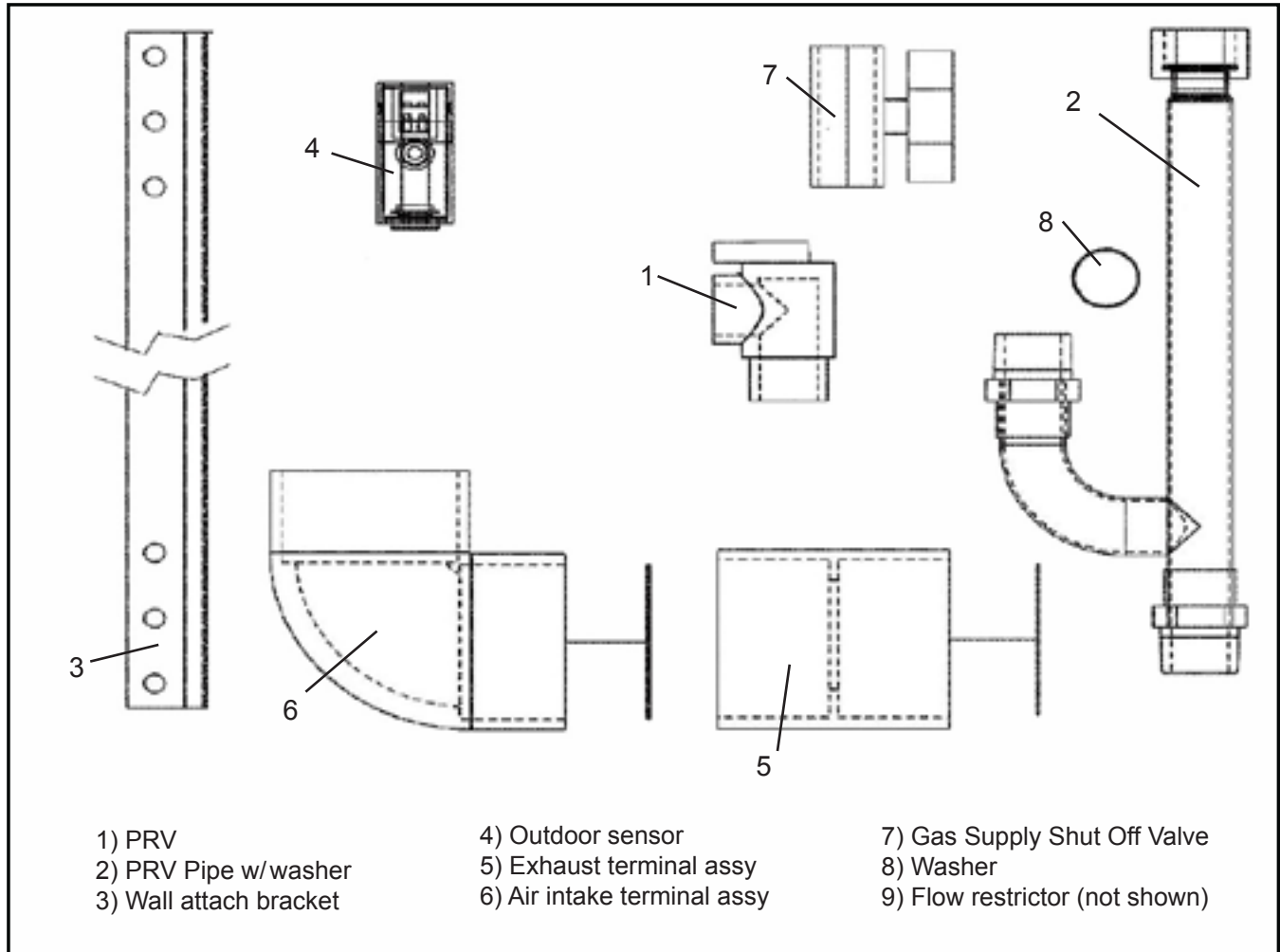


Figure 6. Contents of the Hardware Shipping Package

1.9 Warranty

LAARS Heating Systems' Mascot LX 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 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 must be filed with the carrier. **The carrier, not the shipper, is responsible for shortages and damage to the shipment whether visible or concealed.**

SECTION 2. Locating the Appliance

2.1 Locating the Appliance

The Mascot LX is designed for indoor wall-mounted installations only.

The Mascot LX must be mounted to a suitable wall by a qualified heating contractor under the guidelines of a wall mounted boiler or combination unit. Use a suitable wall, either concrete or wood and use the appropriate fasteners for that wall. Failure to wall mount this boiler using correct fasteners will affect the performance and life expectancy of the boiler and will void the warranty.

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, the wall that it is hung on, or to the 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 **wall-mounted** installation in basements; in closets, utility rooms or alcoves. The location for the appliance should be chosen with regard to the vent pipe lengths and external plumbing and on a plumb (vertical) wall. 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.). 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 must be installed at an appropriate level above grade or the maximum expected snow line.

The dimensions and requirements that are shown in **Table 3** should be met when choosing the locations for the appliance.

2.2 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 4 are followed.

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

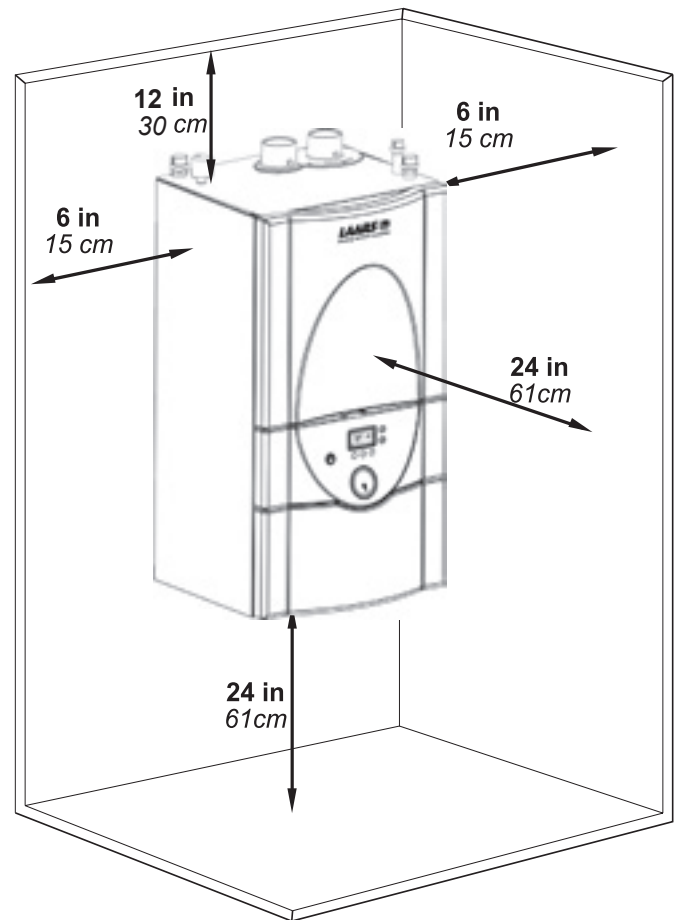


Figure 7. Locating the Appliance.

APPLIANCE SURFACE	SUGGESTED SERVICE ACCESS CLEARANCE	
	INCHES	CM
Left Side	6	15
Right Side	6	15
Top	12	30
Closet, Front	6	15
Front	24	61
Bottom	24	61
Vent	1	3
Certified by CSA for zero clearance to combustible materials on all sides.		

Table 3. Clearances

NOTE: When located on the same wall, the Minimum Venting Distance is found on **Figure 11**.

2.2 Wall Mount Hole Locations.

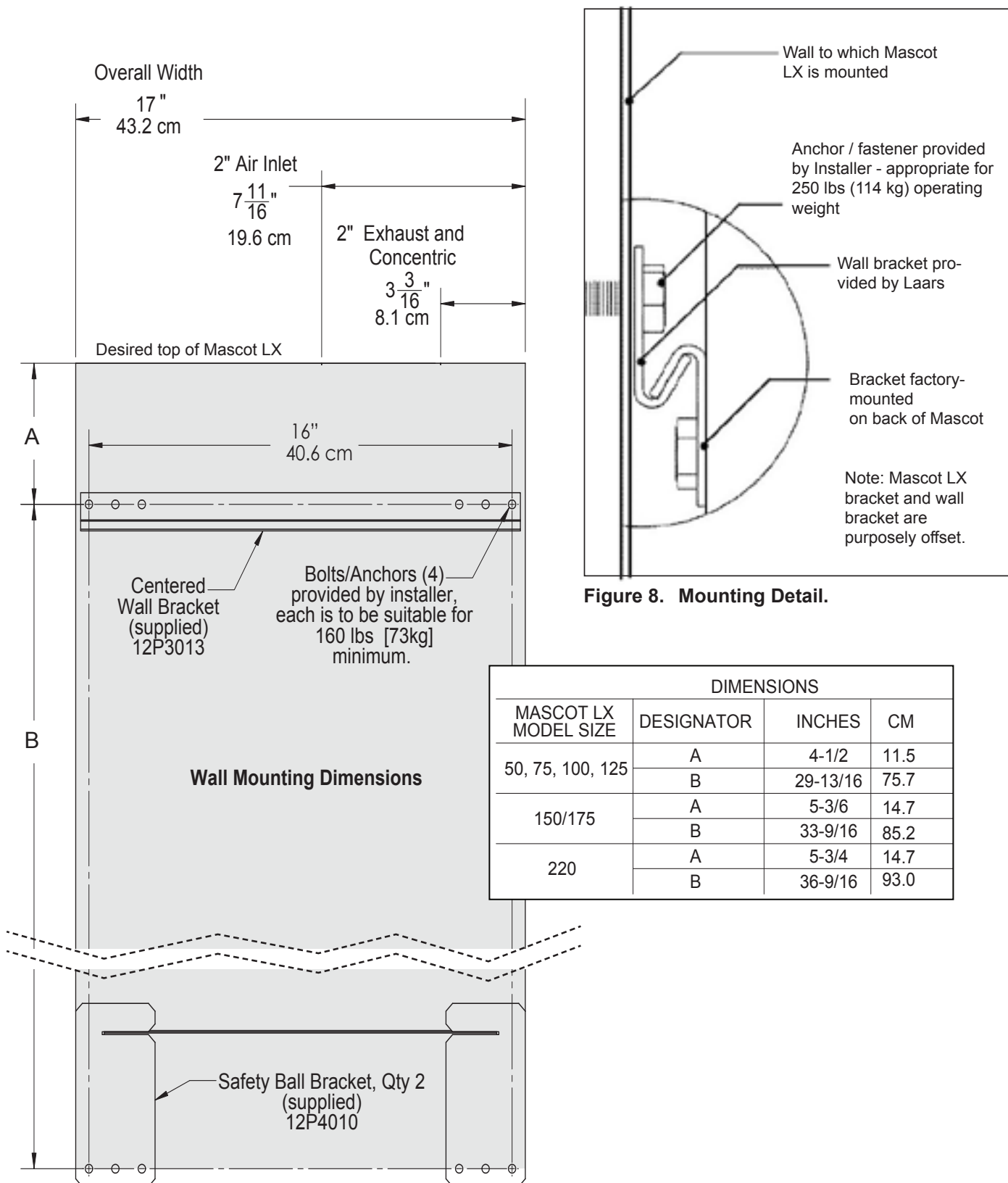


Figure 8. Mounting Detail.

Figure 9. Wall Bracket Hole Mounting Locations

SECTION 3.

Venting and Combustion Air

Laars Mascot LX includes a standard CPVC vent/combustion air adapter. If field connections require use of PVC/CPVC vent materials, the installer must use proper adhesive to join CPVC and/or PVC pipe and fittings.

3.1 Combustion Air

Mascot LX 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 Mascot LX 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.

3.1.1 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

INTAKE				EXHAUST LENGTH					
SIZE	VENT	MAX EQUIV.		VENT	MAX EQUIV.		CONCENTRIC VENT	MAX EQUIV.	
		FT.	M		FT.	M		FT.	M
50	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
75	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
100	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
125	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
150	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
175	2"	40	6.1	3"	150	30.5	3/5"	40	6.1
220	2"	30	4.6	3"	120	24.4	3/5"	40	6.1

Installations in the U.S. require exhaust vent pipe that is a combination of PVC & CPVC complying with ANSI/ASTM D1785 F441 or stainless steel complying with UL1738 Polypropylene. Installations require exhaust vent pipe that is certified to ULC S636.

Intake (air) pipe may be any material that complies with ANSI/ASTM D1785 F441, ABS that complies with ANSI/ASTM D1527 or galvanized material.

Installer must comply fully with manufacturer's installation instructions, to maintain ANSI Z21.13 safety certification.

Closet and alcove installations do not allow the use of PVC under any circumstances

To calculate max equivalent length, measure the linear feet of the pipe, and add 5 feet (1.5m) for each elbow used.

* Must use 2x3 adapter within 1 ft. (30cm) of boiler.

Table 4. Vent / Air Pipe Sizes

INSTALLATION STANDARDS		
MATERIAL	UNITED STATES	CANADA
ABS	ANSI/ASTM D1527	Air pipe material must be chosen CPVC, sch 40, ANSI/ASTM, Polypropylene based upon the intended application of the boiler.
PVC, sch 40	ANSI/ASTM D1785 or D2665	
CPVC, sch 40	ANSI/ASTM F441	
Polypropylene	UL1738, ULC S636.	
Single wall galv. steel	26 gauge	

Table 6. Required Combustion Air Pipe Material.

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.

3.1.2 Ducted 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 5](#). See [Table 4](#) 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 5](#)).

Use ABS, PVC, CPVC, polypropylene, or galvanized pipe for the combustion air intake (see [Table 6](#)), sized per [Table 4](#). Route the intake to the boiler 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 4](#). 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 (see [Figure 3](#)).

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.

3.2 Venting (Exhaust)

The flue temperature of the Mascot LX 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 Mascot LX is installed in an application where the ambient temperature is elevated, and/or installed in a closet/alcove, CPVC, polypropylene, or stainless steel material is required. If the system temperatures are unknown at the time of installation, stainless, polypropylene or CPVC material is recommended.

The Mascot LX is a Category IV appliance and may be installed with PVC, ULC-S636 CPVC or polypropylene that complies with ANSI/ASTM D1785 F441, or a stainless steel venting system that complies with UL 1738 Standard

(see [Table 8](#)).

Part Number	Size	Description
239-44069-02	2"	PVC Concentric Vent Terminal
239-44069-01	3"	PVC Concentric Vent Terminal
CA007100	3" to 5"	Stainless Steel Concentric Vent Terminal
CA010101	2"	Flush Vent Terminal PVC
CA010100	3"	Flush Vent Terminal PVC

Table 5. Vent Termination Options

⚠ 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.

INSTALLATIONS IN CANADA require the use of venting material certified to ULCS636. All Gas vents connected to the Mascot LX, 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 Mascot LX.

The flue temperature of the Mascot LX 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 Mascot LX is installed in an application where the outlet water temperature exceeds 145°F, 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.

See **Table 4** to select the appropriate vent pipe diameter. Vent pipe must pitch upward, toward the vent terminal, not less than 1/4" per foot, so that condensate will run back to the Mascot LX to drain. Route 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.

⚠ NOTICE

The instructions for the installation of the venting system shall specify that the horizontal portions of the venting system shall be supported to prevent sagging; the methods of and intervals for support shall be specified. These instructions shall also specify that the venting system:

Category I, II and IV boilers must be installed so that horizontal sections have a slope of at least 1/4 inch per foot (21 mm/m) to prevent accumulation of condensate; and

For Category II and IV boilers, where necessary, have means provided for drainage of condensate.

⚠ AVIS

Les instructions d'installation du système d'évacuation doivent préciser que les sections horizontales doivent être supportées pour prévenir le fléchissement. Les méthodes et les intervalles de support doivent être spécifiés. Les instructions doivent aussi indiquer les renseignements suivants:

les chaudières de catégories I, II et IV doivent présenter des tronçons horizontaux dont la pente montante est d'au moins 1/4 po par pied (21 mm/m) entre la chaudière et l'évent; les chaudières de catégories II et IV doivent être installées de façon à empêcher l'accumulation de condensat;

et si nécessaire, les chaudières de catégories II et IV doivent être pourvues de dispositifs d'évacuation du condensat.

⚠ NOTICE

For Category II and IV boilers, be installed so as to prevent accumulation of condensate; and

For Category II and IV boilers, where necessary, have means provided for drainage of condensate.

⚠ AVIS

les chaudières de catégories II et IV doivent être installées de façon à empêcher l'accumulation de condensat; et

si nécessaire, les chaudières de catégories II et IV doivent être pourvues de dispositifs d'évacuation du condensat.

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.

INSTALLATION STANDARDS

MATERIAL	UNITED STATES	CANADA
Stainless Steel	UL 1738	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	
Polypropylene	UL1738 or ULC-S636	

Table 8. Required Exhaust Vent Material.

3.2.1 About Common Venting

NOTICE

DO NOT COMMON VENT MASCOT LX UNITS.
Mascot LX units are never permitted to share a vent with Category I appliances.

AVIS

NE PAS ÉVENT COMMUNE MASCOTTE LX UNITÉS. Mascotte LX unités ne sont jamais autorisés à partager un évent Catégorie I avec les appareils.

Allowable Polypropylene Vent Manufacturers / Trade Names

MFR (model number abbreviated*)

	Centrotherm	DuraVent	Selkirk
Example Components	Trade Names/Models		
	InnoFlue	PolyPro	Polyflue
Single Wall Pipe	ISVLxxxx	xPPS-x	xPF-xx
Elbow	ESELxxxx	xPPS-E90	xPF-90
PVC adapter	ISAGxxxx	xPPS-AD	xPF-PVC-PF

Notes:

"x", "xx" and "xxxx" refer to variations in nominal size. See manufacturer's catalog for a particular application.

These manufacturers samples have been tested and authorized to safely operate with Laars equipment.

Only the above manufacturers and models have been approved.

Substitutes are not allowed.

Manufacturers materials and models may not be mixed in the same application.

Contact Polypropylene manufacturer's distributor for complete model number selection.

Installer must follow Polypropylene manufacturers installation instructions.

Table 7. Allowable Vent Manufacturers

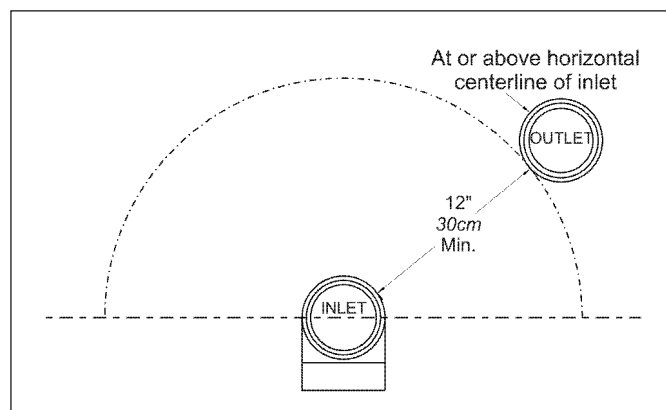


Figure 10. Minimum Venting Distance.

3.3 Locating Vent & Combustion Air Terminals

3.3.1 Side Wall Vent Terminal

The appropriate Laars side wall vent terminal must be used. 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 12 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, see Figure 12 for proper spacing and orientation.

If the vent termination is located in an area exposed to high winds, an optional PVC tee (the same diameter as the vent pipe) may be used. The tee'd vent termination offers greater protection from wind related operating issues.

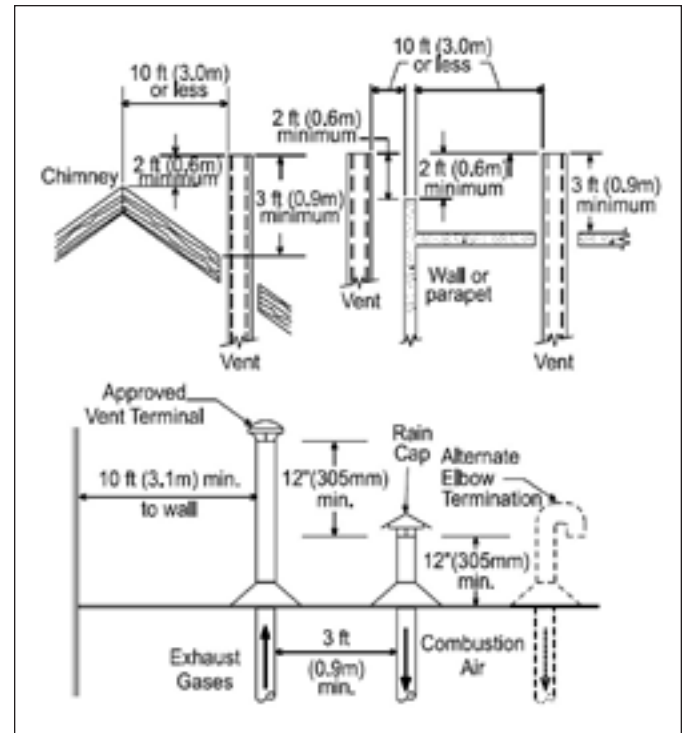


Figure 11. Combustion Air and Vent Through Roof.

3.3.2 Side Wall Combustion Air Terminal

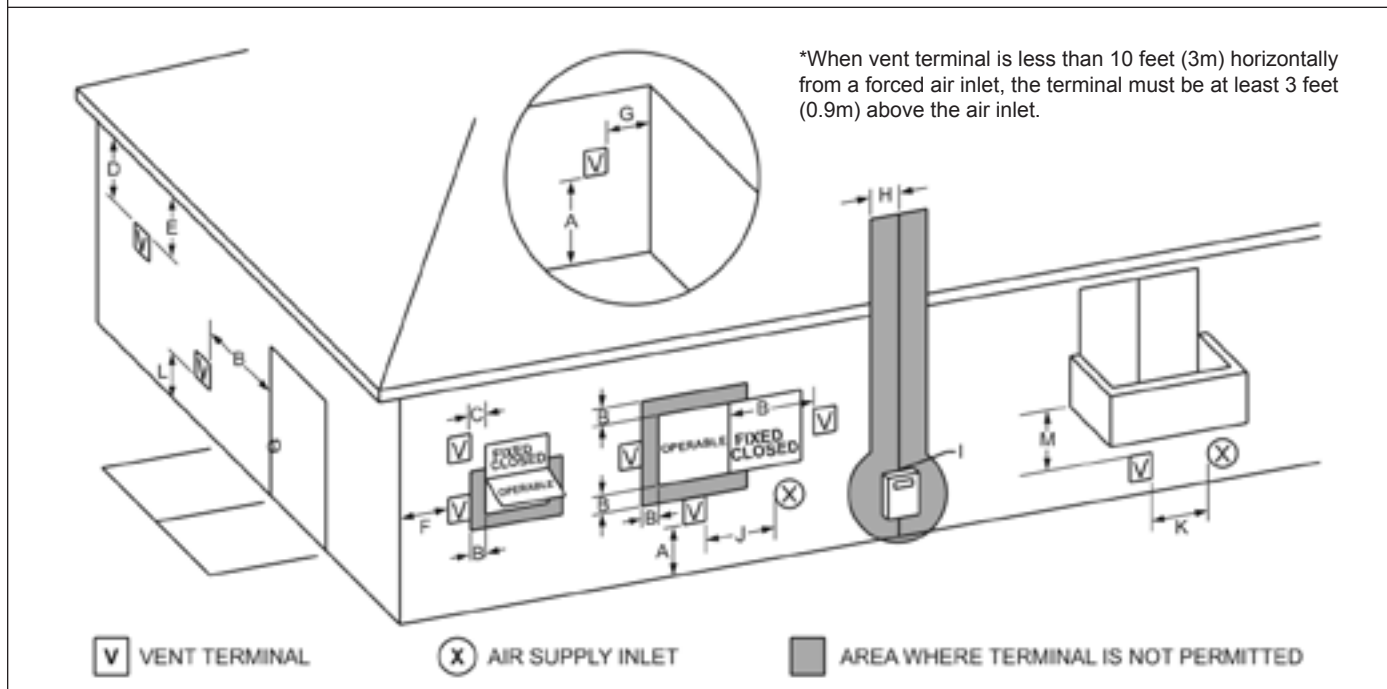
The LAARS side wall combustion air terminal, or concentric terminal (see Table 5), must be used when the heater takes air from a side wall. Consider the following when installing the terminal (see Figure 12):

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. **For concentric vent, follow instructions included with vent kit.**
5. Multiple vent kits should be installed such that the horizontal distance between outlet group and inlet group is 36" (90cm) minimum.
6. Vent outlet must be no lower than the center of the air inlet, and must be at least 12" (30cm) away from the air inlet (see Figure 10).

	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	3 feet (91 cm) minimum	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" (30cm) 80-285; 36" (91cm) 399-850. 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 12. Combustion Air and Vent Through Side Wall.**

3.3.3 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 11).

3.3.4 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 11). 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.

3.3.5 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.

3.4 Common Vent Test

NOTE: This section does not describe a method for common venting Mascot LX units. It describes what must be done when a unit is removed from a common vent system.

Mascot LX units require special vent systems and fans for common vent. **See Section 3.2.1** or contact the factory if you have questions about common venting Mascot LX units.

NOTICE

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 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.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so the appliance will operate continuously.
5. Operate the main burner for 5 minutes then, determine if the cut-draw overflows to the discharge opening. Use the flame of a match or a candle or the smoke of a cigarette, a cigar or a pipe
6. Once it has been determined, according to the method indicated above, that each device connected to the drainage system is placed in the open air in an adequate manner. Install the doors and windows, fans, the registers of chimneys and gas appliances to their original position
7. Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CAN/CSA-B149.1. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) les codes d'installation CAN/CSA-B149.1

AVIS

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas:

1. Sceller toutes les ouvertures non utilisées du système d'évacuation.
2. Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.
3. Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés au système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.
4. Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.
5. Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allumette ou d'une chandelle ou la fumée d'une cigarette, d'un cigare ou d'une pipe.
6. Une fois qu'il a été déterminé, selon la méthode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.
7. Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CAN/CSA-B149.1. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) les codes d'installation CAN/CSA-B149.1

SECTION 4.

Gas Supply and Piping

4.1 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. Mascot LX 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 11**, **Table 10**, **Table 9** and **Table 12** 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 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 Mascot LX 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.

SCHED 40 METAL PIPE CAPACITY FOR 1.50 SPECIFIC GRAVITY UNDILUTED PROPANE			
NOMINAL PIPE SIZE @ 11" W.C. INLET AND 0.5" W.C. PRESSURE DROP			
SIZE	1/2"	3/4"	1"
LENGTH FOOT	MAXIMUM CAPACITY IN THOUSANDS OF BTU PER HOUR		
20	200	418	787
40	137	287	541
60	110	231	434
80	94	197	372
100	84	175	330

NOTES: 1. Follow all local and national LP gas codes for line sizing and equipment requirements. 2. Verify that inlet gas pressure remains between 4 and 13 inches of water column before and during operation.

Source: ANSI Z223.1-80 National Fuel Gas Code.

Table 9. Nominal Pipe Size, Propane

SCH 40 METAL PIPE CAPACITY FOR 0.60 SPECIFIC GRAVITY NATURAL GAS			
NOMINAL PIPE SIZE @ 0.30" W.C. PRESSURE DROP			
LENGTH FT	1/2"	3/4"	1"
CUBIC FEET OF GAS PER HOUR			
20	92	190	350
40		130	245
60		105	195
80		90	170
100			

Table 10. Nominal Pipe Size, Natural Gas

Mascot LX NATURAL GAS REQUIRED	
SIZE	CU FT / HR INPUT RATE.
50	50
75	75
100	100
125	125
150	150
175	175
220	220

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. Verify gas inlet pressure is between 4 and 13 in W.C. before starting boiler.

Table 11. Natural Gas Required

Model: 125			
Inlet Temp F			
	50	60	70
GPM	Temp Rise F		
2	100	97	95
3	79	77	75
4	59	58	56
5	48	46	45
Model: 150			
Inlet Temp F			
	50	60	70
GPM	Temp Rise F		
3	95	92	90
4	71	69	68
6	48	46	45
8	36	35	34
Model: 175			
Inlet Temp F			
	50	60	70
GPM	Temp Rise F		
4	83	81	79
5	67	65	63
6	55	54	53
8	42	40	39

Table 13. DHW, Performance Data.

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

Table 12. Equivalent Pipe Lengths.

SECTION 5.

Pump Capacity

5.1 Mascot LX Heating System Pump Capacity

Mascot LX's internal pump is sized for a maximum of 30 ft total equivalent pipe. Laars strongly recommends the unit to be piped in primary/secondary fashion, or use a low loss header/hydraulic separator.

Please contact Laars for further application details.

SECTION 6.

Water Connections

6.1 Central Heat System Piping

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 pressure relief valve (full size) to a drain or in a manner to prevent injury in the event of pressure relief. Minimum fill pressure must be 12psig (82.7kPa). Install shutoff valves where required by code.

CAUTION

PRV (included) must be installed immediately at boiler outlet with no valves between. Use PRV adapter pipe (included) for bottom connections or add PRV directly to the top of boiler with pipe coupling.

ATTENTION

PRV (inclus) doit être installé immédiatement à sortie chaudière avec pas de vannes entre. Utiliser le PRV tuyau adaptateur (inclus) pour les connexions bas ou ajouter PRV directement vers le haut de la chaudière avec raccord de tuyau.

Suggested piping diagrams are shown on **the following pages**. These diagrams are meant only as a guide. Components required by local codes must be properly installed.

Mascot LX's efficiency is higher with lower return water temperatures.

Laars strongly recommends that Mascot LX 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.

Mascot LX boiler must 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.

The system designer should take into account allowable boiler temperature rise of 65°F (36°C) Maximum.

6.2 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.

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 at the time of boiler installation.

6.3 Freeze Protection

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

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 antifreeze or ethylene glycol. To help prevent freezing, Laars recommends the use of inhibited propylene glycol concentrations between 20% and 35% glycol. Typically, this concentration will serve as burst protection for temperatures down to approximately -5°F (-20°C). If temperatures are expected to be lower than -5°F (-20°C), glycol concentrations up to 50% can be used. **NOTE: Laars supplied pumps are not all capable of maintaining the reduced temperature rise required with glycol concentrations greater than 35%.**

NOTICE

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

6.4 Recognized Chemicals

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

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

6.5 Domestic Hot Water Piping (MLXC)

Connect domestic hot and cold water piping to the boiler at locations noted in **Figure 14**. Expected DHW performance is indicated in **Table 13**.

Use of flow restrictor is optional to prevent colder water at excessive flow rates. Contact Laars for alternate configurations.

6.6 Indirect Water Heater Piping

The MLXH model can control an indirect water heater zone. Pipe to the locations shown in **Figure 14**. Setpoint is made via aquastat or sensor well located on the indirect water heater, or can be controlled at the boiler via a remote sensor. **See Section 9 for control details.**

Sensor, Laars PN E2337501

6.7 Condensate Drain

A condensate drain trap is built into the Mascot LX.

Connect a 3/4" PVC pipe between the drain connection and a condensate neutralizer before entering drainage system.

The condensate drain and included trap must be installed. When a condensate pump is not used, the tubing must continuously slope downward toward the drain with no spiraling.

Consult local codes for the 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.** Contact Laars for available kits.

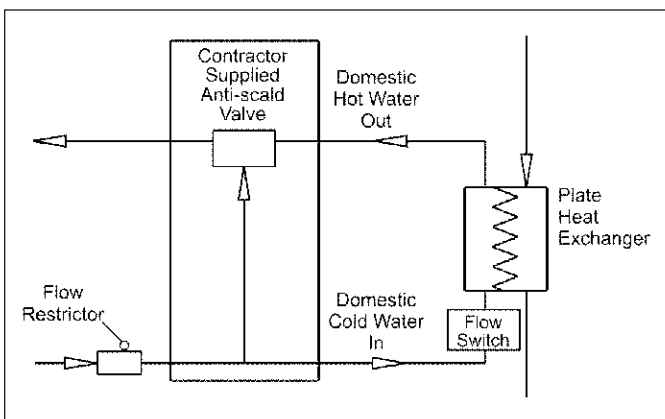
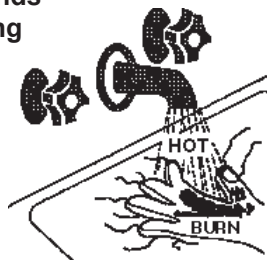


Figure 13. DHW Connections with Anti-Scald Valve and Flow Restrictor.

CAUTION

Scalding Risk: Laars recommends the use of a thermostatic mixing valve at domestic hot water outlet (boiler location) to reduce potential for scalding. Contact Laars for recommended models.



6.8 Piping Schematics

Figure 14 through Figure 19 illustrate typical piping configurations for Mascot LX boilers. These diagrams are only meant as a guide. All components or piping required by local code must be installed.

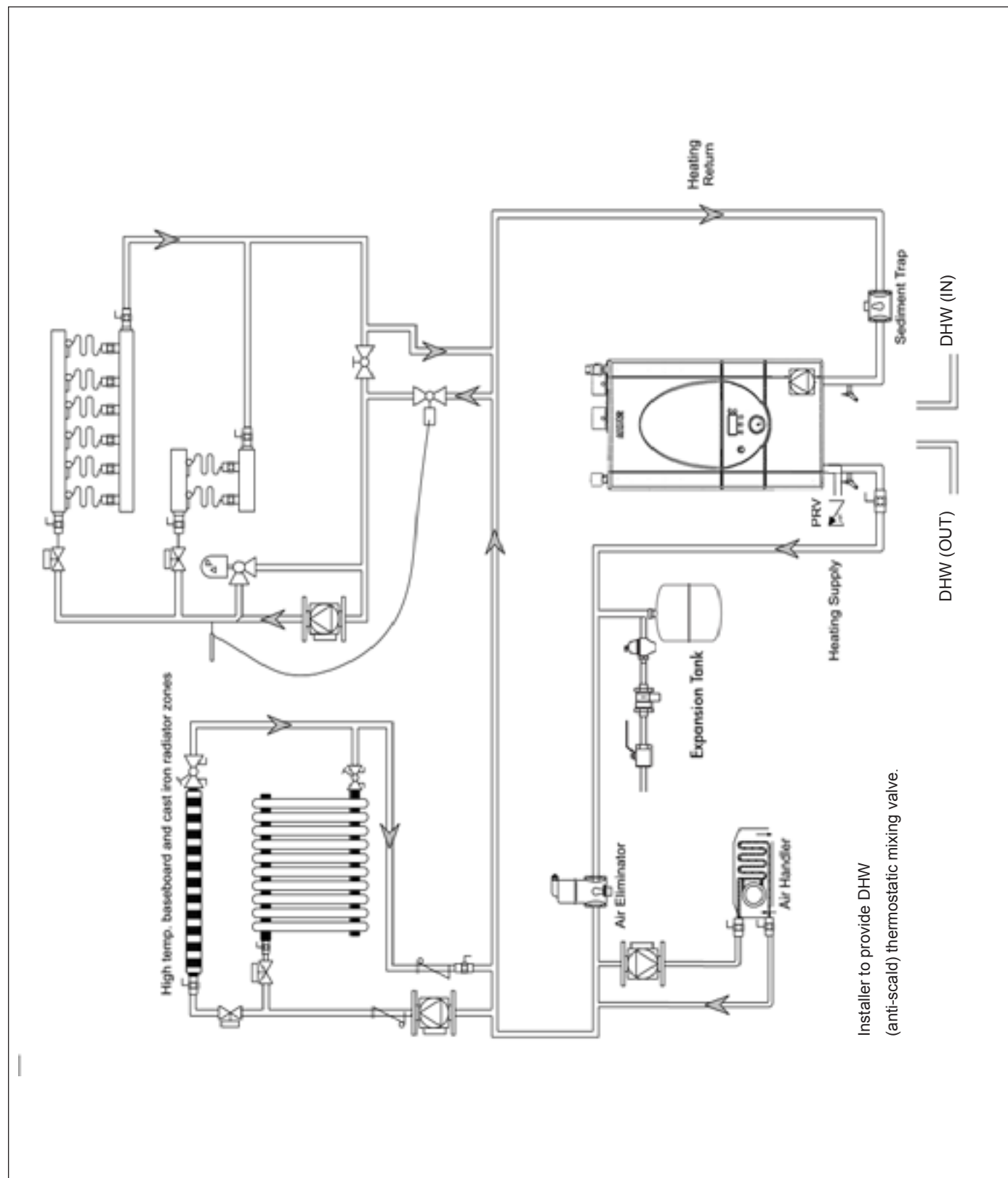


Figure 14. Hydronic Piping — MLXH Unit, High and low temp zones.

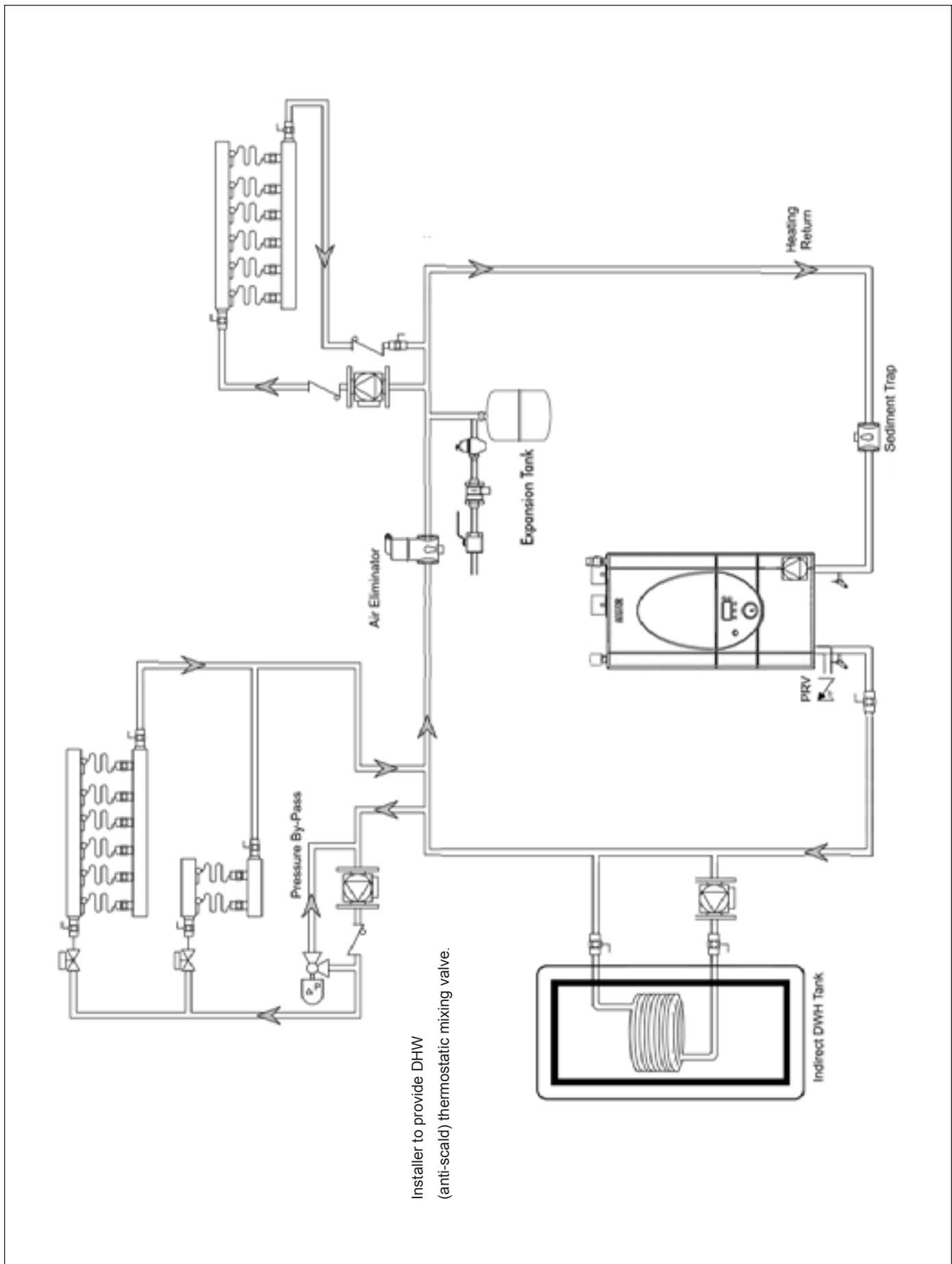


Figure 15. Hydronic Piping (only) — with an indirect tank as a zone.

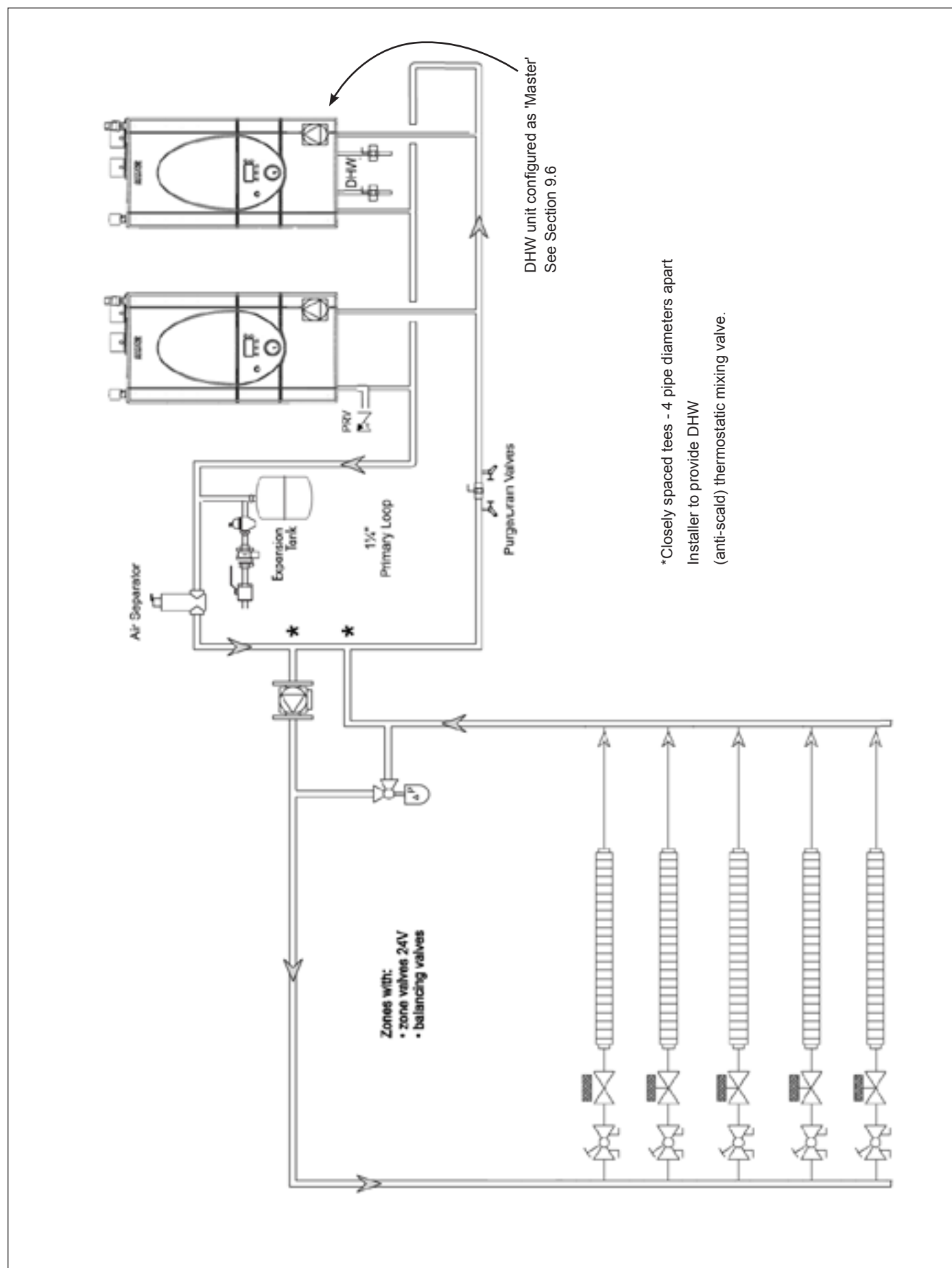


Figure 16. Hydronic Piping — MLXC Multi boilers for large homes with long / multiple baseboard zones.

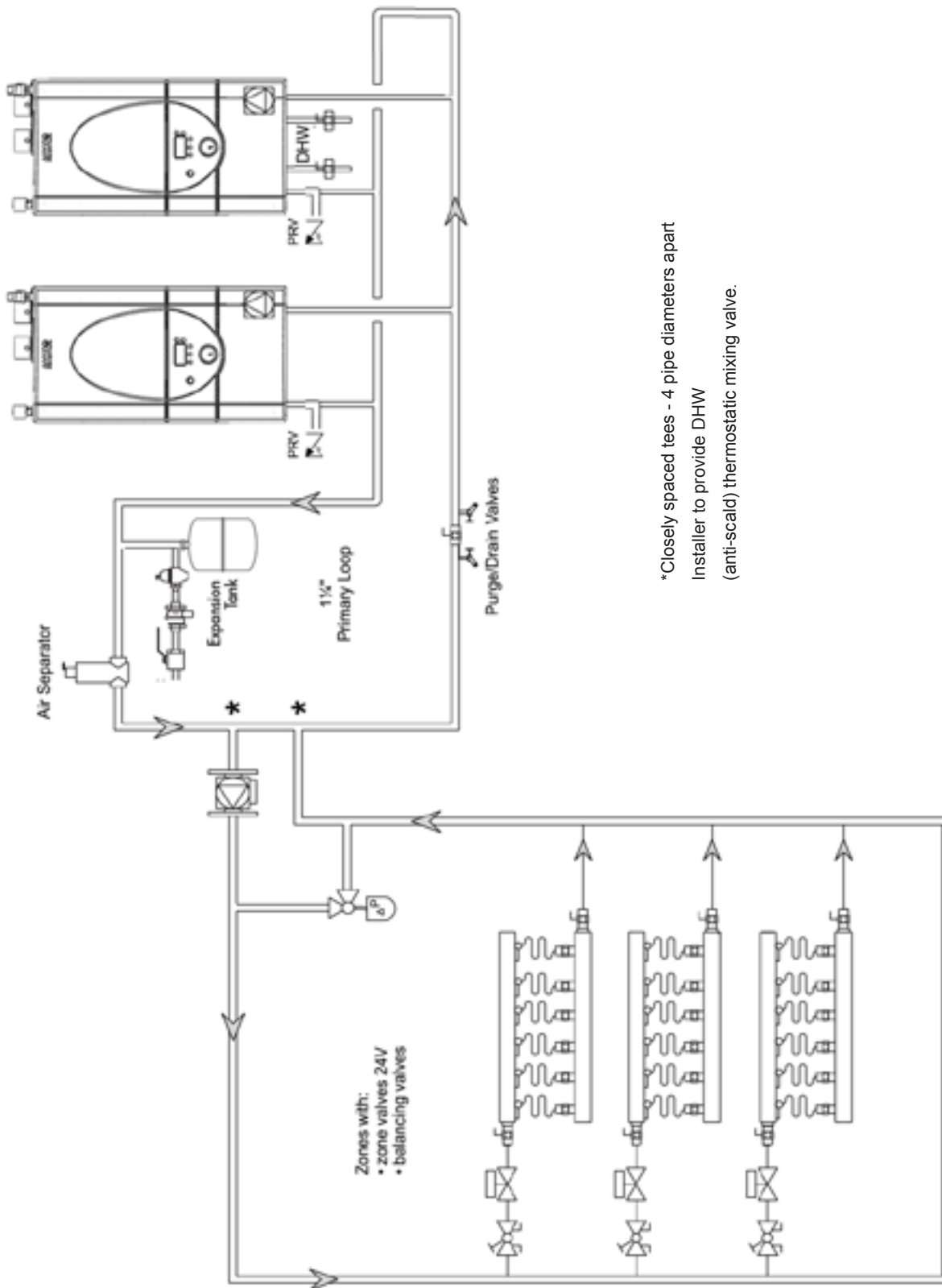


Figure 17. Hydronic Piping — MLXC Multi boilers for large homes with long / multiple radiant zones.

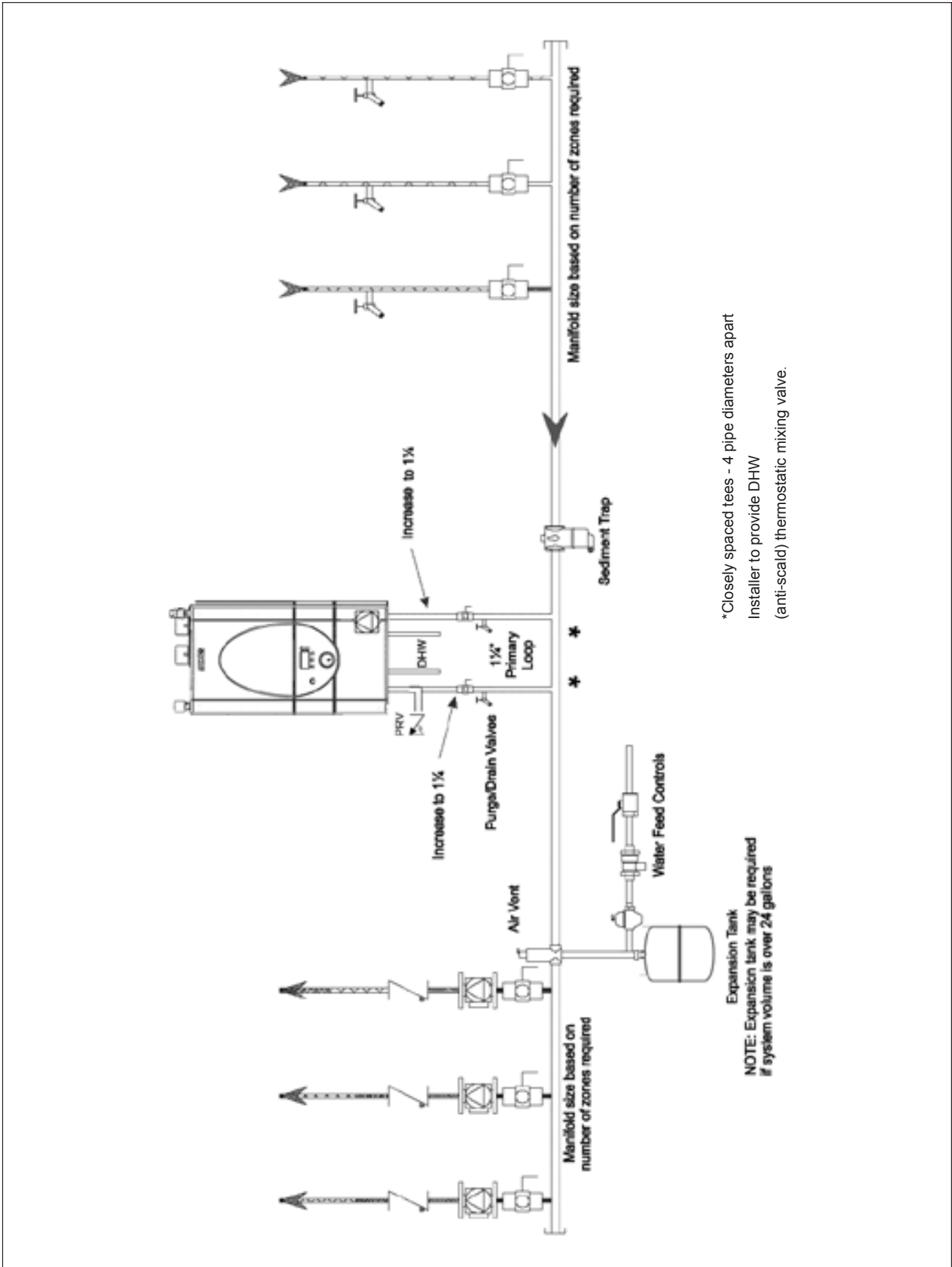


Figure 18. Hydronic Piping — MLXC Heating zones piped with zone pumps.

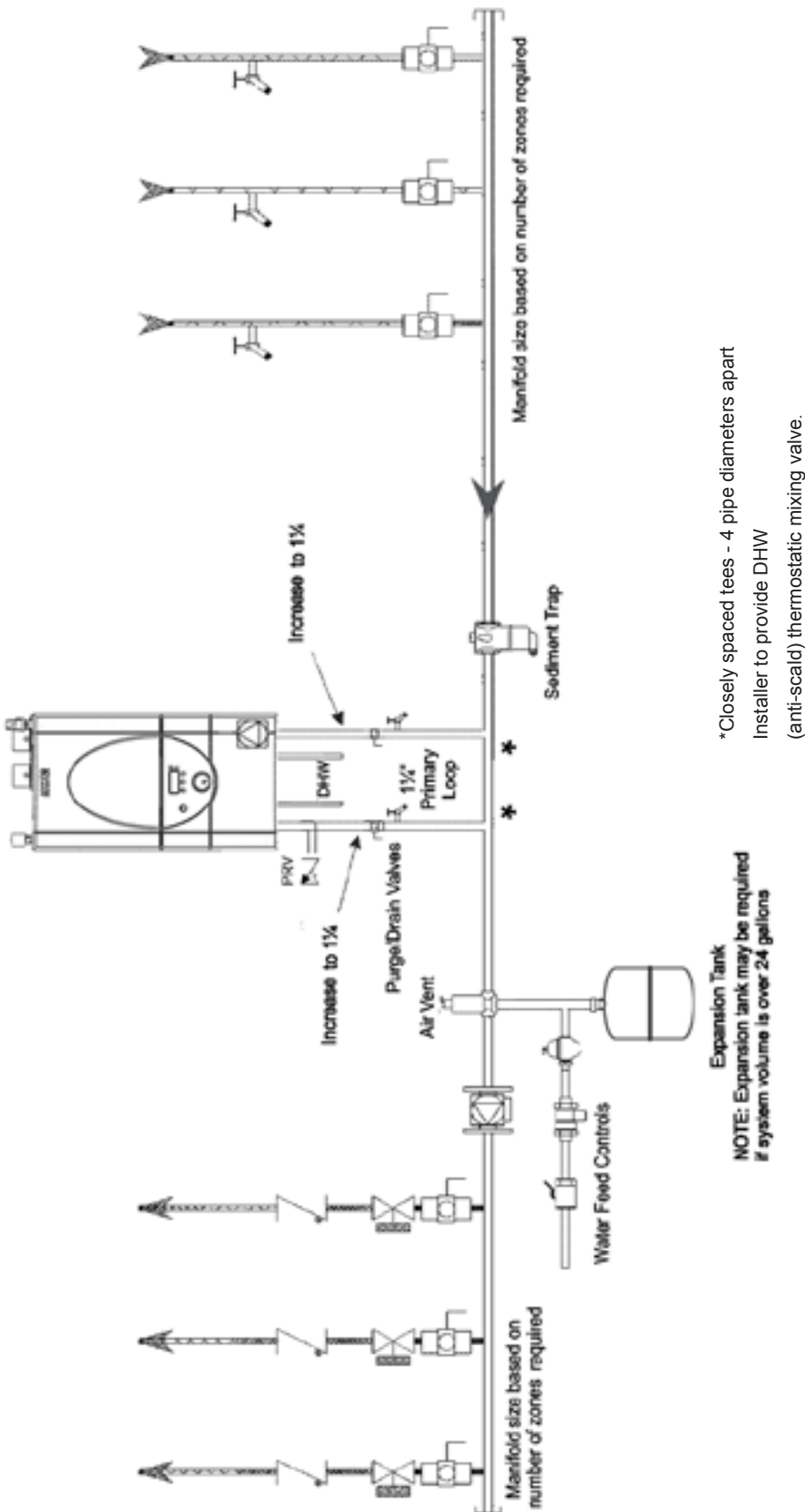


Figure 19. Hydronic Piping — Heating zones piped with zone valves.

SECTION 7. 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.

CAUTION

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

CAUTION

Mascot LX 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 DC field-interlock, as shown in the wiring diagram(s).

7.1 Main Power

Plug power cord into a non-switched 115V electrical outlet with 15A circuit protection. FLA is 2A. There is an internal 10A breaker to protect internal system components.

7.2 Pump Connections

Mascot LXC energizes boiler pump (opens 3-way valve), and system pump upon a demand for Central Heat. Mascot LXH energizes boiler pump and system pump upon a central heat demand. The combined load for all pumps must not exceed 5 amps. In some installations, a pump relay may be required.

7.3 24Vac Transformer with Circuit Breaker

24Vac is supplied by a transformer mounted behind the lower door. All 24Vac power is supplied through a 2A circuit breaker located behind lower door.

7.4 Central Heat - Call for Heat

Connect the Call for Heat to terminals #5 and #6 (connections labeled "T-T or interlock").

7.5 Outdoor Air Temperature Sensor

Connect the outdoor air temperature sensor to connections labeled "Outdoor sensor." The outdoor air temperature sensor is used for warm weather shutdown and outdoor reset. If an outdoor sensor is not installed, the CH setpoint of the boiler is limited to 140°F.

7.6 Domestic Hot Water Connection

For indirect water heater, connect aquastat for remote sensor to terminals #7 & #8 or domestic hot water sensor to terminals #9 & #10 (see [Figure 21](#)).

Domestic Hot Water Sensor PN is E2337501

7.7 System Sensor

Connect the system sensor to connections labeled "system sensor" on lead boiler only. #3 and #4

7.8 External Control Connections

If the unit is being controlled by an external 0-10VDC signal, connect this to terminals 11 and 12. When making the connections, follow the polarity designations shown on the label.

Note: The 0-10VDC signal may be to send a modulation signal, or a temperature setpoint signal. See Section 9.

7.9 Ladder Diagram, Connections, and Wiring Diagrams

(see *Figure 20 thru Figure 22*)

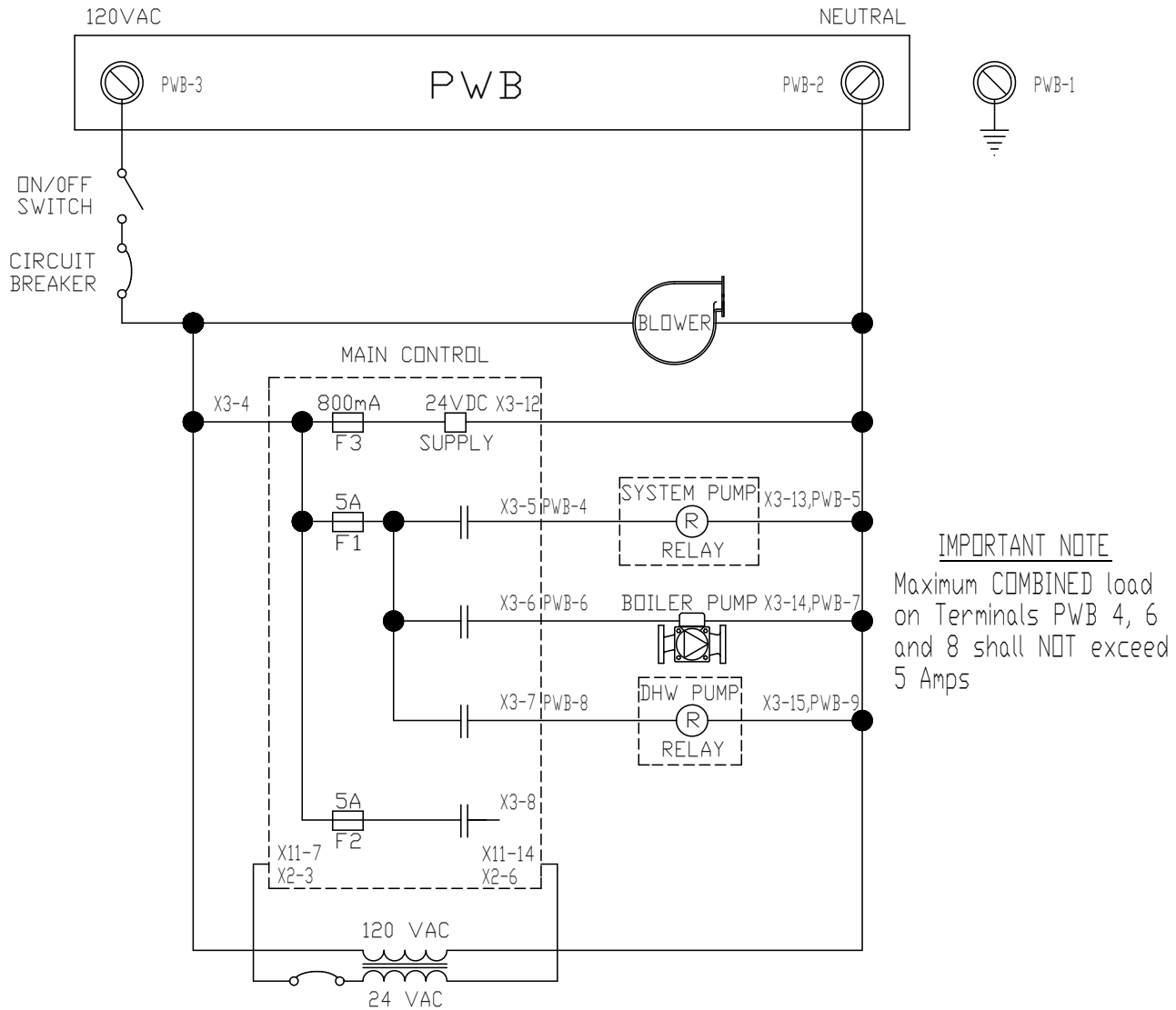


Figure 20. Ladder Diagram.

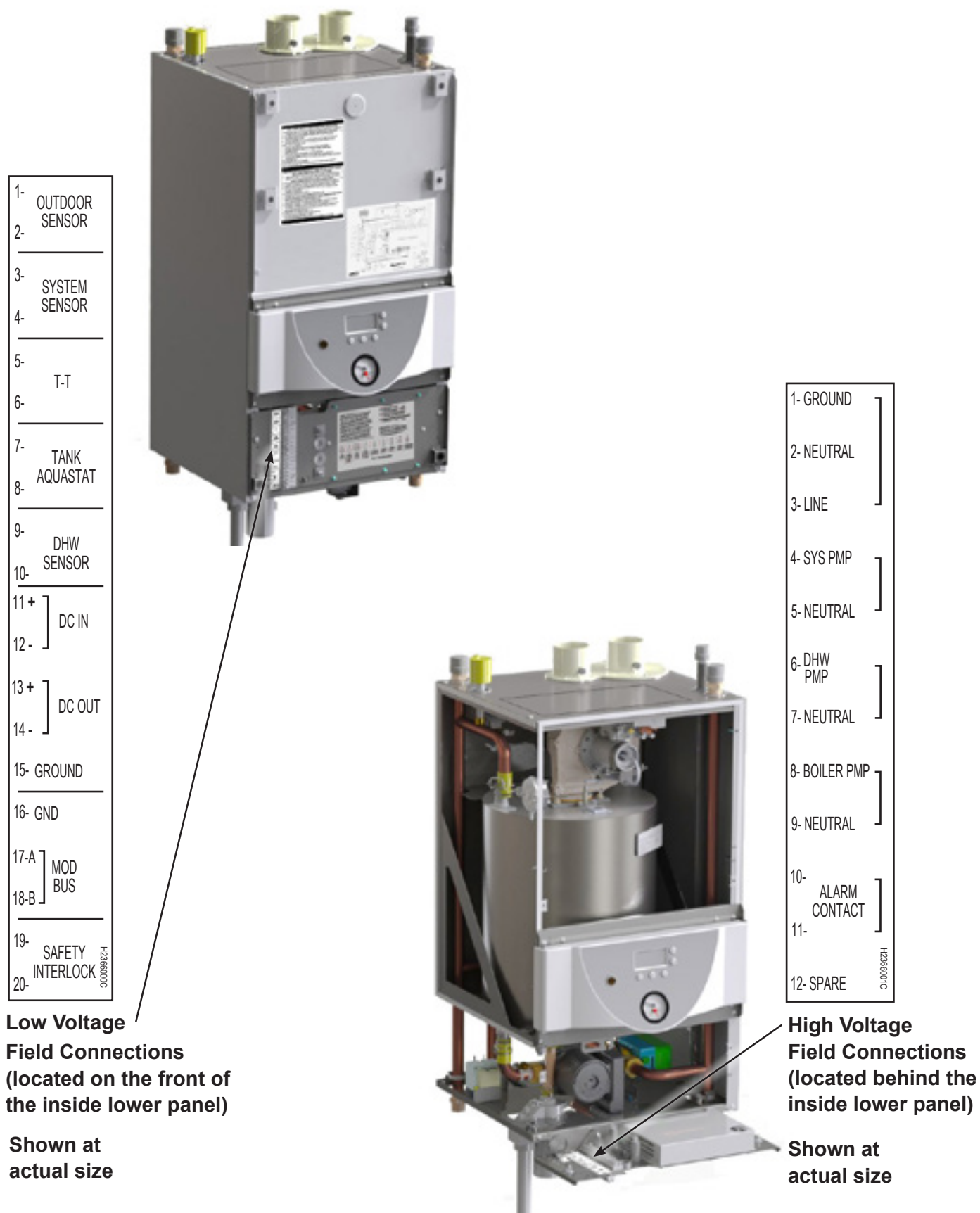


Figure 21. Field Wiring Connections

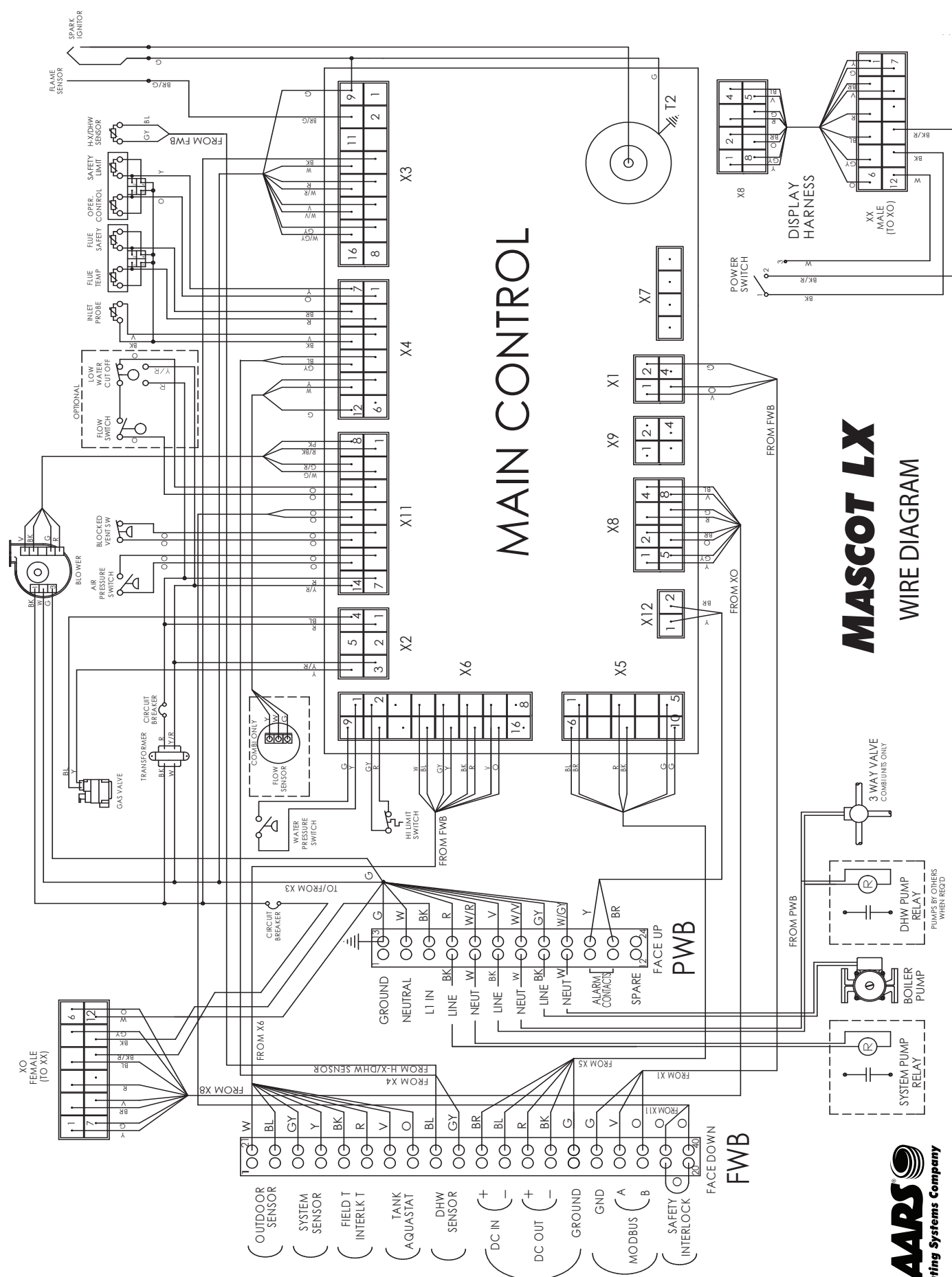


Figure 22. Wiring Diagram.

SECTION 8. Control Setup and Operation

The Mascot LX control is an integrated electronic control that includes flame control, safety device monitoring and pump regulating functions. The control regulates the heat input by controlling the blower speed and activating the gas valve. The board controls the ignition sequencing and monitors signals received by all boiler

sensors. The control regulates the boiler set temperatures and operating modes. For typical heating and DHW operation, the control is programmed to give priority to domestic hot water. The control is setup using the User Interface which contains 5 buttons and a digital display.

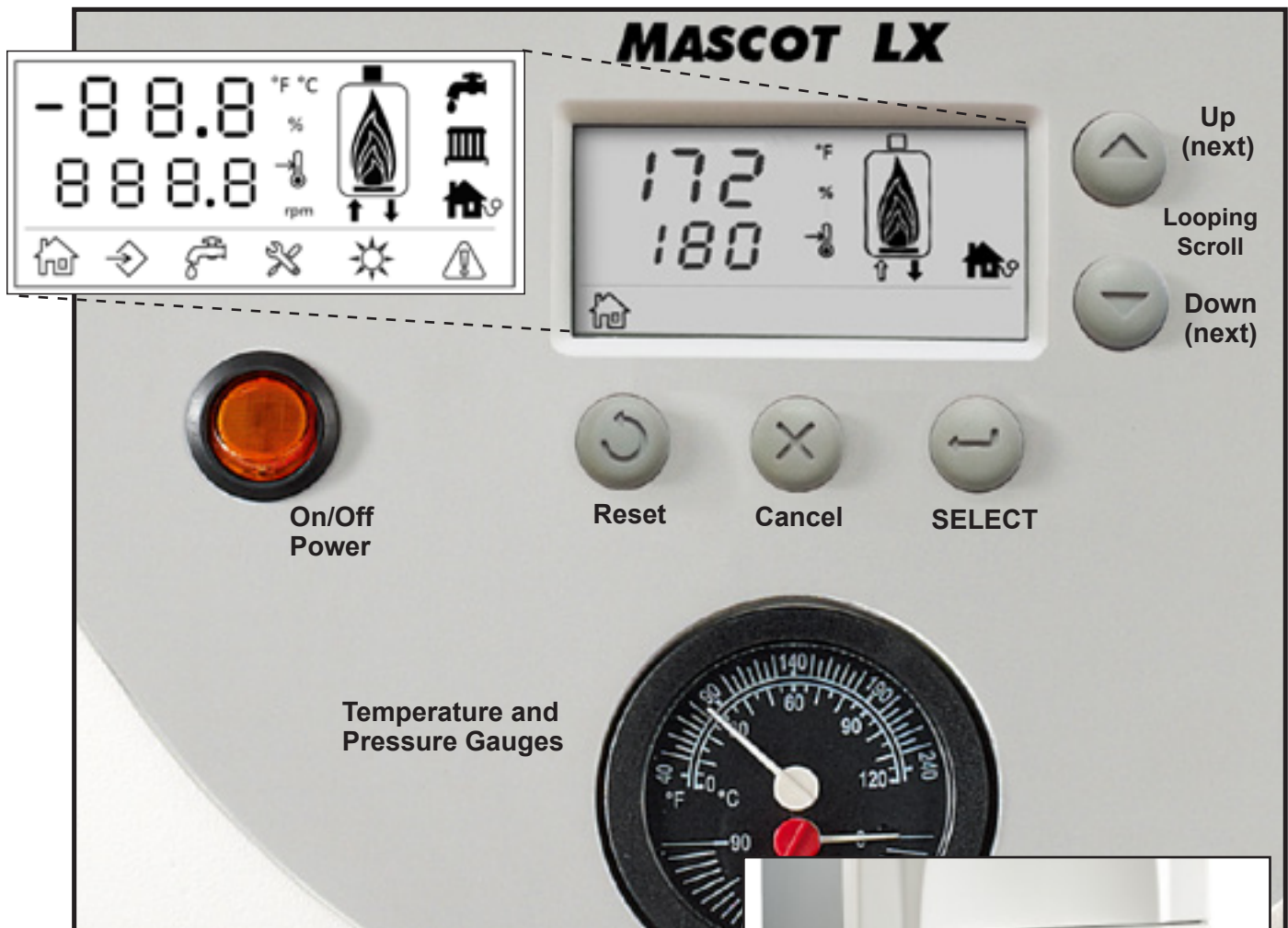


Figure 23. The User Interface

The User Interface is located on the one panel of the Mascot LX that is not removable. It contains all the buttons and gauges that are necessary to control and monitor the unit. See [Figure 23](#)

8.1 Digital Display

The centerpiece of the User Interface is the Digital Display. All of the needed parameters of the Mascot LX can be viewed and monitored on this Digital Display. All controls can be adjusted using the SELECT button and the Up and Down arrows.

Descriptions of the icons used in the display are shown in [Figure 24](#).

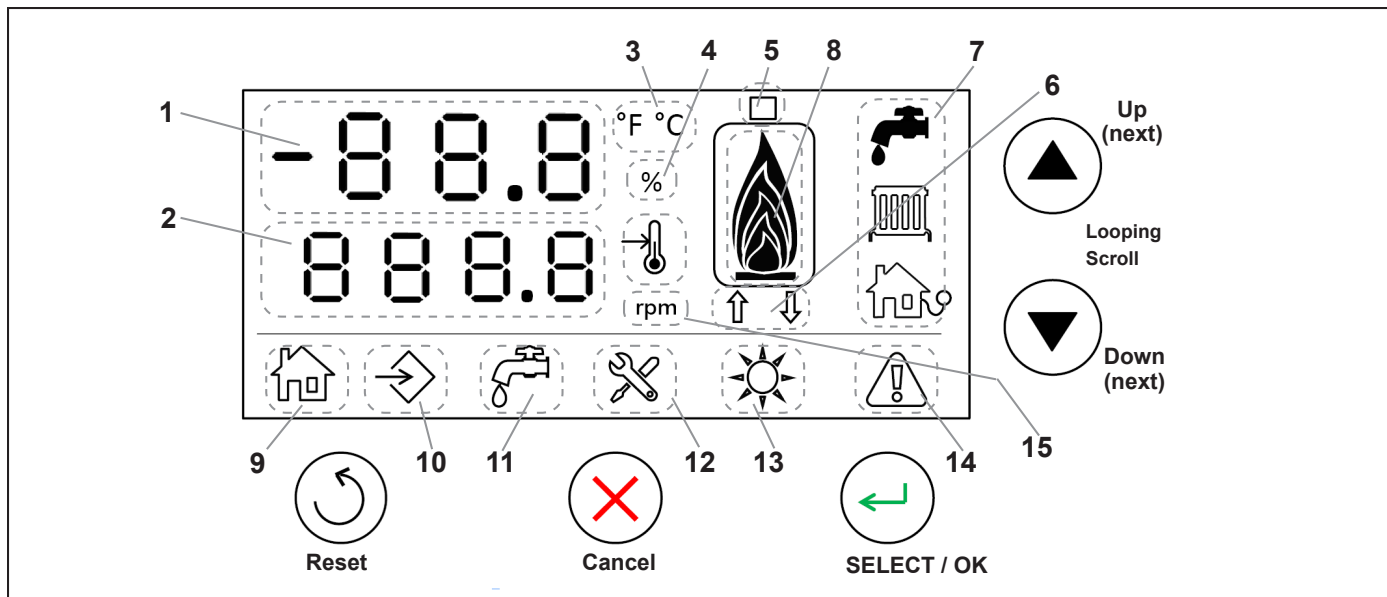


Figure 24. Display Icons

These icons and numbers are always displayed (either outlined or 'Darkened')

- 1- Current or set temperature, parameter number, modulation percentage.
- 2- Set temperature, parameter value, error code, announcement code.
- 3- Temperature unit (will show either Fahrenheit or Celsius).
- 4- Percentage or temperature set point.
- 5- Icon 1 displays the flue temperature when 'Darkened'.
- 6- Icon 1 displays inlet temperature when arrow up is 'Darkened',
outlet temperature when arrow down is 'Darkened',
differential (outlet –inlet) temperature when both arrows are 'Darkened'.
- 7- DHW/Tank temperature, System temperature, Outdoor temperature.
When respective probe is present, the icon outline will be outlined. When the respective temperature will be displayed, the icon inner part will be 'Darkened'.
- 8- Heat input in five steps (20%, 40%, 60%, 80%, 100%).

Will be 'Darkened' when,

- 9- Heat demand is active.
- 10- External demand is active (e.g. cascade master or 0-10V input).
- 11- DHW demand is active.
- 12- Service is required or when in installer mode.
- 13- Summer mode is present (only DHW request will be satisfied).
- 14- Boiler is in lockout.
- 15- Revolutions Per Minute (fan speed, shows only in Service Mode).

8.2 CONTROLLER Modes

Three control modes can be displayed: USER, INSTALLER, and SERVICE.

USER Mode is for a homeowner or service technician to adjust the most common operating parameters (See Table 14).

INSTALLER Mode allows an installer access to all of the parameters for installation, setup, and reconfiguration of the boiler.

SERVICE mode is used only by trained Mascot LX technicians.

8.3 USER Mode

The USER Mode is for a homeowner or service technician to adjust the most common operating parameters (See Table 14). In the USER Mode, when the boiler is ON and operating normally, the USER can scroll Up and Down using the Arrow Keys. Of the 7 viewable parameters, 4 can be adjusted (depending on if they are installed). The USER adjustable parameters are the Outlet Temp, DHW Setpoint, and Outdoor Air Temp. If the System Setpoint is installed, it can be adjusted, but then the Outlet Temperature can no longer be adjusted.

These parameters can be adjusted in the USER Mode by pressing the 'Select/OK' button (while in that parameter) and then using the Up and Down arrows to set to the desired temperature.

Once the desired parameter is displayed, always press 'Select/OK' again to Save that setting.



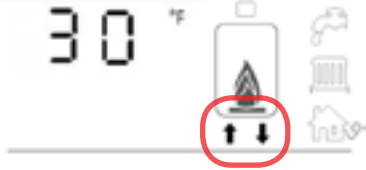




Setpoint (°F)				
Parameter	Display	Description	Range	Default
Outlet Temp		Outlet Temperature is displayed as well as the 'darkened' arrow pointing away from boiler icon. The boiler setpoint (CH) can be changed by pressing 'Select/OK' until 'Set' is displayed. Use the Arrows to adjust to the desired Outlet temperature and then press 'Select' to Save.	45 - 189	130
Inlet Temp		Inlet Temperature is displayed as well as the 'darkened' arrow pointing towards boiler icon		
Delta T		Delta T is the temperature difference between the outlet and inlet. The temperature difference is displayed and both arrows below boiler icon become 'darkened'.		
Stack Temp		The Stack Temperature is displayed and the box on top of the boiler icon is 'darkened'.		
DHW Setpoint		If the DHW Sensor is installed, Domestic Hot Water temperature is displayed and the the faucet icon will be 'darkened'. The DHW setpoint can be changed by pressing 'Select' until 'Set' is displayed on the left. Use the Arrows to adjust to the desired temperature and then press 'Select' to Save.	68 - 189	120
System Setpoint		If a System Sensor is installed, it will over-ride the Outlet Temp, and the System Setpoint will be displayed and the radiator (system) icon 'darkened'. The system setpoint can be changed by pressing 'Select'. Use the Arrows to adjust to the desired temperature and then press 'Select' to Save.	45-189	130
Outdoor Air Temp		If the Outdoor Air Temperature Sensor is installed, the house icon (showing the outdoor sensor) becomes 'darkened' and the Outdoor Air temperature is displayed.		

Table 14. User Mode Displays.

8.4 INSTALLER Mode

INSTALLER Mode is an extensive set of parameters that can be changed to suit the individual installation and should only be accessed by a trained service technician or installer. To access the INSTALLER Mode, hold 'Select/OK' and then press the down ∨ arrow key until U00 is displayed. Press 'Select/OK' again and then release. Change the value to '15'. The INSTALLER Mode Parameters will then be accessible by pressing the Up or Down arrows. (See Table 15 and Table 16)

PARAMETER	Description	DEFAULT	
P01	Service notification months	12	Service
P02	Service notification hours since last service	8760	
P03	Service notification cycles	500	
P04	Timeout for service mode	180 secs	
P06	Cascade address and configuration	-1	Control
P07	Cascade temperature set point	140 ° F	
P08	Cascade temperature offset	10 ° F	
P09	Cascade temperature hysteresis from offset	20 ° F	
P11	min time a bic must remain on or off	30 sec	
P12	min next on time	60 sec	
P23	Anti cycling time	30 sec	ANTICYCLING & FLAGS
P24	Anti cycling dropoff temperature on s2	10 ° F	
P25	0-10V to Power (fan speed)	Enabled	
P26	0-10V to outlet setpoint	Disabled	
P27	Alarm contact configuration	Enabled	
P28	DHW demand blocks system pump Enable / Disable	Disabled	
P29	System Pump Always On Enable / Disable	Disabled	
P30	0-10V Input - Enable / Disable	Enabled	
P31	BMS Voltage at Minimum	2 VDC	BMS
P32	BMS Voltage at Maximum	10 VDC	
P33	On threshold Voltage	1 VDC	
P34	On hysteresis Voltage	.5 VDC	
P35	BMS Rate at Minimum Voltage	20%	
P36	BMS Rate at Maximum Voltage	100%	
P37	BMS Temperature Setpoint at Minimum Voltage	70 ° F	
P38	BMS Temperature Setpoint at Maximum Voltage	180 ° F	
P39	Postcirculation time CH pump	30 sec	CIRCULATION PUMPS
P40	Postcirculation time DHW pump	30 sec	
P41	Postcirculation time System pump	30 sec	
P42	Summer kick CH pump timer	20 sec	
P43	Summer kick DHW pump timer	20 sec	
P44	Summer kick System pump timer	20 sec	
P45	Delta T Setpoint for CH pump speed control	20 ° F	
P46	Minimum output voltage for CH pump output	3.5 VDC	
P47	Differential Max Fan Speed for DHW demand	0 RPM	
P48	Differential Maximum Fan Speed for CH demand	0 RPM	

Table 15. Installer Parameters (part 1)

P49	CH Priority time over DHW	0 min	DHW SETTINGS
P50	DHW Priority time over CH	55 min	
P51	DHW tank setpoint	180 ° F	
P52	Stop DHW tank demand offset	0 ° F	
P53	Start DHW tank demand offset	6 ° F	
P54	Block DHW demand (combi) offset	12 ° F	
P55	Unblock DHW demand (combi) offset	20 ° F	
P56	Minimum user setting DHW set point	60 ° F	
P57	Maximum user setting DHW set point	140 ° F	FROST PROTECTION & OUTDOOR RESET
P58	Frost protection start pump temperature	45 ° F	
P59	Frost protection start burner temperature	37 ° F	
P60	Frost protection stop burner hysteresis	5 ° F	
P61	Low outdoor air temperature for heat curve	25 ° F	
P62	High setpoint for heat curve	180 ° F	
P63	High outdoor air temperature for heat curve	70 ° F	
P64	Low setpoint for heat curve	120 ° F	
P65	Outside temperature disabling CH demand	90 ° F	TEMP. SETTINGS
P66	Outside temperature disabling CH hysteresis	5 ° F	
P70	Minimum user setting CH set point	32 ° F	
P71	Maximum user setting CH set point	190 ° F	
P72	Block offset CH demand	10 ° F	
P73	Block hysteresis CH demand	20 ° F	

Table 16. Installer Parameters (part 2)

8.5 SERVICE Mode

The Mascot LX Series of appliances has been designed with a **SERVICE Mode of operation intended for servicing and troubleshooting of the unit by a Mascot LX trained service technician.**

'SERVICE' Mode can be activated by pressing and holding the 'Select/OK' button and 'Up Arrow' simultaneously for five seconds. With an active call for heat, the boiler will light and run at 100% of firing rate. The boilers input can be adjusted in 20% rate increments by pressing the 'Up' or 'Down' Arrows. You can also toggle between Maximum Rate and Minimum Rate by pressing the 'Select/OK' button. To exit SERVICE Mode depress and hold the 'Select/OK' button for five seconds.

NOTE: There must be an active call for heat given to the appliance for Service Mode to allow the boiler to start. When the Service Mode is exited, the boiler will continue to run until the call is either satisfied or removed.

8.6 Modulation Control

The control uses a PID algorithm to adjust the firing rate of the boiler as the control point is approached. The goal of the control is to operate at a minimum firing rate to match the load on the appliance.

8.7 Pump Control

The boiler pump is active anytime there is a call for heat applied to the control. When there is a central heat call the system pump relay is active. If there is a DHW call while the central heat call is active the system pump turns off. This happens because of domestic hot water priority, which forces the control to satisfy the domestic water demand prior to the hydronic demand. When the last heat demand is satisfied the boiler pump enters an overrun time.

8.8 High Limit

The control uses a dual thermistor sensor to monitor the Mascot LX's maximum temperature. The high limit sensor is installed in the outlet water. A dual thermistor sensor is used, so that the two temperatures can be monitored and compared to confirm accuracy. The control will automatically reduce the firing of the Mascot LX to prevent the high limit from tripping. The high limit setpoint is not adjustable.

8.9 Stack Temperature

The stack temperature is a dual thermistor sensor and is limit rated. The control compares each of the temperature readings to determine accuracy. The stack sensor is used as a limiting feature to avoid excessive temperatures in the venting.

8.10 Domestic Hot Water Temperature

The domestic hot water temperature sensor is used to control the DHW temperature. The DHW setpoint can be adjusted through the Base / Home state and the User Mode. On LX 'C' or Combi models, the DHW sensor is pre-installed in the DHW exchanger. On LX 'H' or Heat models the DHW can be controlled by an aquastat or optional DHW sensor installed in an indirect tank.

SECTION 9. OPERATION Modes

To access the setup parameters for configuring different Operation Modes, the installer level password must be used according to section 8.4.

9.1 Hydronic Heating Demand

When using the Mascot LX for hydronic heating a call for heat must be supplied to the "T-T or Interlock" terminals. Once the call is supplied the control energizes the boiler pump, the system pump relay, shifts the 3-way valve position and begins the ignition process. The ignition process consists of a prepurge, trial for ignition, and run period. The prepurge period starts once the fan RPM reaches a preset level. The trial for ignition period follows. The trial for ignition period lasts 4 seconds during which the direct spark ignition system and gas valve are energized. At the end of the trial for ignition period the flame signal is compared with the preset flame threshold value. If the flame signal is higher than the flame threshold the Mascot LX enters "run". If the flame signal is below the threshold the Mascot LX returns to prepurge and starts the ignition process over. In "run" the Mascot LX monitors the flame signal, call for heat, safeties, and water temperatures and modulates as needed between 100% and 20% of rate to satisfy the call for heat.

9.2 Hydronic Heating with Outdoor Reset

Outdoor reset varies the control setpoint based on the outdoor temperature. The reset function works as shown in Figure 25. When the outdoor air temperature reaches P61 "high outdoor temperature setpoint" the control point setting is adjusted to P62 "low boiler temperature setpoint". When the outdoor air temperature reaches P63 "low outdoor temperature setpoint" the control setpoint is adjusted to P64 "high boiler temperature".

9.3 Hydronic Heating Using External Modulation Control (BMS)

The Mascot LX can accept a 0-10 VDC input to integrate with a building management system or external modulating control. Utilizing Installer Parameters P31 "BMS Voltage at minimum" and P32 "BMS voltage at maximum" the installer can set the minimum and maximum input voltages. By default this input is enabled but can be disabled using Installer Parameter P30 "0-10v Input Enable / Disable".

The Mascot LX can use an external 0-10VDC signal to control its fan speed (modulation rate), or to control its

outlet setpoint. The 0-10V signal may also be used to create a heat demand eliminating the need to supply a separate “TT call”.

9.3.a External Signal to Control Modulation.

Installer Parameter P25 “0-10V to Power (fan speed)” – This is the default 0-10VDC configuration in which the external signal directly corresponds to fan speed or ‘boiler power’. In this mode, the call is initiated by the 0-10v input based on Installer Parameters P33 “On threshold voltage” and P34 “Off hysteresis voltage”. The modulation power can also be scaled with P35 “BMS rate at minimum voltage” and P36 “BMS rate at maximum voltage”.

9.3.b External Signal to Control Setpoint.

Installer Parameter P25 “0-10v BMS modulation control” must be disabled – In this mode the 0-10VDC input directly controls the boiler's outlet temperature. Set the parameters using the Installer Parameters P37 “BMS Temperature setpoint at minimum voltage” and P38 “BMS temperature setpoint at maximum voltage”

9.3.c External Signal Initiates Heat Demand

In this mode P26 “0-10V BMS Thermostat Demand Required” must be disabled to eliminate the need for a separate “TT Call”. This allows a heat demand to be created every time the 0-10V signal exceeds P33 “BMS On Volts”. The heat demand will remain until the 0-10V signal drops below P33 “BMS On Volts” – P34 “BMS Demand Off Differential Voltage”

9.4 Warm Weather Shutdown

Warm weather shutdown overrides a central heat call when the outdoor air temperature is greater than the warm weather shutdown setpoint. Warm weather shutdown is always active when there is an outdoor sensor attached to the control. The warm weather shutdown setpoint can be adjusted in Installer mode, using P65 “CH outdoor Air Shutdown Temperature” and P66 “CH Outdoor Air Shutdown Differential”.

9.5 Domestic Hot Water Demand

9.5.a Combi Boiler DHW

For Combi units (MLXC), DHW demand is triggered by a flow sensor located near the DHW cold water inlet. When water begins to flow (open faucet, shower, etc.), the boiler will fire, based on the water temperature requirements. It may cycle on and off under very low flow rates. Minimum flow is 0.5 gpm.

9.5.b Boiler only DHW aquastat demand

For Boiler only units (MLXH), an indirect water heater can be piped-in. An aquastat in the indirect water heater connected to terminals 7 and 8 will signal demand for DHW. In this demand mode the boiler will modulate on the outlet water temperature sensor and use P51 “DHW setpoint (S1 – Tank)” as the setpoint.

9.5.c Boiler only DHW sensor demand

An optional DHW sensor can also be installed in an indirect water heater connected to terminals 9 and 10 to initiate demand. Laars PN E2337501. In this mode the tank sensor will control demand and modulation based on the DHW setpoint. In the case of indirect heaters the boiler will also modulate on the outlet water temperature sensor and use P51 “DHW setpoint (S1 – Tank)” as the setpoint.

The service person should note the minor wiring differences on [Figure 22](#).

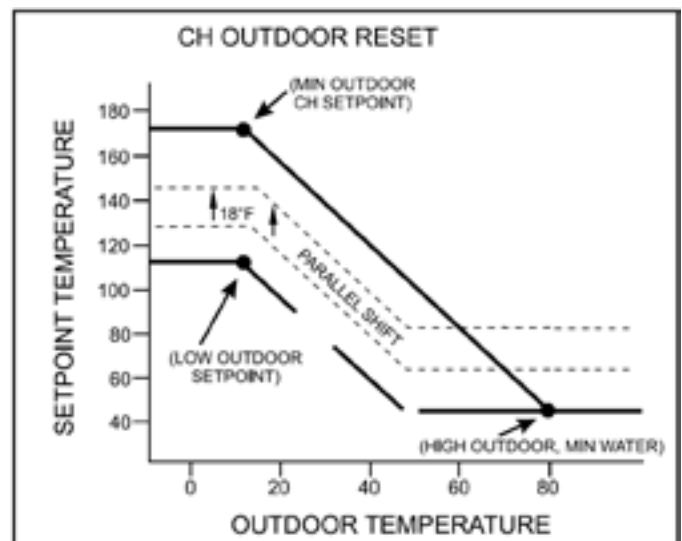


Figure 25. Outdoor Reset Setpoint Temperatures.

9.6 Domestic Hot Water Priority

DHW priority is used to allow the CH call to be interrupted when there is a DHW call. This allows the boiler to use the full capacity to satisfy hot water demands without interruptions. From the factory the default settings give priority to DHW for 55 minutes before switching to satisfy the CH demand. To adjust navigate to installer parameter P50 “DHW priority over CH” and adjust the time as required.

At the end of the DHW priority period the boiler will switch to CH priority to supply heat to the building. The boiler remains in this state until P49, “CH priority time over DHW” expires. To adjust navigate to installer parameter P49 and adjust the time as required.

9.7 Cascade Auto Configuration

To operate up to 8 boilers in cascade, the boilers must be “daisy chained” together using Modbus terminals A, B and GND, located on the boilers terminal block. The wiring should be completed with at least three wire shielded cable with ground. The ground wire should be connected to a suitable chassis ground on one end of the daisy chain only. Wire each boilers terminal A in series with the next boilers terminal A until all are connected. Repeat this process for Terminal B and GND.

To configure the control system, identify which boiler is going to be the “master” boiler for the cascade system and navigate to installer parameter P06, “Cascade Address”. Set the address to “0” and press and hold “select”. When “auto cfg” appears on the display press “select” to start the auto configuration process. The auto configuration process will find all boilers connected to the “master” boiler and assign addresses. When auto configuration is complete the display should show “boilr #” where # is the total number of boilers found in the cascade system.

The final steps are to set the individual setpoints in the cascade system, which include P07 “Cascade Setpoint”, P08 “Cascade off Hysteresis” and P09 “Cascade on hysteresis”. These variables must be set to the appropriate values for the installation. When setting P09 “cascade on hysteresis” the value should NOT be less than P08 “Cascade off Hysteresis” as P09 references the off point (P07+ P08) as the starting point for the on hysteresis. An example of this is shown below.

Correct settings:

P07 = 120°F

P08 = 10°F

P09 = 20°F

With these setting the modulation point is 120°F

The off point is $120^{\circ}\text{F} + 10^{\circ}\text{F} = 130^{\circ}\text{F}$

The on point is $130^{\circ}\text{F} - 20^{\circ}\text{F} = 110^{\circ}\text{F}$

Incorrect settings:

P07 = 120°F

P08 = 10°F

P09 = 5°F

With these setting the modulation point is 120°F

The off point is $120^{\circ}\text{F} + 10^{\circ}\text{F} = 130^{\circ}\text{F}$

The on point is $130^{\circ}\text{F} - 5^{\circ}\text{F} = 125^{\circ}\text{F}$

In this case the boiler is turning back on prior to reaching the modulation point, which could lead to short cycling.

9.7.1 Cascade Manual Configuration

In some applications it may be necessary to configure the cascade system manually. To do this, the boilers should be wired as shown in the Auto Cascade section of the manual. Then each individual control in the cascade must have a specific address assigned by adjusting P06 “ Cascade address” on each boiler. To start, identify the boiler that will be the “master” boiler. Navigate to parameter P06 “cascade address” set to “0” and press “Select” (do NOT press and hold select). Then press and hold select.

Repeat this process for each boiler in the cascade setting each address to a unique number.

The last step is to adjust all of the setpoints for the installation application as shown in the Auto cascade section of the manual.

SECTION 10.

Set Up Instructions

10.1 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. Move manual lever on 3-way valve actuator to "open" position, allowing air to purge from boiler loop. Valve is normally in DHW position until there is a call for Central Heat via "T-T" contacts. 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 Mascot LX, on top of the jacket.

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.
6. Using manual lever located on left side of 3-way valve actuator, move from "open" position back to closed position repeatedly. This process forces air out of the internal DHW loop.

WARNING

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

7. Recheck all air bleeders as described in Step 4.
8. 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.
9. Shut down the entire system and vent all radiation units and high points in the system piping, as described in Step 4.
10. 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.
11. 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.

12. 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.
13. 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.
14. 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.

10.2 Starting the Burner after Set Up

Initial 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.

10.2.1 Burner Operation

REQUIRED TOOLS: Screw drivers, and combustion 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 (Start Up / Shut Down Instruction) Decal, located on the back of the Top Front Cover, and turn on gas and electrical power to appliance.**

4. Mascot LX will enter the start sequence. 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 Mascot LX, check that there is proper gas supply. Wait 5 minutes and start the unit again.
5. Turn Mascot LX on.
6. **After placing the appliance in operation, the Burner Safety Shutoff Device must be tested:**
 - (a) Close gas shutoff valve with burner operating.
 - (b) 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.

10.2.2 Boiler Setup and Adjustment

1. Measure the CO₂ in the flue products at high fire. The Mascot LX can be forced to high fire to allow for easier setup. Refer to **Section 8** for instructions on how to access the forced rate menu. The CO₂ readings should be between the range shown in **Table 17**. 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 (see **Figure 26**). Slowly make adjustments in 1/16 of a revolution increments until the CO₂ is within the range identified.
2. Measure the CO₂ in the flue products at low fire. Mascot LX can be forced to low fire to allow for easier setup. Refer to **Section 8** for instructions on how to access the forced rate menu. CO₂ readings should be between the range shown in **Table 17**. 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. Slowly make adjustments in 1/16 of a revolution increments until the CO₂ is within the range identified (see **Figure 26**).
3. Repeat steps 1 and 2 to confirm that the CO₂ ranges are within the required ranges. High and Low

Fire CO₂ settings should be approximately equal. Adjust if necessary.

If any your CO₂ readings cannot be adjusted to the specified ranges (see **Table 17), please consult the factory for further information.**

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.

10.3 Shutting Down Mascot LX

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

This step to be performed by a qualified service person.

10.4 To Restart Mascot LX

If drained, go back to **Section 10 in this manual for proper filling and purging, prior to continuing.**

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.

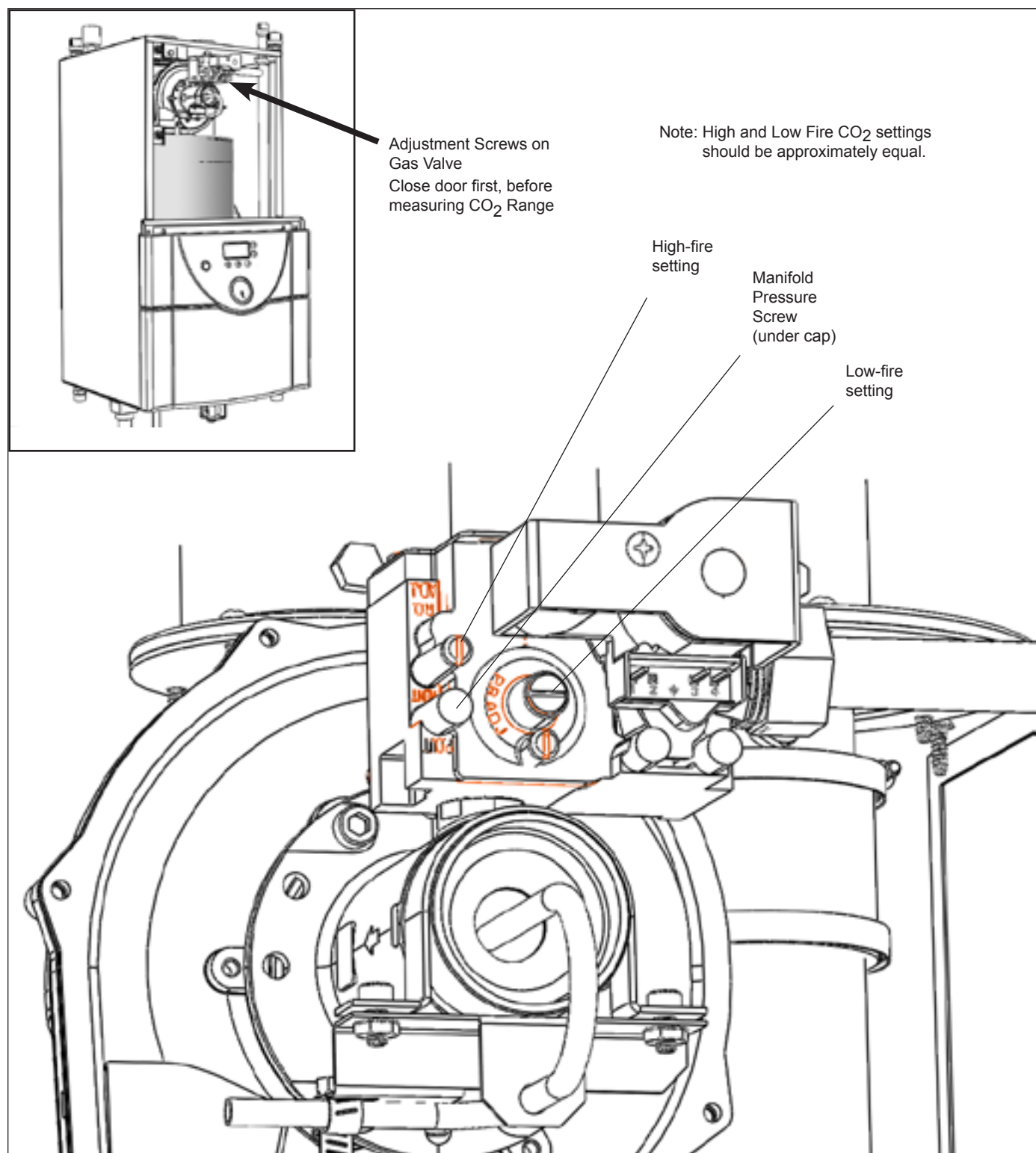


Figure 26. Adjustment Screws and Settings for CO₂

GAS TYPE	CO ₂ (%) RANGE
Natural	8.9 — 9.9
Propane	9.9 — 10.9

Table 17. CO₂ Range and Pressure Settings.

SECTION 11.

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.

11.1 System Maintenance

(yearly, unless otherwise noted)

1. If a strainer is employed in a pressure reducing valve or the piping, clean it every six months.
2. 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).
3. Keep the appliance area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
4. 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.
5. Low water cutoffs, if installed, should be checked every year. Float type low water cutoffs should be flushed periodically.
6. Inspect and clean the condensate collection system yearly.
7. When a means is provided to neutralize condensate, ensure that the condensate is being neutralized properly.
8. Removal of burner and inspection of combustion coil and flue passages is required at least once a year. Clean with a soft bristle brush / vacuum or wash with water if necessary. Sooting and buildup on the coils is an indication of improper set up and poor combustion. Determine the cause and make corrections.
9. 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 Garlock sealing material, and clean with alcohol. Apply new sealing material, and reassemble.

11.2 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.

Mascot LX gas and electric controls are engineered for long life and dependable operation, but the safety of equipment depends on their proper functioning. Only a qualified service technician should inspect the basic items listed below every year:

- | | |
|------------------------|---------------------|
| a. Appliance control | f. Flow switch |
| b. Automatic gas valve | g. Low water cutoff |
| c. Pressure switches | h. Burner |
| d. Blower | i. Heat exchanger |
| e. Pump | |

11.2.1 Burner

Check the burner for debris. Remove the blower assembly to access the burner. Remove the 4 bolts connecting the blower. 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.

11.2.2 Appliance Control

Mascot LX has an integrated control that incorporates manual reset high limit control, 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 and shut off 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

ATTENTION

Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Les erreurs de câblage peuvent nuire au bon fonctionnement et être dangereuses. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.

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 10](#).

11.2.3 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.

11.2.4 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 boiler top. 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.

11.2.5 Blower

The combustion air blower is a high-pressure centrifugal blower with a variable speed motor. Speed of the motor is determined by the control logic. 120 Volts remain 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.

11.2.6 Heat Exchanger Coils

Black carbon soot buildup on the internal 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 at the top of the boiler, and inspect the tubing using a flashlight and a mirror. 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. Disconnect all blower wiring and gas valve piping.
4. Remove the four bolts connecting the blower flange to the burner flange.
5. Remove the burner assembly from the heat exchanger.
6. Disconnect the condensate drain line.
7. Attach a longer hose to drain and run to a bucket.
8. 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 or refractory.

CAUTION

Be careful not to damage refractory material located at top and bottom of heat exchanger.

9. 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.

10. 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.
11. Place the appliance in operation according to **Section 10** checking all gas connections for leaks. Confirm all fasteners are tight.

11.2.7 Gas Conversion

There are no parts or orifices required for the gas conversion of the Mascot LX. But if a gas conversion is performed, the unit must be identified with the appropriate gas labels and a conversion sticker to allow technicians performing maintenance in the future to properly identify the gas type of the appliance. These stickers are included with the boiler during shipment.

Conversion to/from LP Gas Instructions:

1. Open the front covers as described in Section 1 and **Figure 1**.
2. Place "Propane Gas" sticker over the "Natural Gas" sticker (or vice versa) where the gas supply line enters the appliance.
3. Fill out gas conversion sticker with all of the required information and place adjacent to the Rating Plate sticker (which is behind the center door panel).
4. Confirm that the gas supply is turned on.
5. Start boiler per lighting procedure shown on inside front cover or side of appliance.
6. With a combustion analyzer, check CO₂ levels at both maximum and minimum input. Refer to sections **Figure 26** and **Table 17** of this manual for the proper adjusting procedures.
7. Close all front covers.

WARNING

Serious injury or death could occur if CO₂ levels are not adjusted properly.

WARNING

This conversion shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, an explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency is responsible for the proper and complete installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instruction supplied with the kit.



AVERTISSEMENT

Ce conversion doit être installé par un organisme de service conformément aux instructions du fabricant et tous les codes et les exigences de l'autorité compétente. Si les informations contenues dans ces instructions n'est pas suivi à la lettre, un incendie, une explosion ou de la production de monoxyde de carbone mais résultat causant des dommages matériels, des blessures ou des pertes de vie. Le service est responsable pour la bonne et complète l'installation de ce kit. L'installation n'est pas correcte et complète jusqu'à ce que le fonctionnement de l'appareil converti est vérifiée comme spécifié dans le manuel d'instruction fourni avec le kit.



Figure 27. Natural Gas Sticker



Figure 28. Propane Gas Sticker




		20 Industrial Way Rochester, NH 03867	
This boiler has been converted to use:		<input type="checkbox"/> Natural Gas <input type="checkbox"/> Propane	
Converted by: _____			
Date: _____			
H2200500D			

Figure 29. Gas Conversion Sticker

SECTION 12.

Trouble Shooting

12.1 Sequence of Operation

Mascot LX 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 (flow switch for DHW).

1. Upon a call for heat: (a) the internal pump and system pump will start; (b) the blower will begin a short 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 45% rate ignition will occur. The unit will remain in the reduced rate start-up period for ten (10) 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 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).

12.2 Short Cycling

Because Mascot LX 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 or piping layout. When in DHW mode under low load conditions, the boiler will normally cycle more often, but should not cycle frequently during call for central heating.

12.3 Error Codes - See *Table 18*.

LOCKOUT CODES

CODE	DESCRIPTION
E001	Memory error lockout
E002	Fan speed error
E003	Flame present when not in run
E004	Outlet auto-reset hi limit
E005	Water pressure switch error
E006	Safety Switch - TBD
E007	Optional low-water cutoff error
E008	Field Interlock error
E009	Blocked vent switch (175C, 175H only at this time)
E010	Blocked vent / fan proving switch error
E011	Lockout due to 3 consecutive flame losses during run
E012	Lockout due to 3 consecutive failed ignitions
E013	Flue high temperature
E014	Outlet high temperature (manual reset hi limit)
E015	Flue sensor drift too high
E016	Outlet sensor drift too high
E017	Flue sensor error
E018	Outlet sensor error
E019	Inlet sensor error

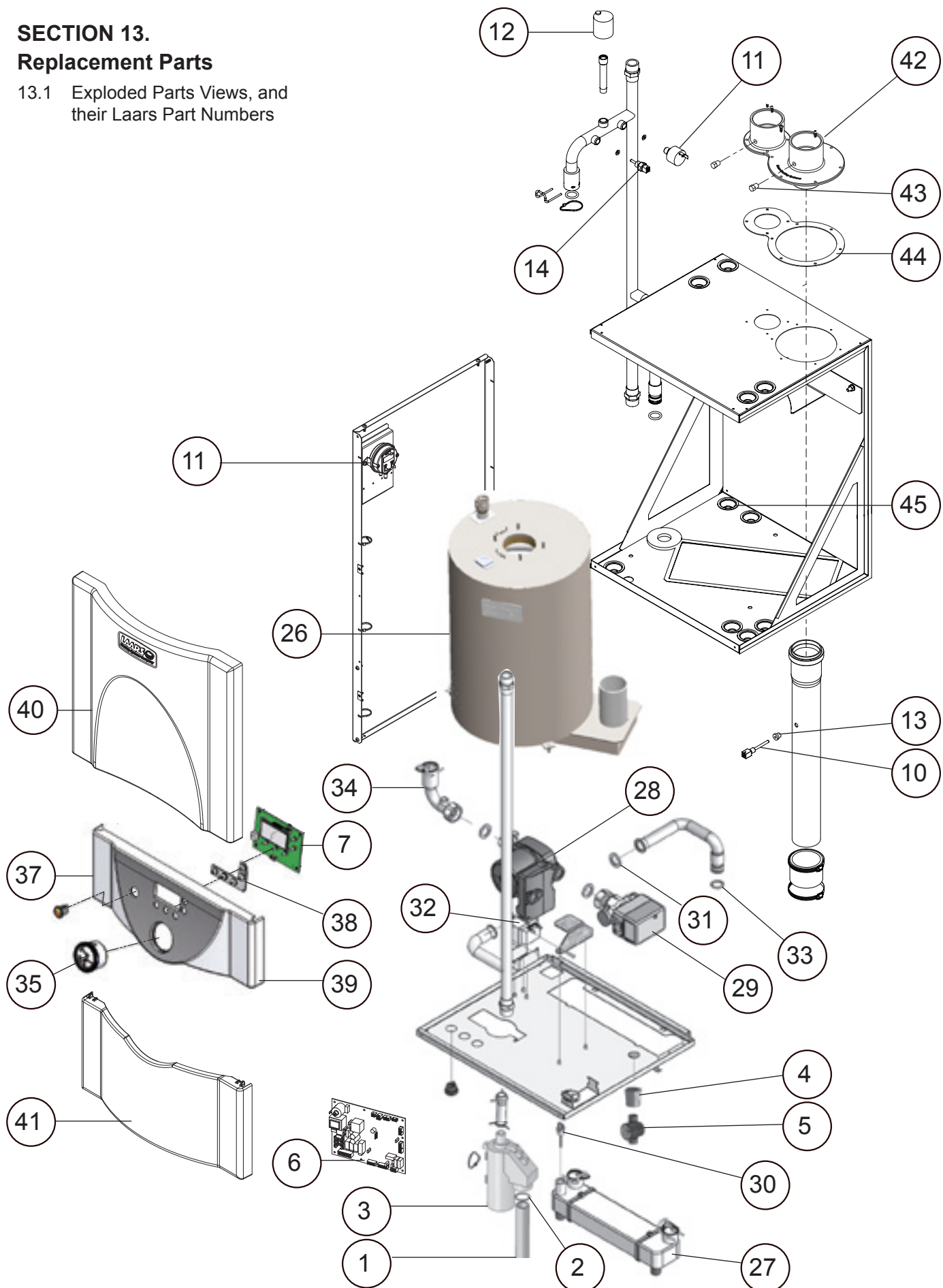
NOTIFICATION CODES

CODE	DESCRIPTION
n01	Fan speed limited due to flue gradient not detected
n02	Fan speed limited due to outlet temperature
n03	Fan speed limited due to delta T (Outlet - Inlet)
n04	Fan speed limited due to flue temperature
n05	DHW sensor not present in combi boiler. HW call will be blocked
n06	Outdoor sensor not preset
b01	General (e.g. if setpoint not reach or other not specified)
b02	Anticycling
b03	Outlet temperature too high
b04	Delta T (Outlet-Inlet) temperature too high
b05	Flue temperature too high
b06	Line voltage too low

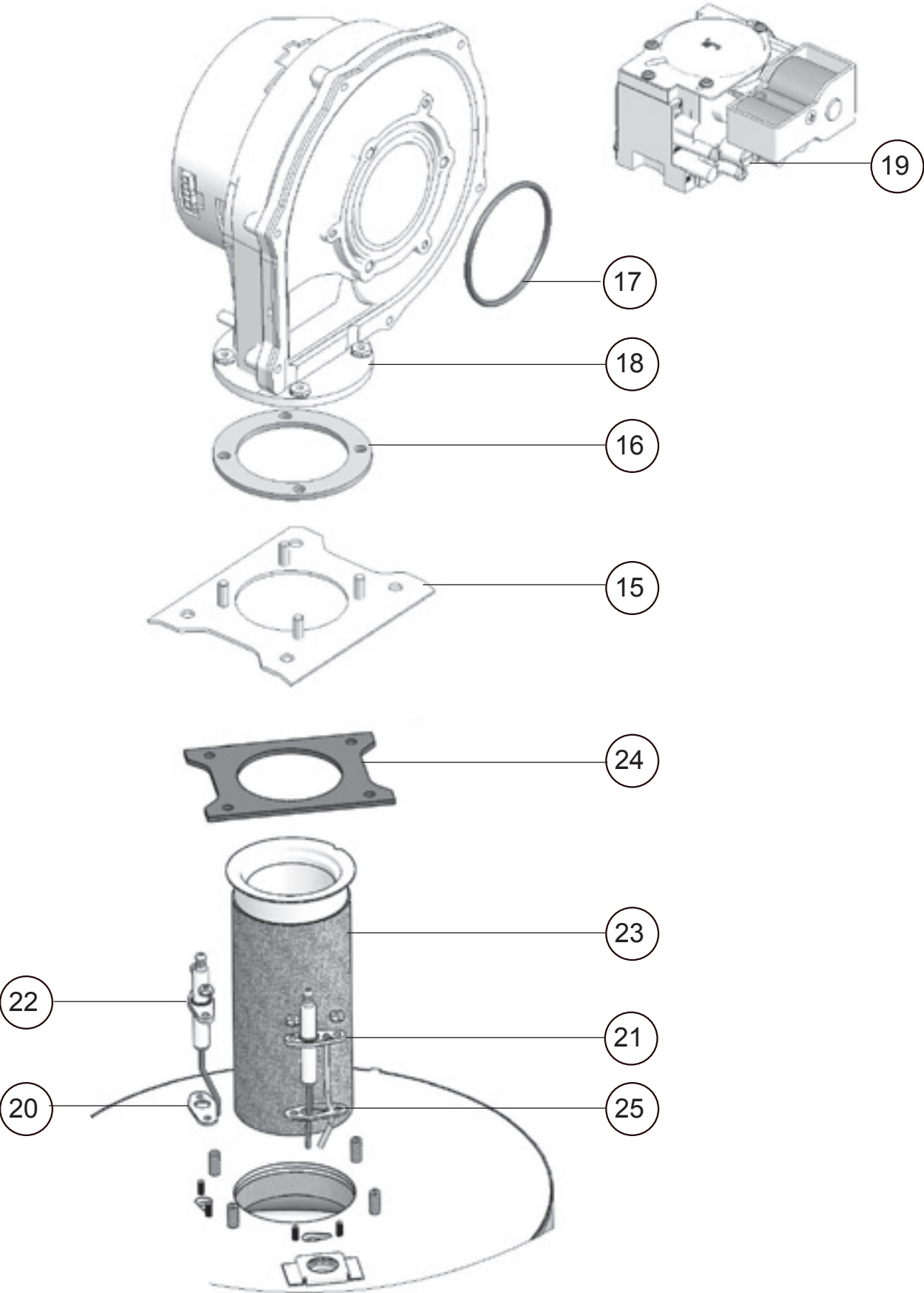
Table 18. Error Codes

SECTION 13. Replacement Parts

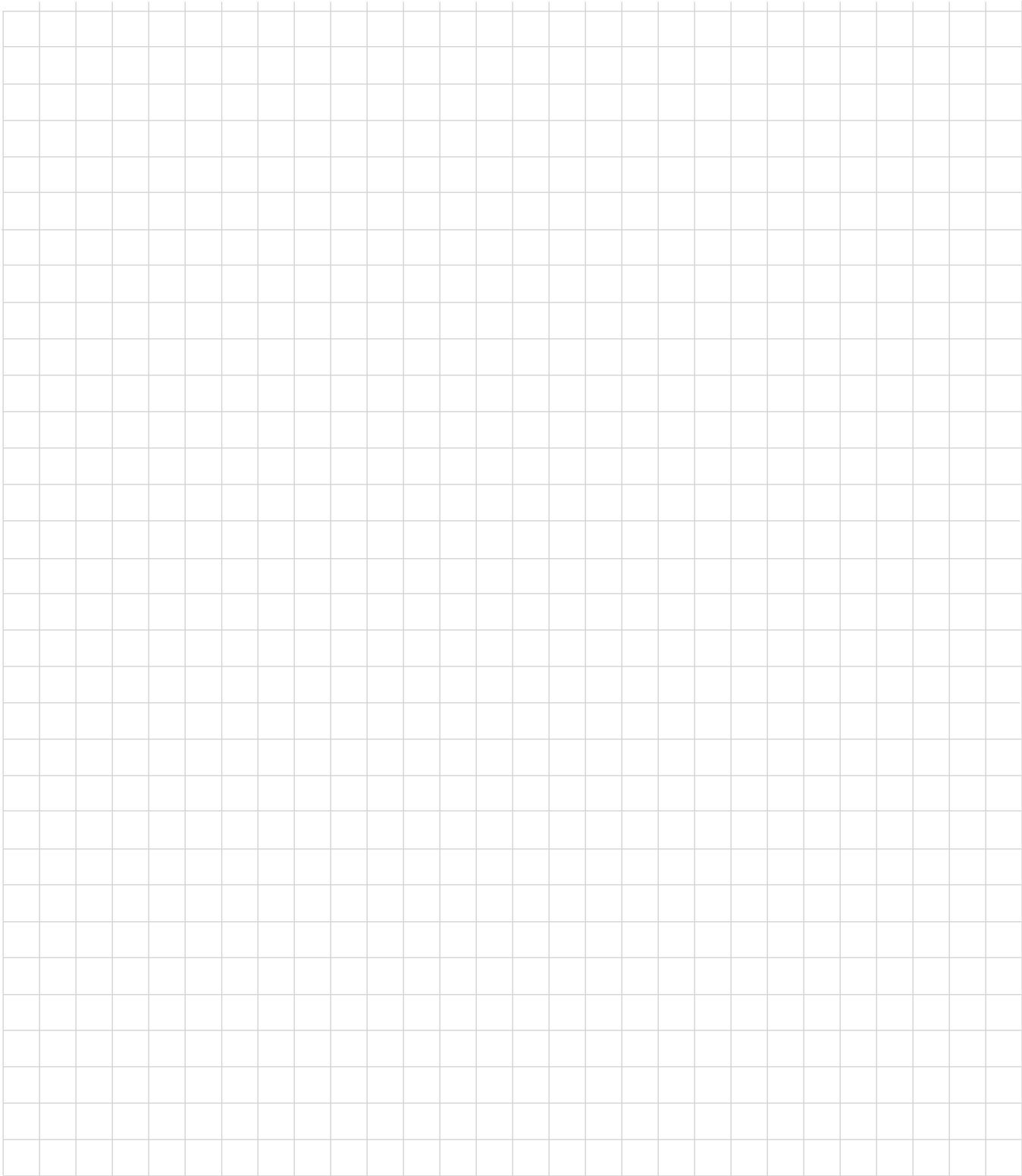
13.1 Exploded Parts Views, and their Laars Part Numbers



	Laars PN	Description	50	75	100	125	150	175	220
1	P2067603	PIPE, PVC, 3/4" SCH 40 X 6" LONG	x	x	x	x			
2	S2116300	O-RING, -120, 1" ID X 1-3/16" OD	x	x	x	x			
3	A2117500	TRAP, CONDENSATE	x	x	x	x			
3	TBD	TRAP, CONDENSATE - LARGE					x	x	x
4	P2093100	COUPLING, PIPE, SS, 1/2" NPT				x	x	x	
5	E2359000	FLOW SENSOR - DHW				x	x	x	
6	Call Factory	CONTROL BOARD - w/Firmware	Call Factory						
7	E2356800	DISPLAY UNIT	x	x	x	x	x	x	x
8	E2335100	CIRCUIT BREAKER, 2A	x	x	x	x	x	x	x
9	E2318900	CIRCUIT BREAKER, 10 AMP	x	x	x	x	x	x	x
10	E2357200	SENSOR, DUPLEX, FLUE	x	x	x	x	x	x	x
11	P2074600	SWITCH, LOW PRESSURE	x	x	x	x	x	x	x
12	P2074500	VENT, AIR, AUTO	x	x	x	x	x	x	x
13	E2357300	GROMMET, SENSOR, FLUE	x	x	x	x	x	x	x
14	E2357500	SENSOR, OUTLET	x	x	x	x	x	x	x
26	05P2100	HEAT EXCHANGER 50	x						
26	07P2100	HEAT EXCHANGER 75		x					
26	10P2100	HEAT EXCHANGER 100			x				
26	12P2100	HEAT EXCHANGER 125				x			
26	15P2100	HEAT EXCHANGER 150					x		
26	17P2100	HEAT EXCHANGER 175						x	
26	22P2100	HEAT EXCHANGER 220							x
27	S2123800	HEAT EXCHANGER PLATE 125/150				x	x		
27	S2125400	HEAT EXCHANGER PLATE 175						x	
28	A2117700	PUMP 50-125	x	x	x	x			
28	Call Factory	PUMP 150					x		
28	A2122600	PUMP 175-220						x	x
29	A2122004	3-WAY VALVE, ACTUATOR				x	x	x	
30	RE2337501	SENSOR, TEMPERATURE, DHW				x	x	x	
31	F2027600	WASHER, SEALING, 1.19 OD X .79 ID				x	x	x	
32	R0021300	TRANSFORMER, 40VA, 115V/24V	x	x	x	x	x	x	x
33	S2115100	O RING, 20.04 mm I.D. X 27.10 mm O.D.				x	x	x	
34	E2357000	SENSOR, TEMPERATURE, INLET	x	x	x	x	x	x	x
35	A2117600	GAUGE, PRESS/TEMP	x	x	x	x	x	x	x
37	E2335000	SWITCH, ROCKER, 120V, AMBER	x	x	x	x	x	x	x
38	E2357700	COVER, DISPLAY, PUSH BUTTON	x	x	x	x	x	x	x
39	12P7015	PANEL, MIDDLE	x	x	x	x	x	x	x
40	12P3006	PANEL, TOP LAARS W/TREELOK	x	x	x	x	x	x	x
41	12P3004	PANEL, BOTTOM SHORT	x	x	x	x			
41	12P3005	PANEL, BOTTOM LONG					x	x	x
42	12H5500	ADAPTER, VENT, CPVC	x	x	x	x	x	x	x
43	500-168	PLUG, HEX, 1/8" NPT	x	x	x	x	x	x	x
44	12H5501	GASKET, VENT ADAPTER, M2 125	x	x	x	x	x	x	x
45	S2114000	GROMMET	x	x	x	x	x	x	x



	Laars PN	Description	50	75	100	125	150	175	220
15	12P2033	BLOWER MOUNTING PLATE	X	X	X	X	X	X	X
16	S2105400	GASKET, BLOWER OUTLET	X	X	X	X	X	X	X
17	S2124500	ORING, BLOWER INLET	X	X	X	X	X	X	X
18	RA2112400	BLOWER, COMBUSTION	X	X					
18	A2122500	BLOWER, COMBUSTION 100-125			X	X			
18	RA2114200	BLOWER, COMBUSTION 150-220					X	X	X
19	V2022700	VALVE, GAS, LHX	X	X	X	X	X	X	X
20	RW2013400	GASKET, FLAME SENSOR	X	X	X	X	X	X	X
21	W2014200	IGNITOR, SPARK	X	X	X	X	X	X	X
22	W2014300	SENSOR, FLAME	X	X	X	X	X	X	X
23	RL2018401	BURNER 50-75	X	X					
23	RL2018402	BURNER 100			X				
23	RL2018403	BURNER 125-175				X	X	X	
23	RL2018404	BURNER 220							X
24	12P2032	BLOWER MOUNT PLATE GASKET	X	X	X	X	X	X	X
25	RW2013300	GASKET, IGNITOR	X	X	X	X	X	X	X



Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.



H2364000-