

INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

ALPINE™ CONDENSING HIGH EFFICIENCY DIRECT VENT GAS - FIRED HOT WATER BOILER



As an ENERGY STAR® Partner, Burnham by U.S. Boiler Company has determined that the Alpine™ Series meets the ENERGY STAR® guidelines for energy efficiency established by the United States Environmental Protection Agency (EPA).

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. For assistance or additional information, consult a qualified installer, service agency or the gas supplier. This boiler requires a special venting system. Read these instructions carefully before installing.

IMPORTANT INFORMATION - READ CAREFULLY

NOTE: The equipment shall be installed in accordance with those installation regulations enforced in the area where the installation is to be made. These regulations shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or local regulations. All wiring on boilers installed in Canada shall be made in accordance with the Canadian Electrical Code and/or local regulations.

The City of New York requires a Licensed Master Plumber supervise the installation of this product.

The Massachusetts Board of Plumbers and Gas Fitters has approved the Alpine™ Series boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, http://license.reg.state.ma.us/pubLic/pl_products/pb_pre_form.asp for the latest Approval Code or ask your local Sales Representative.

The Commonwealth of Massachusetts requires this product to be installed by a Licensed Plumber or Gas Fitter.

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

DANGER

DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

If you smell gas vapors, **DO NOT** try to operate any appliance - **DO NOT** touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a remotely located phone. Follow the gas supplier's instructions or if the supplier is unavailable, contact the fire department.

Special Installation Requirements for Massachusetts

- A. For all sidewall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes and where the sidewall exhaust vent termination is less than seven (7) feet above grade, the following requirements shall be satisfied:
1. If there is no carbon monoxide detector with an alarm already installed in compliance with the most current edition of NFPA 720, NFPA 70 and the Massachusetts State Building Code in the residential unit served by the sidewall horizontally vented gas fueled equipment, a battery operated carbon monoxide detector with an alarm shall be installed in compliance with the most current edition of NFPA 720, NFPA 70 and the Massachusetts State Building Code.
 2. In addition to the above requirements, if there is not one already present, a carbon monoxide detector with an alarm and a battery back-up shall be installed and located in accordance with the installation requirements supplied with the detector on the floor level where the gas equipment is installed. The carbon monoxide detector with an alarm shall comply with 527 CMR, ANSI/UL 2034 Standards or CSA 6.19 and the most current edition of NFPA 720. In the event that the requirements of this subdivision can not be met at the time of the completion of the installation of the equipment, the installer shall have a period of thirty (30) days to comply with this requirement; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed in compliance with the most current edition of NFPA 720, NFPA 70 and the Massachusetts State Building Code. In the event that the sidewall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the carbon monoxide detector may be installed on the next adjacent habitable floor level. Such detector may be a battery operated carbon monoxide detector with an alarm and shall be installed in compliance with the most current edition of NFPA 720, NFPA 70 and the Massachusetts State Building Code.
 3. 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 the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **“GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS”**.
 4. A final inspection by the state or local gas inspector of the sidewall horizontally vented equipment shall not be performed until proof is provided that the state or local electrical inspector having jurisdiction has granted a permit for installation of carbon monoxide detectors and alarms as required above.
- B. EXEMPTIONS: The following equipment is exempt from 248 CMR 5.08(2)(a) 1 through 4:
1. The equipment listed in Chapter 10 entitled “Equipment Not Required To Be Vented” in the most current edition of NFPA 54 as adopted by the Board; and
 2. Product Approved sidewall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
- C. When the manufacturer of Product Approved sidewall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions for installation of the equipment and the venting system shall include:
1. A complete parts list for the venting system design or venting system; and
 2. Detailed instructions for the installation of the venting system design or the venting system components.
- D. When the manufacturer of a Product Approved sidewall horizontally vented gas fueled equipment does not provide the parts for venting flue gases, but identifies “special venting systems”, the following shall be satisfied:
1. The referenced “special venting system” instructions shall be included with the appliance or equipment installation instructions; and
 2. The “special venting systems” shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.
- E. A copy of all installation instructions for all Product Approved sidewall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

WARNING

This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Read and understand the entire manual before attempting installation, start-up operation, or service. Installation and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency

This boiler must be properly vented.

This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

The interior of the venting system must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed venting system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

Installation is not complete unless a pressure relief valve is installed into the tapping located on left side of appliance. - See the Water Piping and Trim Section of this manual for details.

This boiler is supplied with safety devices which may cause the boiler to shut down and not re-start without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.

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

Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.

All cover plates, enclosures and guards must be in place at all times.

NOTICE

This boiler has a limited warranty, a copy of which is printed on the back of this manual. It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete.

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I. Product Description, Specifications and Dimensional Data

Alpine™ Series boilers are condensing high efficiency gas-fired direct vent hot water boilers designed for use in forced hot water space or space heating with indirect domestic hot water heating systems, where supply water temperature does not exceed 210°F. These boilers have special coil type stainless steel heat exchangers, constructed, tested and stamped per Section IV ‘Heating Boilers’ of

ASME Boiler and Pressure Vessel Code, which provide a maximum heat transfer and simultaneous protection against flue gas product corrosion. These boilers are not designed for use in gravity hot water space heating systems or systems containing significant amount of dissolved oxygen (swimming pool water heating, direct domestic hot water heating, etc.).

Table 1: Dimensional Data (See Figures 1A, 1B, 1C & 1D)

Dimension	Boiler Model						
	ALP080 ⁽¹⁾	ALP105 ⁽¹⁾	ALP150 ⁽¹⁾	ALP210 ⁽¹⁾	ALP285 ⁽²⁾	ALP399 ⁽²⁾	ALP500 ⁽²⁾
A - Inch (mm)	12-9/16 (320)	14 (356)	19-11/16 (500)	23-15/16 (608)	21-13/16 (554)	28-7/8 (734)	44-7/8 (1140)
B - Inch (mm)	5-5/8 (142)	5-13/16 (147)			7-5/16 (185)	6-3/16 (157)	22-1/8 (562)
C - Inch (mm)	7-5/16 (186)				14-1/8 (358)	13-1/16 (332)	29 (737)
D - Inch (mm)	9-5/16 (237)	10-3/4 (273)	16-7/16 (417)	17-1/8 (435)	18 (456)	23-3/4 (602)	39-11/16 (1008)
E - Inch (mm)	5-15/16 (151)				12-1/4 (312)	15-13/16 (402)	29-3/8 (752)
Gas Inlet F (FPT)	1/2"				3/4"	3/4"	3/4"
Return G (FPT)	1"				1-1/4"	1-1/2"	
Supply H (FPT)	1"				1-1/4"	1-1/2"	
Condensate Drain J *	* Factory Provided Socket End Compression Pipe Joining Clamp for 3/4" Schedule 40 PVC Pipe						
Boiler Two-Pipe CPVC/PVC Vent Connector (Figs. 1A, 1C, 1D) - Inch	3 x 3		3 x 4		4 x 4		
Boiler CPVC Vent Connector/Pipe (Fig. 1B) - Inch	3"				N/A	N/A	N/A
Boiler Inlet Air Connector (Fig. 1B) - Inch	3"	3"	4"	4"	N/A	N/A	N/A
Approx. Shipping Weight (LBS)	137	155	182	206	256	304	350

NOTES:

⁽¹⁾ - These boiler models available as either Floor mounted (suffix F) or, Wall mounted (suffix W).

⁽²⁾ - These boiler models available as Floor mounted (suffix F) only.

I. Product Description, Specifications and Dimensional Data (continued)

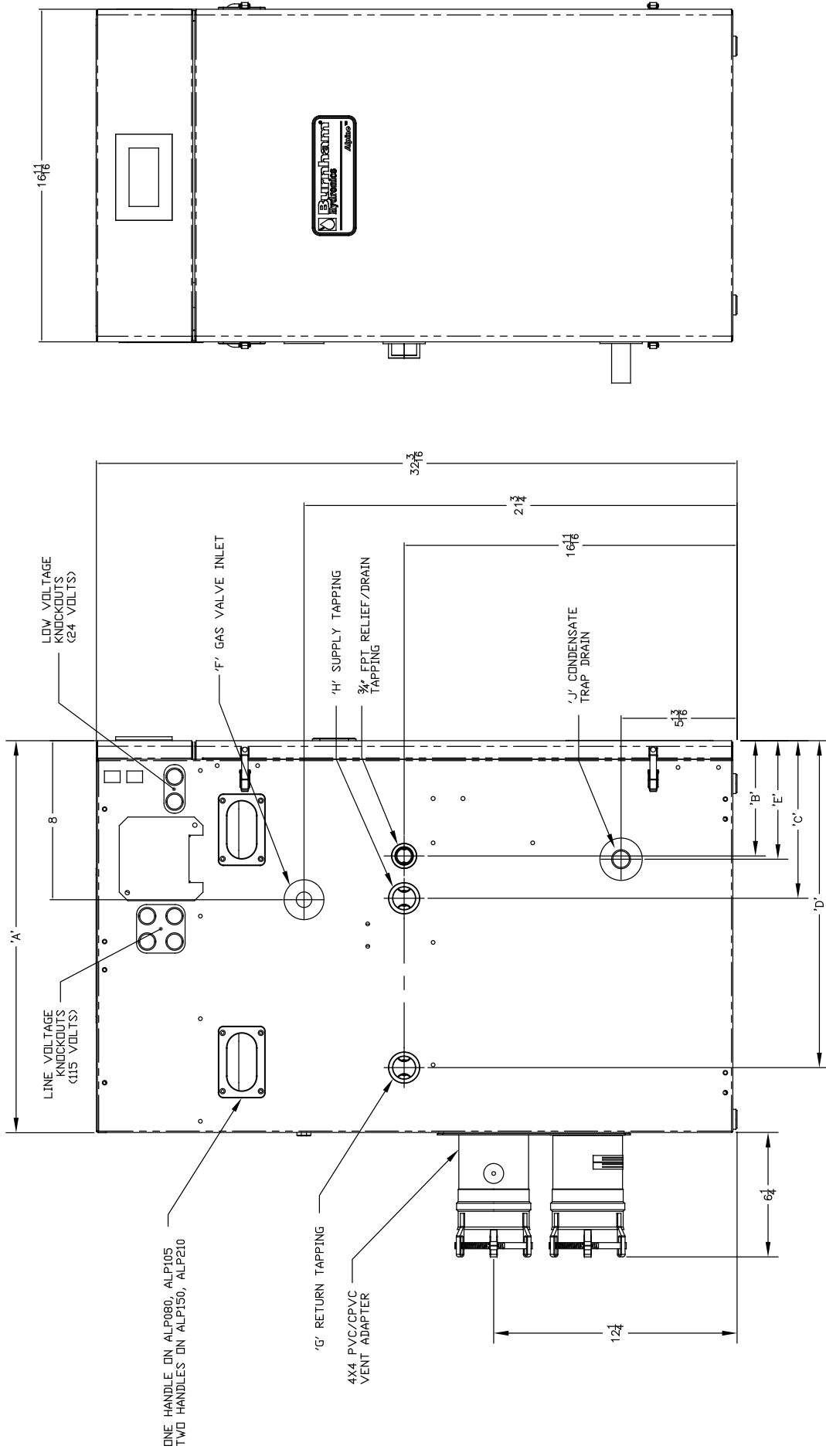


Figure 1A: Alpine™ - Models ALP080 thru ALP210 (Floor Mounted)

89 I. Product Description, Specifications and Dimensional Data (continued)

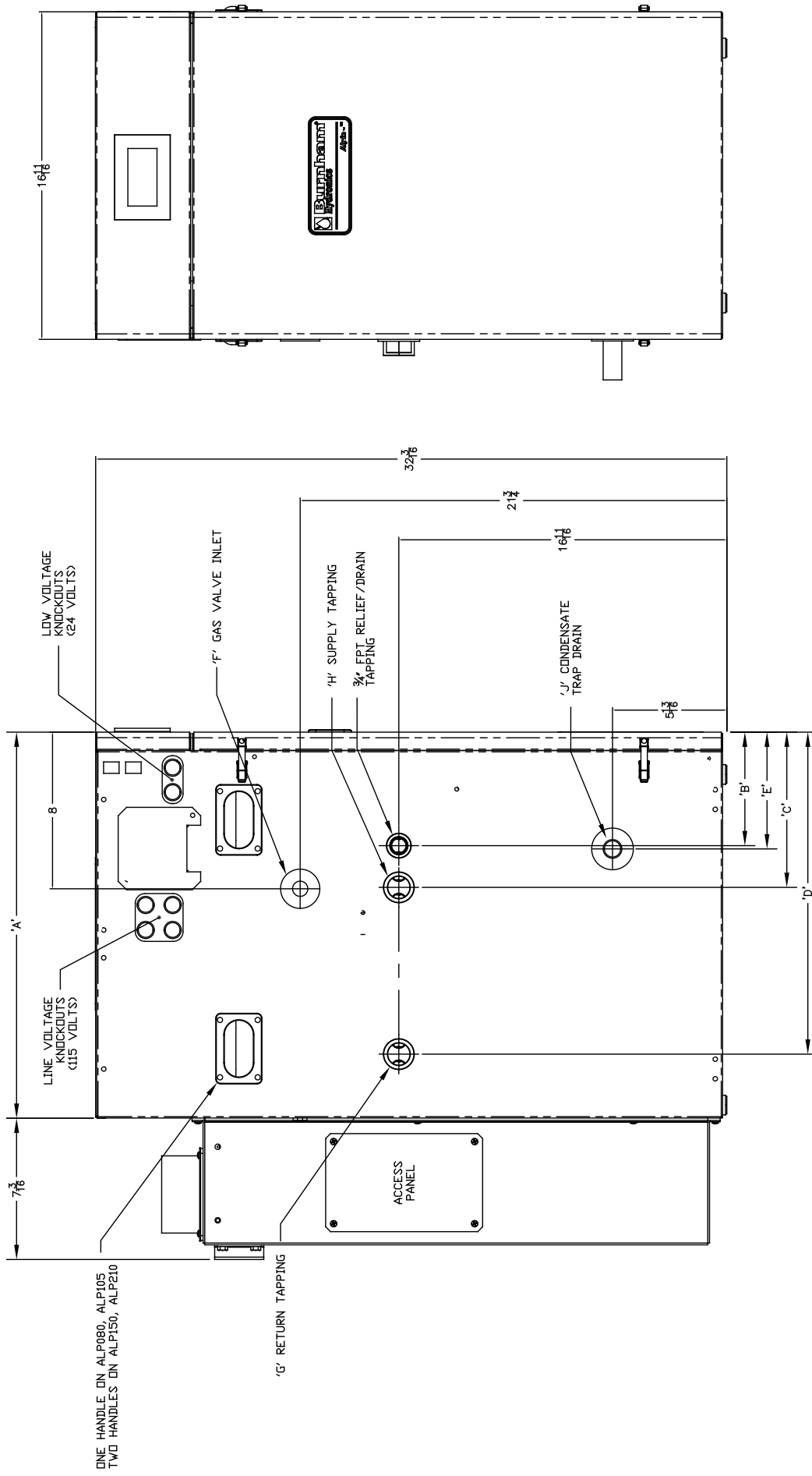


Figure 1B: Alpine™ - Models ALP080 thru ALP210 (Wall Mounted)

I. Product Description, Specifications and Dimensional Data (continued)

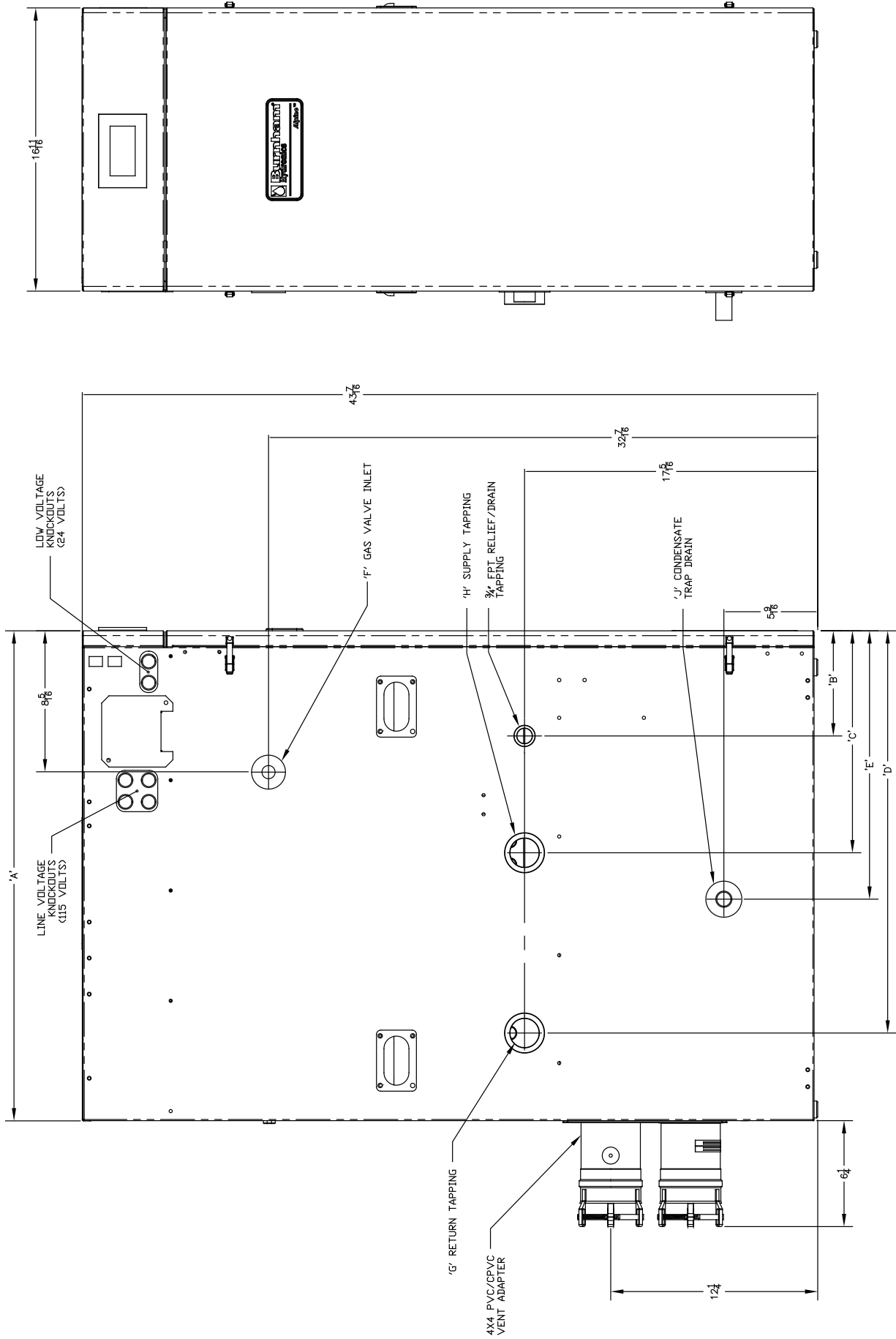


Figure 1C: Alpine™ - Models ALP285 thru ALP399 (Floor Mounted Only)

1 I. Product Description, Specifications and Dimensional Data (continued)

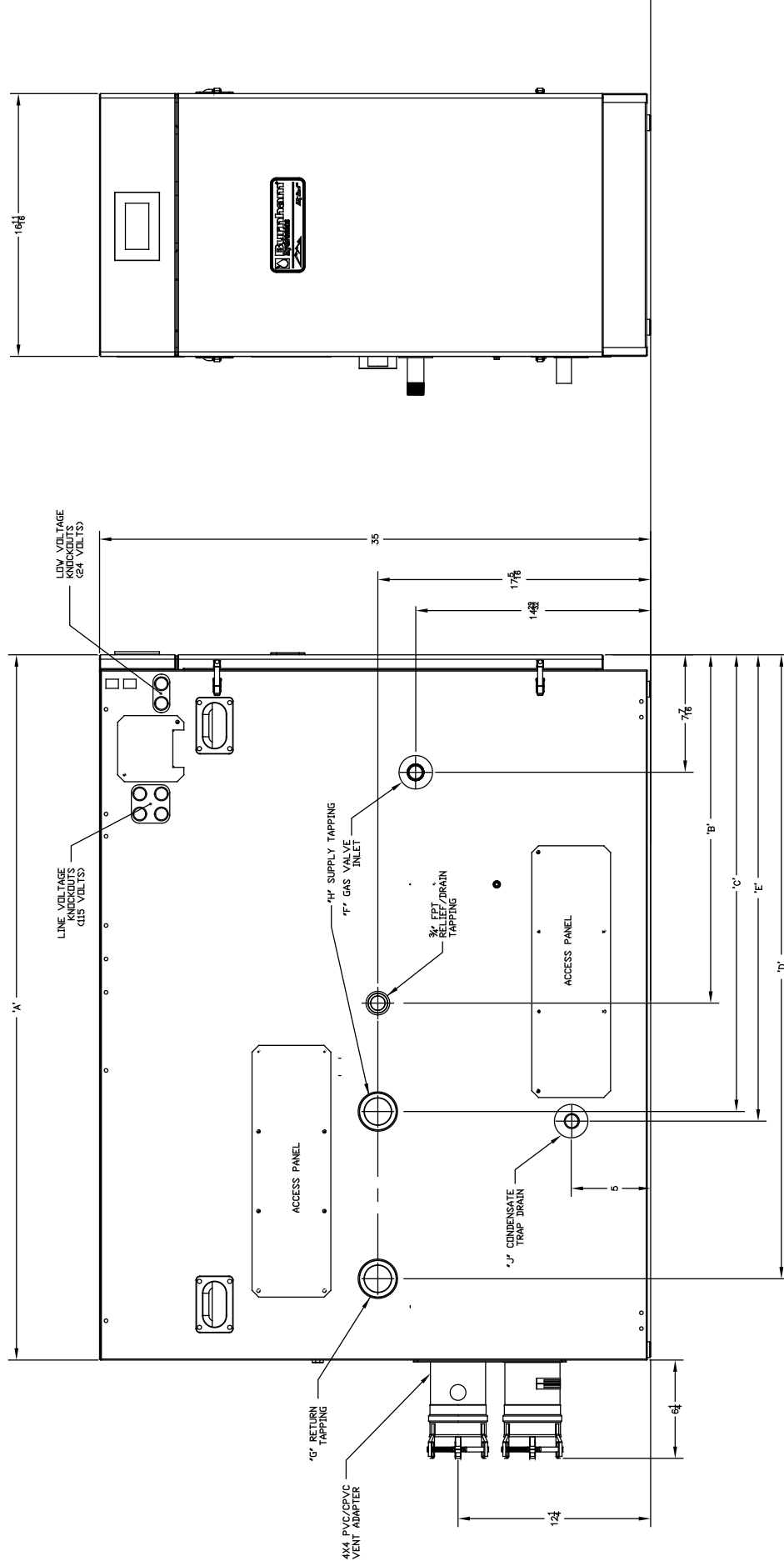


Figure 1D: Alpine™ - Model ALP500 (Floor Mounted Only)

I. Product Description, Specifications and Dimensional Data (continued)

Table 2A: Rating Data - Models ALP080 thru ALP500 (0 to 2000 Feet Elevation Above Sea Level)

* Model Number		Input (MBH)		** Output (MBH)	Net I=B=R Ratings Water (MBH)	AFUE %	Thermal Efficiency (%)	Combustion Efficiency (%)	Boiler Water Volume (Gal.)	Heat Transfer Area (Sq. Ft.)
		Min.	Max.							
ALP080		16	80	73	63	95			0.6	7.3
ALP105		21	105	96	83	95			0.7	9.1
ALP150		30	150	138	120	95			1.3	16.4
ALP210		42	210	194	169	95			1.7	21.8
ALP285		57	285	265	230	95			2.4	29.1
ALP399		80	399	377	328		94	95	3.4	41.8
ALP500		100	500	475	413		95	95	4.2	50.8

* Add Suffix "F" for Floor mounted Models or Suffix "W" for Wall mounted Models.

Notes: ** DOE Heating Capacity (ALP080 thru ALP285); Gross Output (ALP399 thru ALP500)
 Maximum Working Pressure, Water - 30 PSI Shipped from Factory (std.); 50 PSI, 80 PSI and 100 PSI - Optional (ALP080 thru ALP285)
 Maximum Working Pressure, Water - 50 PSI Shipped from Factory (std.); 80 PSI and 100 PSI - Optional (ALP399 thru ALP500)
 Maximum Allowable Temperature, Water - 210°F, Maximum Firing Rate Target Setpoint is 190°F, Automatic Reset High Limit Setpoint is 200°F and Manual Reset High Limit Setpoint is 210°F.
 Boilers are factory shipped as Natural Gas builds and have to be field adjusted for LP gas application. Refer to 'System Start-Up Section of this manual for detailed procedure.
 Ratings shown are for installations at sea level and elevations up to 2000 Feet. For elevations above 2000 Feet, ratings should be reduced at the rate of four percent (4%) for each 1000 Feet above sea level.

Table 2B: Rating Data - Models ALP080 thru ALP500 (2001 to 7000 Feet Elevation Above Sea Level)

Model Number *		Input (MBH)		** Output (MBH)	Net I=B=R Ratings Water (MBH)	AFUE %	Thermal Efficiency (%)	Combustion Efficiency (%)	Boiler Water Volume (Gal.)	Heat Transfer Area (Sq. Ft.)
		Min.	Max.							
ALP080		27	80	73	63	95			0.6	7.3
ALP105		35	105	96	83	95			0.7	9.1
ALP150		50	150	138	120	95			1.3	16.4
ALP210		70	210	194	169	95			1.7	21.8
ALP285		57	285	265	230	95			2.4	29.1
ALP399		80	399	377	328		94	95	3.4	41.8
ALP500		100	500	475	413		95	95	4.2	50.8

* Add Suffix "F" for Floor mounted Models or Suffix "W" for Wall mounted Models.

Notes: ** DOE Heating Capacity (ALP080 thru ALP285); Gross Output (ALP399 thru ALP500)
 Maximum Working Pressure, Water - 30 PSI Shipped from Factory (std.); 50 PSI, 80 PSI and 100 PSI - Optional
 Maximum Working Pressure, Water - 50 PSI Shipped from Factory (std.); 80 PSI and 100 PSI - Optional (ALP399 thru ALP500)
 Maximum Allowable Temperature, Water - 210°F, Maximum Firing Rate Target Setpoint is 190°F, Automatic Reset High Limit Setpoint is 200°F and Manual Reset High Limit Setpoint is 210°F.
 Boilers are factory shipped as Natural Gas builds and have to be field adjusted for LP gas application. Refer to 'System Start-Up" Section of this manual for detailed procedure.
 For elevations above 2000 Feet, ratings should be reduced at the rate of four percent (4%) for each 1000 Feet above sea level.

I. Product Description, Specifications and Dimensional Data (continued)

Table 2C: Rating Data - Models ALP150 thru ALP285 (7001 to 10,000 Feet Elevation Above Sea Level)

Model Number *		Input (MBH)		** Output (MBH)	Net I=B=R Ratings Water (MBH)	AFUE %	Thermal Efficiency (%)	Combustion Efficiency (%)	Boiler Water Volume (Gal.)	Heat Transfer Area (Sq. Ft.)
		Min.	Max.							
ALP150		38	113	104	90	95			1.3	16.4
ALP210		53	158	145	126	95			1.7	21.8
ALP285		68	204	188	163	95			2.4	29.1

* Add Suffix "F" for Floor mounted Models or Suffix "W" for Wall mounted Models.

Notes: ** DOE Heating Capacity (ALP150 thru ALP285)
 Maximum Working Pressure, Water - 30 PSI Shipped from Factory (std.); 50 PSI - Optional
 Maximum Allowable Temperature, Water - 210°F
 Boilers are factory shipped as Natural Gas builds **only**.
 Input has been de rated for noted elevation above sea level.

II. Pre-Installation & Boiler Mounting

WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage or personal injury.

NOTICE

Due to the low water content of the boiler, mis-sizing of the boiler with regard to the heating system load will result in excessive boiler cycling and accelerated component failure. U.S. Boiler DOES NOT warrant failures caused by mis-sized boiler applications. DO NOT oversize the boiler to the system. Modular boiler installations greatly reduce the likelihood of boiler oversizing.

- A. **Installation must conform** to the requirements of the authority having jurisdiction. In the absence of such requirements, installation must conform to the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, and/or CAN/CSA B149.1 Installation Codes.
- B. **Appliance is design certified** for installation on combustible flooring. Do not install boiler on carpeting.
- C. **Provide clearance** between boiler jacket and combustible material in accordance with local fire ordinance. Refer to Figures 2A and 2B for minimum listed clearances from combustible material. Recommended service clearance is 24 inches from left side, front, top and rear of the boiler. Recommended front clearance may be reduced to the combustible material clearance providing:
1. Access to boiler front is provided through a door or removable front access panel.
 2. Access is provided to the condensate trap located underneath the heat exchanger.
- D. **Protect gas ignition system components** from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.).
- E. **Provide combustion and ventilation air** in accordance with applicable provisions of local building codes, or: USA - *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, Air for Combustion and Ventilation; Canada - *Natural Gas and Propane Installation Code*, CAN/CSA-B149.1, Venting Systems and Air Supply for Appliances.

WARNING

Adequate combustion and ventilation air must be provided to assure proper combustion.

- F. **The boiler should be located** so as to minimize the length of the vent system. The PVC combustion air piping, or the optional concentric vent piping, containing integral combustion air inlet piping, must terminate where outdoor air is available for combustion and away from areas that may contaminate combustion air. In particular, avoid areas near chemical products containing chlorines, chlorofluorocarbons, paint removers, cleaning solvents and detergents. Avoid areas containing saw dust, loose insulation fibers, dry wall dust etc.

CAUTION

Avoid operating this boiler in an environment where saw dust, loose insulation fibers, dry wall dust, etc. are present. If boiler is operated under these conditions, the burner interior and ports must be cleaned and inspected daily to insure proper operation.

G. General.

1. Alpine boilers are intended for installations in an area with a floor drain, or, in a suitable drain pan to prevent any leaks or relief valve discharge to cause property damage
2. Alpine boilers are not intended to support external piping and venting. All external piping and venting must be supported independently of the boiler.
3. Alpine boilers must be installed level to prevent condensate from backing up inside the boiler.
4. Alpine boilers can be installed either as floor standing (ALP080 thru ALP500), or, as wall hung (ALP080 thru ALP210). Factory assembled floor standing models are identified with suffix F in a boiler model code (example – ALP210F-1L02). Factory assembled wall hung models are identified with suffix W in a boiler model code (example – ALP210W-1L02).
5. Boiler Floor Standing Installation:
 - a. For basement installation provide a solid base such as concrete, where floor is not level, or, water may be encountered on the floor around boiler. Floor must be able to support weight of boiler, water and all additional system components.
 - b. Boiler must be level to prevent condensate from backing up inside the boiler.
 - c. Insure there is adequate space for condensate piping or a condensate pump if required.

II. Pre-Installation & Boiler Mounting (continued)

6. Boiler Wall Hung Installation:

- a. If the boiler is installed on a framed wall, minimum acceptable framing is 2 x 4 studs on 16" centers. The boiler mounting holes are on 16" centers for installation between two studs at the standard spacing. In cases where the boiler cannot be centered between the studs, or where the studs are spaced closer than 16" apart, the boiler may be anchored to 3/4" plywood or horizontal 2 x 4's anchored to the studs.

CAUTION

Alpine boiler approximate dry weights:

**ALP080W – 98 lbs; ALP105W – 112 lbs;
ALP150W – 136 lbs; ALP210W – 150 lbs**

Two people are required to safely lift these boilers onto the installed wall mounting bracket.

Make sure that wall mounting bracket is anchored to a structure capable of supporting the weight of the boiler and attached piping when filled with water. Jurisdictions in areas subject to earthquakes may have special requirements for supporting these boilers. Such local requirements take precedence over the requirements shown below.

- b. Locate Wall Mounting Bracket Kit carton (p/n 102988-01) enclosed inside boiler carton. The kit contains Wall Mounting Bracket, Bottom Securing Bracket, (4) 5/16" x 2" long hex head lag screws, (4) 5/16" flat plated washers and (2) #8 x 1/2" Phillips round head sheet metal screws.
- c. 5/16" x 2" lag screws and 5/16" plated washers are intended for mounting the boiler directly onto studs covered with 1/2" sheet rock. When the boiler is attached to other types of construction, such as masonry, use fasteners capable of supporting the weight of the boiler and attached piping in accordance with good construction practice and applicable local codes.
- d. Make sure that the surface to which the boiler is mounted is plumb.
- e. Before mounting the boiler, make sure that wall selected does not have any framing or other construction that will interfere with the vent pipe penetration.
- f. Once a suitable location has been selected for the boiler, and any needed modifications have been made to the wall, use Figure 2C to locate and layout holes "A" and "B". These holes must be positioned on mounting stud centers, if the boiler is installed on a framed wall. Make sure that

the horizontal centerline of these holes is level. Holes "C" and "D" may also be drilled at this time, or after the boiler is hung on the wall. If the 5/16 x 2" lag screws are used, drill 3/16" pilot holes.

- g. An alternate way to locate/mark holes "A" and "B" is to use template P/N 102986-01 enclosed into Vent Part Carton [P/N 102981-01 (ALP080W/105W) or, P/N 102981-02 (ALP150W/210W)], which can be found inside boiler carton.

CAUTION

The outer edges of the template represent minimum side, top and bottom clearances to combustible material. If the template needs to be cut to fit into a selected location, it would indicate the minimum clearances to combustible material are not met.

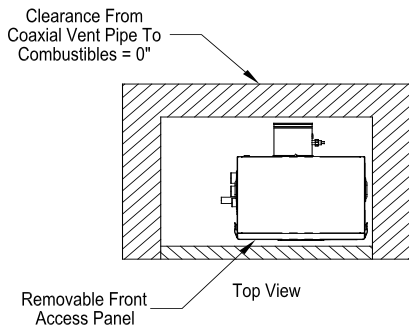
- h. Attach the wall hanging bracket using the 5/16" x 2" lag screws and 5/16" plated washers, or other suitable anchors as appropriate (Figure 2D). Make sure the bracket is level.
- i. Attach Bottom Securing Bracket to boiler air box with two #8 x 1/2" Phillips round head sheet metal screws. Refer to Figure 2D for details.
- j. Hang the boiler on the installed wall bracket as shown in Figure 2D.
- k. If not already done in Step (4) locate and drill holes "C" and "D" using the ob-round slots in the Bottom Securing Bracket. Secure the Bracket to the wall using the 5/16" x 2" lag screws and 5/16" plated washers, or other fasteners as appropriate (Figure 2D).
- l. Verify that the front of the boiler is plumb. If it is not, install shims (installer provided) at holes "C" and "D" between the Bottom Securing Bracket and the wall to adjust.

CAUTION

When positioning the template in the desired location on the wall insure that *the minimum clearances to combustible material at adjacent walls and ceiling are maintained. Consult Figures 2A thru 2C in this manual. Be sure to allow space at the boiler left side for gas and water connections, as well as for access to the condensate trap and boiler controls for servicing.*

- m. Remove Access Panel and Access Panel Gasket from zip lock plastic bag (placed inside 102981-01 or 102981-02 Vent Kit carton).

II. Pre-Installation & Boiler Mounting (continued)



CLEARANCES TO COMBUSTIBLE & NON-COMBUSTIBLE CONSTRUCTION:

THIS BOILER IS APPROVED FOR CLOSET INSTALLATION WITH THE FOLLOWING CLEARANCES: TOP = 1", FRONT = 1", LEFT SIDE = 10", RIGHT SIDE = 2", REAR = 6".

RECOMMENDED SERVICE CLEARANCES:

TOP = 24", FRONT = 24", LEFT SIDE = 24", BACK = 24"

THESE SERVICE CLEARANCES ARE RECOMMENDED, BUT MAY BE REDUCED TO THE COMBUSTIBLE CLEARANCES PROVIDED:

1. ACCESS TO THE FRONT OF THE BOILER IS PROVIDED THROUGH A DOOR.
2. ACCESS IS PROVIDED TO THE CONDENSATE TRAP LOCATED ON THE LEFT SIDE OF THE BOILER.

* NOTE: WHEN BOILER IS VENTED VERTICALLY, THE MINIMUM CLEARANCE FROM THE BACK OF THE JACKET IS INCREASED TO 15" WITH A SHORT RADIUS ELBOW AND 18" WITH A LONG RADIUS ELBOW.

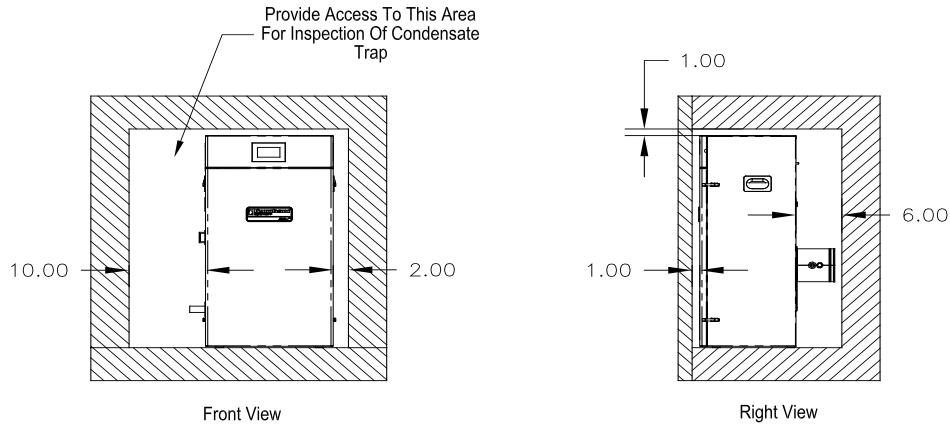
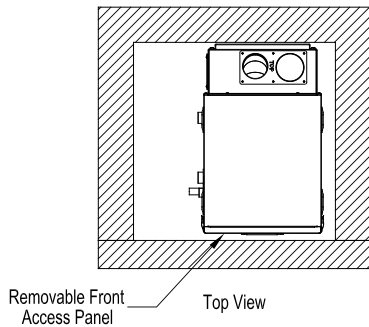


Figure 2A: Clearances To Combustible and Non-combustible Material, Floor Standing



CLEARANCES TO COMBUSTIBLE & NON-COMBUSTIBLE CONSTRUCTION:

THIS BOILER IS APPROVED FOR CLOSET INSTALLATION WITH THE FOLLOWING CLEARANCES: TOP = 1", FRONT = 1", LEFT SIDE = 10", RIGHT SIDE = 2", REAR = 1".

RECOMMENDED SERVICE CLEARANCES:

TOP = 24", FRONT = 24", LEFT SIDE = 24"

THESE SERVICE CLEARANCES ARE RECOMMENDED, BUT MAY BE REDUCED TO THE COMBUSTIBLE CLEARANCES PROVIDED:

1. ACCESS TO THE FRONT OF THE BOILER IS PROVIDED THROUGH A DOOR.
2. ACCESS IS PROVIDED TO THE CONDENSATE TRAP DRAIN CONNECTION LOCATED ON THE LEFT SIDE OF THE BOILER.

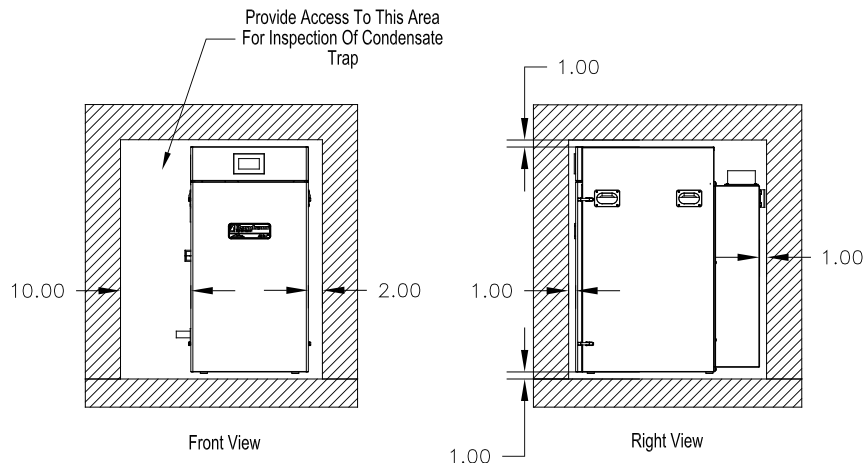
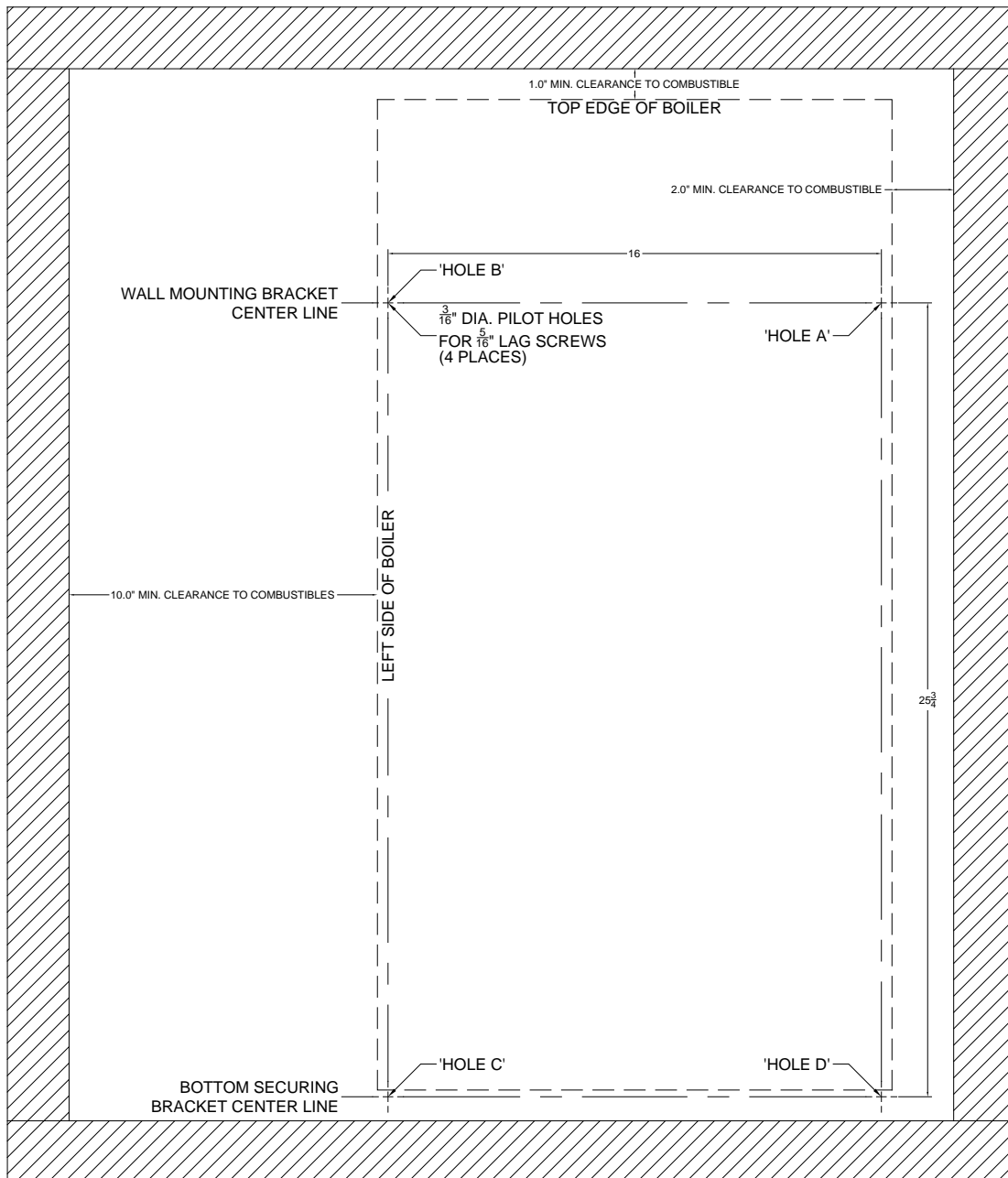


Figure 2B: Clearances To Combustible and Non-combustible Material, Wall Mounted

II. Pre-Installation & Boiler Mounting (continued)

- n. Place Access Panel Gasket adhesive side (protective paper) down onto Access Panel underside and align gasket edges flush with panel edges. Peel off protective paper from one end of the gasket to expose adhesive, then place the gasket onto the panel aligning gasket and panel side, top and bottom edges, and press the gasket lightly down. Continue peeling of protective paper and positioning the gasket in place while insuring edge alignment. Once the gasket is fully in place and edges are aligned, press the gasket firmly in position.
- o. Set the panel with gasket aside.
- p. See Section IV Venting; paragraph "Field Installation of CPVC Vent Pipe - Wall Mounted Boiler Builds" for instructions on attaching the vent system to the boiler.
- q. After the boiler has been piped, wired, connected to vent and combustion air system piping and combustion performance testing completed per Section XI "System Start-up", install Access Panel/Gasket assembly and secure with provided four #8 x 1/2" black oxide Phillips head sheet metal screws (located in coin envelope inside zip lock plastic bag). See Figure 2E "access Panel and Gasket Installation".



II. Pre-Installation & Boiler Mounting (continued)

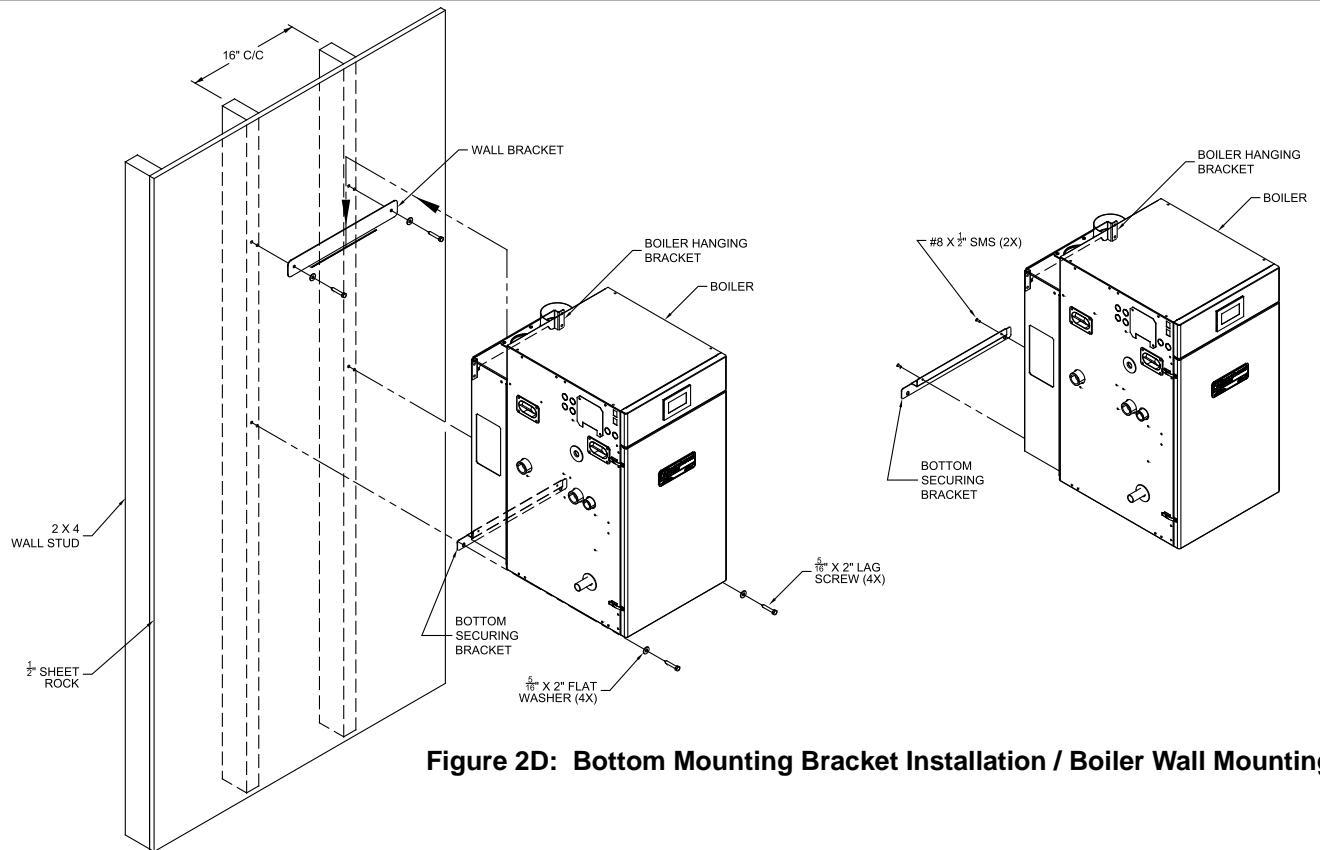


Figure 2D: Bottom Mounting Bracket Installation / Boiler Wall Mounting

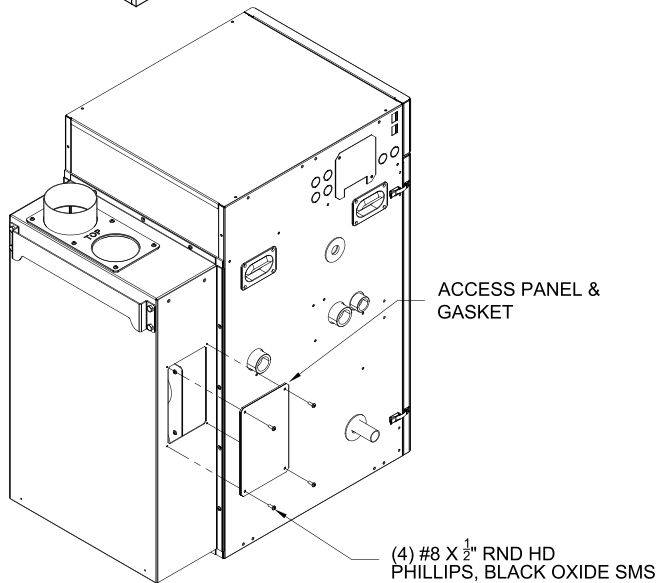


Figure 2E: Access Panel and Gasket Installation

III. Unpacking Boiler

CAUTION

Do not drop boiler.

- A. Move boiler to approximate installed position.
- B. Remove all crate fasteners.
- C. Lift and remove outside container.

- D. Remove boiler from cardboard positioning sleeve on shipping skid.

WARNING

Installation of this boiler should be undertaken only by trained and skilled personnel from a qualified service agency.

- E. Move boiler to its permanent location.

IV. Venting

WARNING

Failure to vent this boiler in accordance with these instructions could cause products of combustion to enter the building resulting in severe property damage, personal injury or death.

Do not interchange vent systems or materials unless otherwise specified.

The use of thermal insulation covering pipe and fittings is prohibited.

Do not use a barometric damper, draft hood or vent damper with this boiler.

When using the CPVC/PVC vent option, the use of CPVC is required when venting in vertical or horizontal chase ways.

The CPVC vent materials supplied with this boiler do not comply with B149.1.S1-07 and are not approved for use in Canadian jurisdictions that require vent systems be listed to ULC S636-2008. In these jurisdictions, vent this boiler using either stainless steel Special Gas vent or a listed ULC S636 Class IIB venting system.

Do not locate vent termination where exposed to prevailing winds. Moisture and ice may form on surface around vent termination. To prevent deterioration, surface must be in good repair (sealed, painted, etc.).

Do not locate air intake vent termination where chlorines, chlorofluorocarbons (CFC's), petroleum distillates, detergents, volatile vapors or other chemicals are present. Severe boiler corrosion and failure will result.

The use of cellular core PVC (ASTM F891) is prohibited.

Do not locate vent termination under a deck.

Do not reduce specified diameters of vent and combustion air piping.

When installing vent pipe through chimney, as a chase, no other appliance can be vented into the chimney.

Do not allow low spots in the vent where condensate may pool.

A. General Guidelines

1. Vent system installation must be in accordance with *National Fuel Gas Code*, NFPA 54/ANSI Z221.3 or applicable provisions of local building codes. Contact local building or fire officials about restrictions and installation inspection in your area.
2. The Alpine™ is designed to be installed as a Direct Vent (sealed combustion) boiler. The air for combustion is supplied directly to the burner enclosure from outdoors and flue gases are vented directly outdoors (through wall or roof).
3. The following combustion air/vent system options are approved for use with the Alpine™ boilers (refer to Table 3):
 - **Two-Pipe CPVC/PVC Vent/Combustion Air System** - separate CPVC/PVC pipe serves to expel products of combustion and separate PVC pipe delivers fresh outdoor combustion air. Refer to Part B for specific details.
 - **Two-Pipe Stainless Steel Vent/Combustion Air System** - separate stainless steel pipe serves to expel products of combustion. Separate PVC or galvanized pipe delivers fresh outdoor air. Refer to Part C for specific details.
- **Concentric Inner Polypropylene Vent and Outer Steel Combustion Air System** - the assembly consists of inner fire resistant polypropylene vent pipe and outer steel pipe casing. The inner pipe serves as conduit to expel products of combustion, while outdoor fresh combustion air is drawn through the space between the inner and outer pipes. Refer to Part D for specific details.
4. Horizontal vent pipe must maintain a 1/4" per foot slope down towards the boiler.
5. Horizontal combustion air pipe must maintain a minimum 1/4" per foot slope down towards terminal, when possible. If not, slope toward boiler.
6. Do not install venting system components on the exterior of the building except as specifically required by these instructions (refer to Figure 3):
 - Vent terminals must be at least 1 foot from any door, window, or gravity inlet into the building.
 - Maintain the correct clearance and orientation between the vent and air intake terminals. The vent and air intake terminals must be at the same height and their center lines must be spaced apart 12" minimum. Locate air intake termination on the same wall as the vent termination if possible,

IV. Venting (continued)

Table 3: Vent/Combustion Air System Options

Boiler Build	Approved Direct Vent System	Vent Material	Orientation	Termination	Description	Figures	Component Table	Part
Floor Standing or Wall Hung	Two-Pipe, CPVC/PVC Vent and PVC air intake (Factory Standard)	CPVC/PVC	Horizontal	Standard (thru sidewall)	The system includes separate CPVC vent pipe and PVC air intake pipe terminating thru sidewall with individual penetrations for the vent and air intake piping and separate terminals (tees).	4 thru 9	4A	B.
				Optional Snorkel (thru sidewall)	Same as above but separate snorkel type terminals.	4, 5A, 5B, 6, 7, 9, 10	4B	
			Optional Vertical	Vertical (thru roof)	The system includes separate CPVC vent pipe and PVC air intake pipe terminating thru roof with individual penetrations for the vent and air intake piping and separate vertical terminals.	4, 5A, 5B, 6, 9, 11	4C	
Floor Standing Only	Two-Pipe, Stainless Steel Vent and PVC/galvanized steel air intake (Available Optional)	Stainless Steel	Horizontal	Standard (thru sidewall)	The system includes separate stainless steel vent pipe and PVC/galvanized steel air intake pipe terminating thru sidewall with individual penetrations for the vent and air intake piping and separate terminals	8, 13	8A & 8B	C.
				Optional Snorkel (thru sidewall)	Same as above but separate snorkel type terminals.	10, 13		
			Vertical	Vertical (thru roof)	The system includes separate stainless steel vent pipe and PVC/galvanized steel air intake pipe terminating thru roof with individual penetrations for the vent and air intake piping and separate terminals.	11, 12, 13		
Floor Standing Only	Concentric, Inner Polypropylene Vent and Outer Steel Air intake (Available Optional)	Polypropylene	Horizontal	Horizontal (Wall) Terminal	Concentric vent/air pipe terminates thru sidewall.	14 thru 21	10	D.
			Vertical	Vertical (Roof) Terminal	Concentric vent/air pipe terminates thru roof.	14, 15, 16, 17, 22 thru 26		

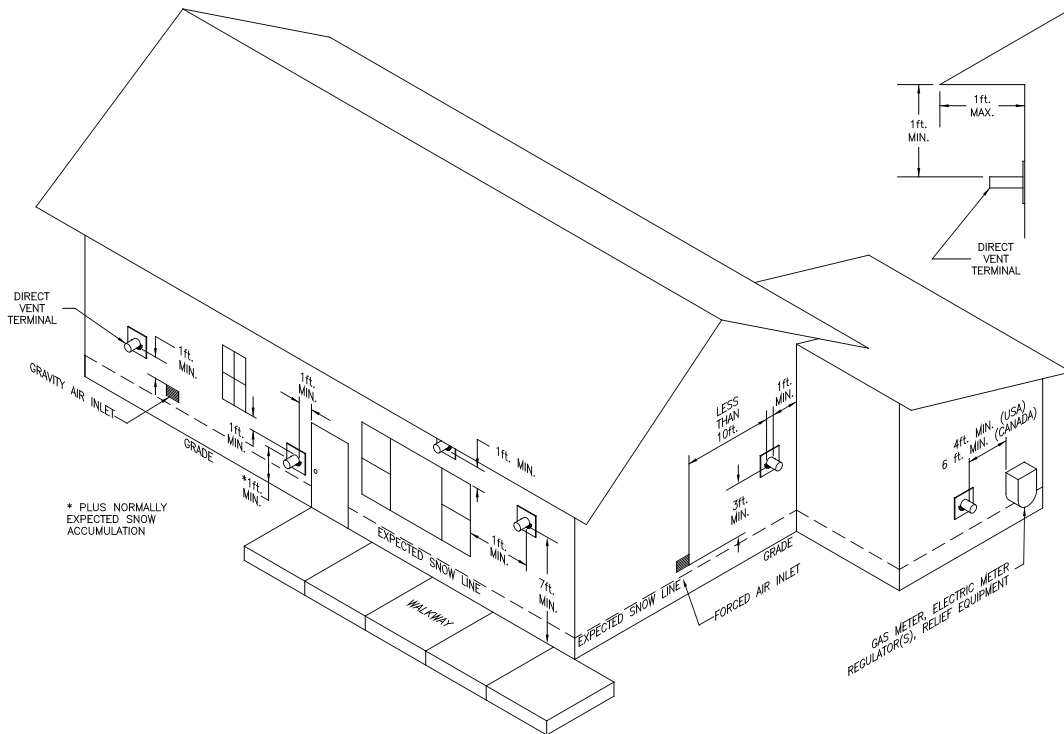


Figure 3: Location of Vent Terminal Relative to Windows, Doors, Grades, Overhangs, Meters and Forced Air Inlets (Concentric Terminal Shown - Two-Pipe System Vent Terminal to be installed in same location - Two-Pipe System Air Intake Terminal Not Shown)

IV. Venting (continued)

to prevent nuisance boiler shutdowns. However, boiler may be installed with vertical venting and sidewall combustion air inlet or visa versa, if installation conditions do not allow alternate arrangement.

- The bottom of the vent and air intake terminal must be at least 12" (18" in Canada) above the normal snow line. In no case should they be less than 12" above grade level.
- The bottom of the vent terminal must be at least 7 feet above a public walkway.
- Do not install the vent terminal directly over windows or doors.
- The bottom of the vent terminal must be at least 3 feet above any forced air inlet located within 10 feet.
- A clearance of at least 4 feet horizontally must be maintained between the vent terminal and gas meters, electric meters, regulators, and relief equipment. Do not install vent terminal over this equipment.
- Do not locate the vent terminal under decks or similar structures.
- Minimum twelve (12) inches vertically from any roof overhang twelve (12) inches or less wide. If a roof overhang width exceeds twelve (12) inches the terminal vertical clearance must be increased to avoid flue vapor condensation.
- Top of vent terminal must be at least 5 feet below eaves, soffits, or overhangs. Maximum depth of overhang is 3 ft.
- If window and/or air inlet is within four (4) feet of an inside corner, then terminal must be at least six (6) feet from adjoining wall of inside corner.
- Concentric - Minimum twelve (12) inches horizontally from a building corner.
- Under certain conditions, water in the flue gas may condense, and possibly freeze, on objects around the terminal including on the structure itself. If these objects are subject to damage by flue gas condensate, they should be moved or protected.
- If possible, install the vent and air intake terminals on a wall away from the prevailing wind. Reliable operation of this boiler cannot be guaranteed if the terminal is subjected to winds in excess of 40 mph.

- Air intake terminal must not terminate in areas that might contain combustion air contaminants, such as near swimming pools.
- For sidewall venting the minimum horizontal distance between any adjacent individual module (boiler) vent terminations is twelve (12) inches. Increasing this distance is recommended to avoid frost damage to building surfaces where vent terminations are placed.

CAUTION

Installing multiple individual module (boiler) vent terminations too close together may result in cross contamination and combustion product water vapor condensation on building surfaces, where vent termination are placed, and subsequent frost damage. To avoid/minimize frost damage, extend the distance from building surfaces to vent termination end and increase the horizontal distance between adjacent vent terminations.

- The minimum horizontal distance between any adjacent individual module (boiler) roof vent terminations is one (1) foot.
7. Use noncombustible $\frac{3}{4}$ " pipe strap to support horizontal runs and maintain vent location and slope while preventing sags in pipe. Do not restrict thermal expansion or movement of vent system. Maximum support spacing four (4) feet. Avoid low spots where condensate may pool. Do not penetrate any part of the vent system with fasteners.
 8. Maintain minimum clearance to combustible materials. See Figures 2A and 2B for details.
 9. Enclose vent passing through occupied or unoccupied spaces above boiler with the material having a fire resistance rating of at least equal to the rating of adjoining floor or ceiling.
Note: For one or two family dwellings, fire resistance rating requirement may not need to be met, but is recommended.
 10. Multiple individual module vertical vent pipes may be piped through a common conduit or chase so that one roof penetration may be made.

IV. Venting (continued)

B. CPVC/PVC Venting

WARNING

All CPVC vent components (supplied with boiler) must be used for near-boiler vent piping before transitioning to Schedule 40 PVC pipe (ASTM 2665) components for remainder of vent system.

WARNING

CPVC vent components must be used within any interior space where air cannot circulate freely, such as air inside a stud wall, and in any boiler closet.

WARNING

When using the CPVC/PVC vent options, the use of CPVC is required when venting in vertical or horizontal chase ways.

1. Components and Length Restrictions

- a. See Table 4A for CPVC/PVC Vent & Air Intake Components included with boiler, Table 4B for CPVC/PVC Vent and Air Intake Components (Installer Provided) required for Optional Vertical (Roof) Termination and Table 4C for CPVC/PVC Vent and Air Intake Components (Installer Provided) required for Optional Horizontal (Snorkel) Termination.

Table 4A: CPVC/PVC Vent & Air Intake Components Included With Boiler

Vent & Air Intake Components	Part Number	Quantity		
		ALP080 & ALP105 Standard Termination Vent Kit (P/N 102189-01) includes	ALP150 & ALP210 Standard Termination Vent Kit (P/N 102189-02) includes	ALP285 thru ALP500 Standard Termination Vent Kit (P/N 102189-03) includes
3" Schedule 40 PVC Tee (Vent & Air Intake Terminals)	102190-01	2	1	N/A
4" Schedule 40 PVC Tee (Vent & Air Intake Terminals)	102190-02	N/A	1	2
3" Stainless Steel Rodent Screen	102191-01	2	1	N/A
4" Stainless Steel Rodent Screen	102191-02	N/A	1	2
3" x 30" Schedule 40 CPVC Pipe	102193-01	1	1	N/A
4" x 30" Schedule 40 CPVC Pipe	102193-02	N/A	N/A	1
3" Schedule 80 CPVC 90° Elbow	102192-01	1	1	1
4" Schedule 80 CPVC 90° Elbow	102192-02	N/A	N/A	1
4 oz. Bottle of Transition Cement	102195-01	1	1	1
4 oz. Bottle of Primer	102194-01	1	1	1
3" Vent/3" Combustion Air CPVC/PVC Connector	102183-01	1	N/A	N/A
3" Vent/4" Combustion Air CPVC/PVC Connector	102183-02	N/A	1	N/A
4" Vent/4" Combustion Air CPVC/PVC Connector	102183-03	N/A	N/A	1
3" Vent/3" Combustion Air CPVC/PVC Connector Gasket	102185-01	1	N/A	N/A
4" Vent/4" Combustion Air CPVC/PVC Connector Gasket	102185-02	N/A	1	1

Table 4B: CPVC/PVC Vent & Air Intake Components (Installer Provided) required for Optional Vertical (Roof) Termination

Vent Components	Part Number	Quantity		
		ALP080 & ALP105 Vertical (Roof) Termination	ALP150 & ALP210 Vertical (Roof) Termination	ALP285 thru ALP500 Vertical (Roof) Termination
3" Schedule 40 PVC Coupler	N/A Supplied by Others	1	N/A	N/A
4" Schedule 40 PVC Coupler		N/A	1	1
3" Schedule 40 PVC 90° Elbow		2	N/A	N/A
4" Schedule 40 PVC 90° Elbow		N/A	2	2
3" Schedule 40 CPVC Pipe x ½ ft. min. horizontal run		1	N/A	N/A
4" Schedule 40 CPVC Pipe x ½ ft. min. horizontal run		N/A	1	1

IV. Venting (continued)

Table 4C: CPVC/PVC Vent & Air Intake Components (Installer Provided) required for Optional Horizontal (Snorkel) Termination

Vent Components	Part Number	Quantity		
		ALP080 & ALP105 Horizontal (Snorkel) Termination	ALP150& ALP210 Horizontal (Snorkel) Termination	ALP285 thru ALP500 Horizontal (Snorkel) Termination
3" Schedule 40 PVC Pipe x up to 7 ft. max. vertical run	N/A Supplied by Others	2	1	N/A
4" Schedule 40 PVC Pipe x up to 7 ft. max. vertical run		N/A	1	2
3" Schedule 40 PVC 90° Elbow		4	2	N/A
4" Schedule 40 PVC 90° Elbow		N/A	2	4
3" Schedule 40 PVC Pipe x ½ ft. min. horizontal run		2	1	N/A
4" Schedule 40 PVC Pipe x ½ ft. min. horizontal run		N/A	1	2

Table 5: Clearances from Vent Piping to Combustible Material

Vent Pipe	Pipe Direction	Enclosure	Minimum Clearance To Combustible Material
CPVC/PVC Venting	Vertical or Horizontal	Enclosed at all Sides	See Figures 2A and 2B

Table 6: Vent System and Combustion Air System Components

Vent System Component	Equivalent Length (Ft.)
Schedule 40 CPVC Pipe x 30 Inches	2.5
Schedule 80 CPVC 90° Elbow	5

Combustion Air System Component (Parts by Others)	Equivalent Feet of Pipe*
Pipe x 1 Ft.	1
Pipe x 2 Ft.	2
Pipe x 4 Ft.	4
Pipe x 5 Ft.	5
Elbow	5
Elbow	2.5

*Equivalent Feet of Pipe Based on Standard 4" PVC Design

WARNING

All condensate that forms in the vent must be able to drain back to the boiler.

- b. Vent length restrictions are based on equivalent length of vent/combustion air pipe (total length of straight pipe plus equivalent length of fittings). Maximum vent/combustion air lengths are listed in Table 7. Do not exceed maximum vent/combustion air lengths. Table 6 lists equivalent lengths for fittings. Do not include vent/combustion air terminals in equivalent feet calculations. See "Combustion Air/Vent, Equivalent Length Work Sheet".
- c. The vent termination location is restricted as per 'General Guidelines', Paragraph A, 5. (Refer to Figure 3).

2. System Assembly

- a. Plan venting system to avoid possible contact with plumbing or electrical wires. Start at vent connector at boiler and work towards vent termination.
- b. Do not exceed maximum Vent/Combustion Air length. Refer to Table 7.

- c. Design the Vent System to allow 3/8" of thermal expansion per 10 feet of CPVC/PVC pipe. Runs of 20 feet or longer that restrained at both ends must use an offset or expansion loop. Refer to Figure 4.
- d. Follow all manufacturer instructions and warnings when preparing pipe ends for joining and using the primer and the cement.

3. Field Installation of CPVC/PVC Two-Pipe Vent System Connector - Floor Mounted Boiler Builds

Refer to Figure 5 and Steps below:

- a. Position the CPVC/PVC vent connector and gasket onto boiler rear/bottom panel and insert vent connector inner stainless steel vent pipe into heat exchanger vent outlet.
- b. Align vent connector plate and gasket clearance holes with rear/bottom panel engagement holes; then, secure the connector and gasket to the panel with six mounting screws.

IV. Venting (continued)

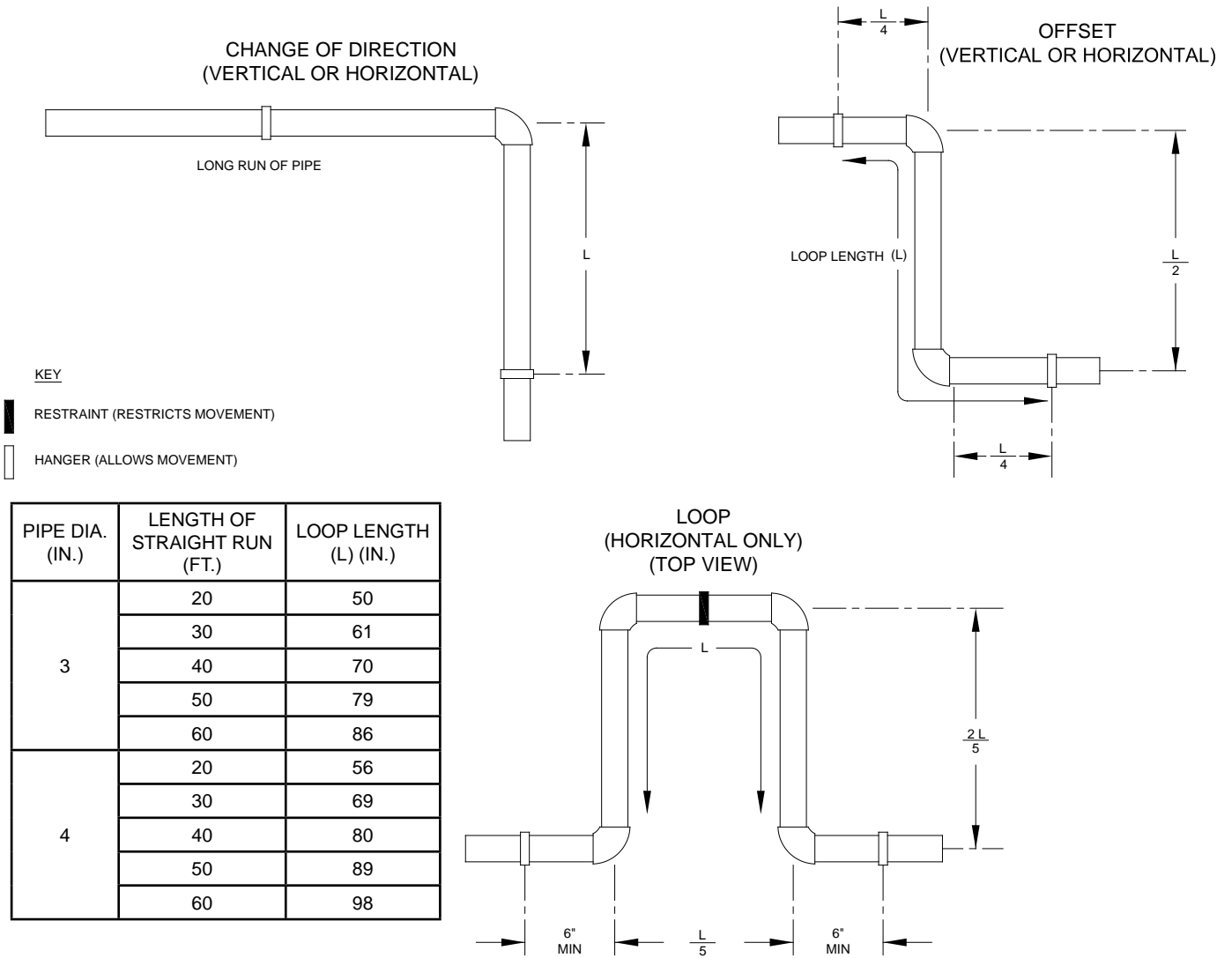


Figure 4: Expansion Loop and Offset

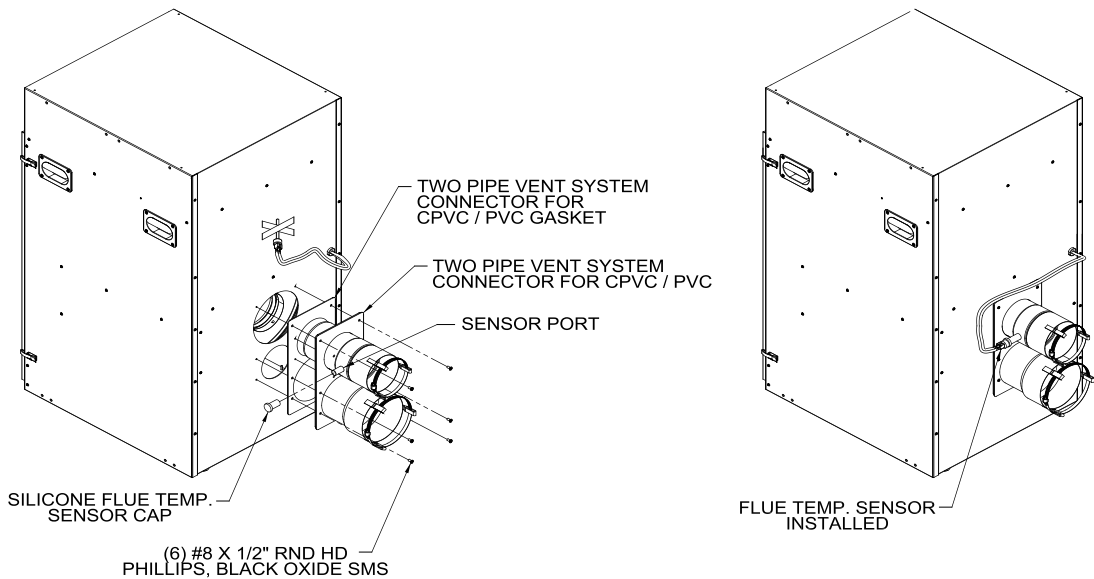


Figure 5: Field Installation of CPVC/PVC Two-Pipe Vent System Connector - Floor Mounted Boiler Builds

IV. Venting (continued)

Table 7: Vent/Combustion Air Pipe Length – Two-Pipe Direct Vent System Options (CPVC/PVC and Stainless Steel/PVC or Galvanized Steel)

Boiler Model	3" Combustion Air Pipe (Equivalent Length)		4" Combustion Air Pipe (Equivalent Length)		3" Vent Pipe (Equivalent Length)		4" Vent Pipe (Equivalent Length)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
ALP080	30 In.	100 Ft.	---	---	30 In.	100 Ft.	---	---
ALP105	30 In.	100 Ft.	---	---	30 In.	100 Ft.	---	---
ALP150	---	---	30 In.	100 Ft.	30 In.	100 Ft.	---	---
ALP210	---	---	30 In.	100 Ft.	30 In.	100 Ft.	---	---
ALP285	---	---	30 In.	60 Ft.	---	---	30 In.	60 Ft.
ALP399	---	---	30 In.	60 Ft.	---	---	30 In.	60 Ft.
ALP500	---	---	30 In.	60 Ft.	---	---	30 In.	60 Ft.

Vent/Combustion Air, Equivalent Length Work Sheet

This sheet is supplied to assist in vent/combustion air, equivalent length calculating

Combustion Air		Vent	
90° elbow(s) PVC Quantity = <input type="text"/> x 5 = <input type="text"/> equiv. ft. a.		Supplied 30" straight CPVC Length ft. = <input type="text"/> 2.5 x 1 = <input type="text"/> 2.5 equiv. ft. a.	
45° elbow(s) PVC Quantity = <input type="text"/> x 2.5 = <input type="text"/> equiv. ft. b.		Supplied 90° elbow CPVC Quantity = <input type="text"/> 1 x 5 = <input type="text"/> 5 equiv. ft. b.	
Straight pipe PVC Length ft. = <input type="text"/> x 1 = <input type="text"/> equiv. ft. c.		90° elbow(s) PVC Quantity = <input type="text"/> x 5 = <input type="text"/> equiv. ft. c.	
		45° elbow(s) PVC Quantity = <input type="text"/> x 2.5 = <input type="text"/> equiv. ft. d.	
		Straight pipe PVC Length ft. = <input type="text"/> x 1 = <input type="text"/> equiv. ft. e.	
Total* a.+b.+c. = <input type="text"/> equiv. ft.		Total* a.+b.+c.+d.+e. = <input type="text"/> equiv. ft.	

* Total cannot exceed 60 equiv. ft. length.

Vent and combustion air terminals do not count towards total equiv. ft.

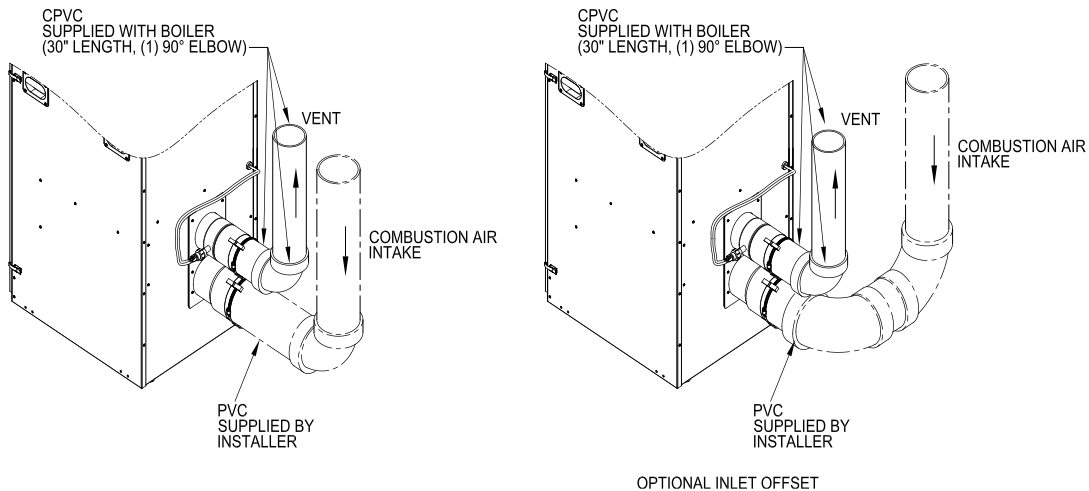


Figure 6A: Near-Boiler Vent/Combustion Air Piping - Floor Mounted Boiler Builds

IV. Venting (continued)

4. Near-Boiler Vent/Combustion Air Piping - Floor Mounted Boiler Builds

Refer to Figure 6A and the following Steps:

- a. All CPVC vent components supplied with boiler inside vent carton (3" or 4" Schedule 40 x 30" long CPVC pipe and 3" or 4" Schedule 80 CPVC 90° Elbow) must be used for near-boiler piping before transitioning to Schedule 40 PVC (ASTM 2665) pipe components for remainder of vent system. The CPVC 30" long straight pipe may be cut to accommodate desired vent configuration provided both pieces are used in conjunction with CPVC 90° Elbow before any PVC components are used. Ensure that the CPVC 90° Elbow is the first elbow used in the vent system as it exits the boiler.
- b. Clean all vent and combustion air pipe joints with primer and secure with transition cement (4-oz. bottles of primer and cement are supplied with boiler inside vent carton). Follow application instructions provided on primer and cement bottles.

5. Field Installation of CPVC Vent Pipe - Wall Mounted Boiler Builds

Refer to Figure 6B and the following Steps:

The wall mounted boiler builds do not require using 3" Schedule 80 CPVC 90° Elbow for near-boiler vent piping.

- a. Insert provided 3" Schedule 40 x 30" long CPVC pipe thru air box top combination vent/combustion air collar vent opening and slide down with a slight twisting motion, until the pipe lower end is firmly inserted into female end of factory installed vent connector 90° Elbow.
- b. Secure the pipe by tightening the metal strap worm screw.
 - i. The CPVC 30" long straight pipe may be cut to accommodate desired vent configuration. If the CPVC 30" straight pipe needs to be cut into two pieces to accommodate desired vent configuration, insure that the first vertical piece has minimum length of 12 inches and extends 1-5/8" above air box top, so a coupling or an elbow can be attached to it.
 - ii. The factory supplied CPVC vent pipe (3" Schedule 40 x 30" long CPVC pipe) must be used for near-boiler piping before transitioning to Schedule 40 PVC (ASTM 2665) pipe components for remainder of vent system.
 - iii. Clean all vent and combustion air pipe joints with primer and secure with transition

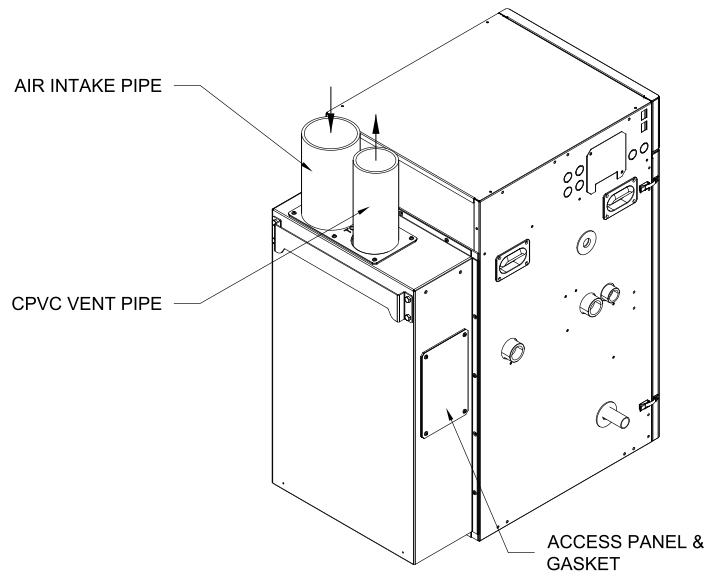


Figure 6B: Field Installation of CPVC Vent Pipe - Wall Mounted Boiler Builds

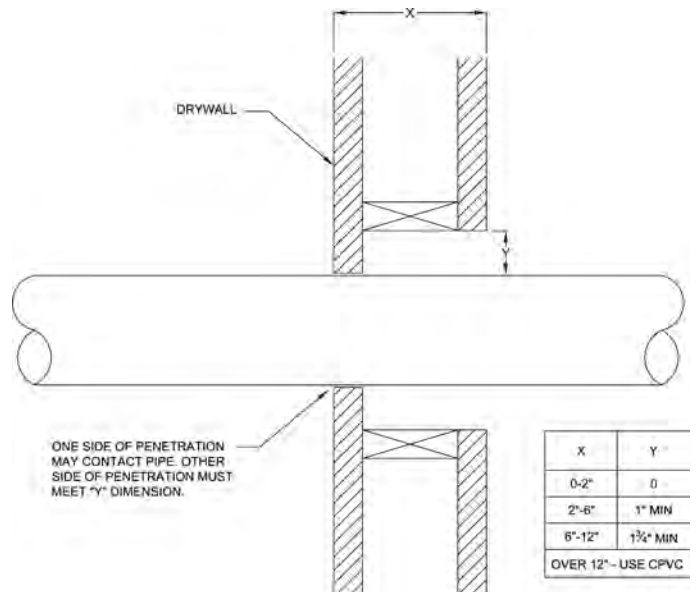


Figure 7: CPVC/PVC Vent Pipe Thru Combustible Wall Installation

cement (4-oz. bottles of primer and cement are supplied with boiler). Follow application instructions provided on primer and cement bottles.

6. Horizontal Vent Termination

- a. Standard Two-Pipe Termination

See Figures 7 through 10.

- i. Vent Piping

- When conditions in Figure 7 cannot be met, use a single wall thimble [(US boiler part number 102180-01 (3") or 102181-01 (4")]] for vent only, when penetrating a combustible wall. Thimble

IV. Venting (continued)

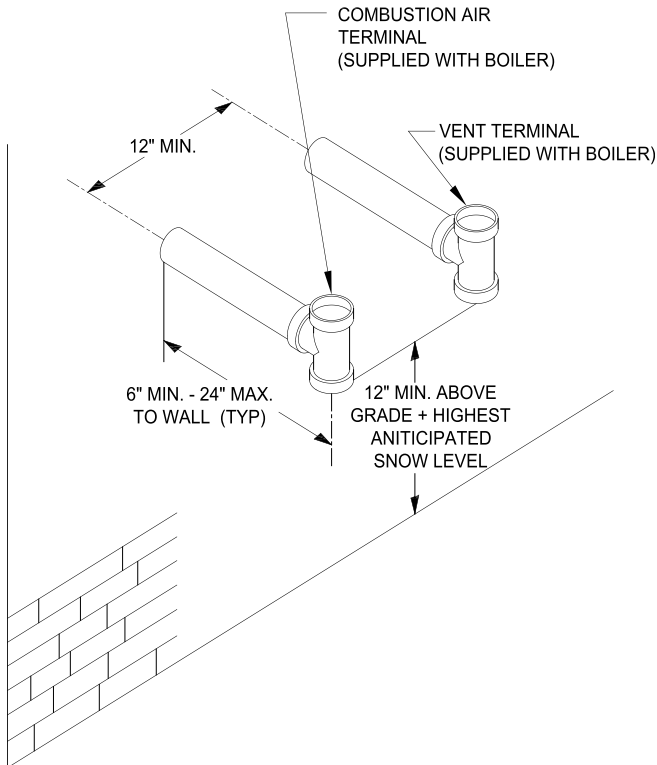
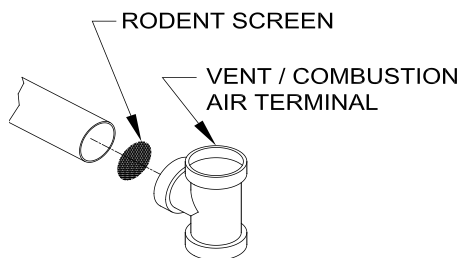


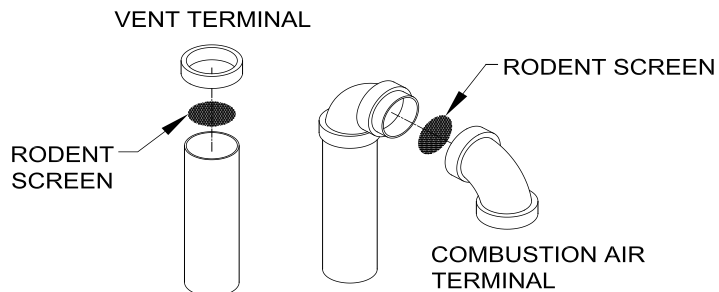
Figure 8 : Direct Vent - Sidewall Terminations

use is optional for non-combustible wall. Insert thimble from wall from outside. Secure outside flange to wall with nails or screws, and seal ID, OD and vent holes with sealant material. Install inside flange to inside wall, secure with nails or screws, and seal with sealant material.

- For noncombustible wall application when thimble is not used, size opening such that a minimal clearance is obtained. See Figure 7.
- Install Rodent Screen and Vent Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
- Apply sealant between vent pipe and opening/thimble to provide weather-tight seal. Sealant should not restrain the expansion of the vent pipe.



(A) HORIZONTAL



(B) VERTICAL

Figure 9: Rodent Screen Installation

ii. Combustion Air Piping

- Do not exceed maximum combustion air length. Refer to Table 7.
- Size combustion air wall penetration to allow easy insertion of combustion air piping.
- Install Rodent Screen and Combustion Air Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
- Apply sealant between vent pipe and opening to provide weather-tight seal.

b. Optional Two-Pipe Snorkel Termination

Refer to Figures 7, 9 and 10.

This installation will allow a maximum of seven (7) feet vertical exterior run of the vent/combustion air piping to be installed on the CPVC/PVC horizontal venting application.

NOTICE

Exterior run to be included in equivalent vent/combustion air lengths.

i. Vent Piping

- After penetrating wall, install a Schedule 40 PVC 90° elbow so that the elbow leg is in the up direction.
- Install maximum vertical run of seven (7) feet of Schedule 40 PVC vent pipe. See Figure 10.
- At top of vent pipe length install another PVC 90° elbow so that elbow leg is opposite the building's exterior surface.
- Install Rodent Screen and Vent Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
- Brace exterior piping if required.

ii. Combustion Air Piping

- After penetrating wall, install a Schedule 40 PVC 90° elbow so that elbow leg is in the up direction.

IV. Venting (continued)

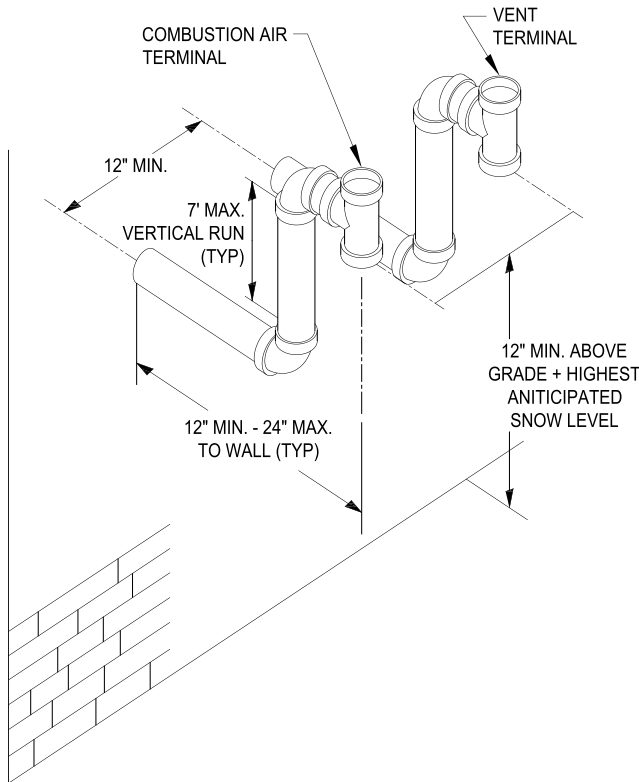


Figure 10: Direct Vent - Optional Sidewall Snorkel Terminations

- Install maximum vertical run of seven (7) feet of Schedule 40 PVC vent pipe. See Figure 10.
- At top of vent pipe length install another PVC 90° elbow so that elbow leg is opposite the building's exterior surface.
- Install Rodent Screen and Combustion Air Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
- Brace exterior piping if required.

WARNING

All CPVC supplied with the vent kit must be used prior to connection of the vent system to this terminal. If the vent system is too short to permit this, do not use this terminal.

Do not operate boiler without the rain cap in place.

Methods of securing and sealing terminals to the outside wall must not restrain the thermal expansion of the vent pipe.

7. Vertical Vent Termination

- Standard Two-Pipe Termination
Refer to Figures 7, 9, 11 and 12.

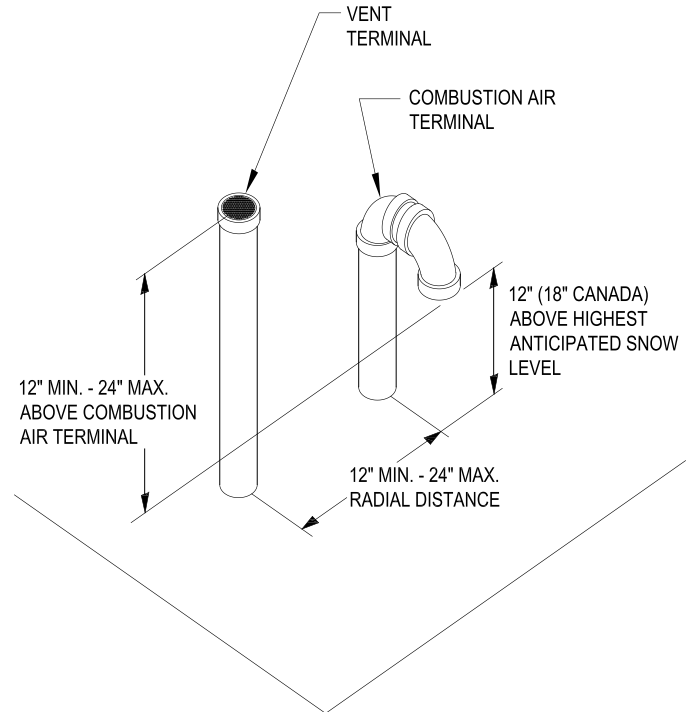


Figure 11: Direct Vent - Vertical Terminations

i. Vent Piping

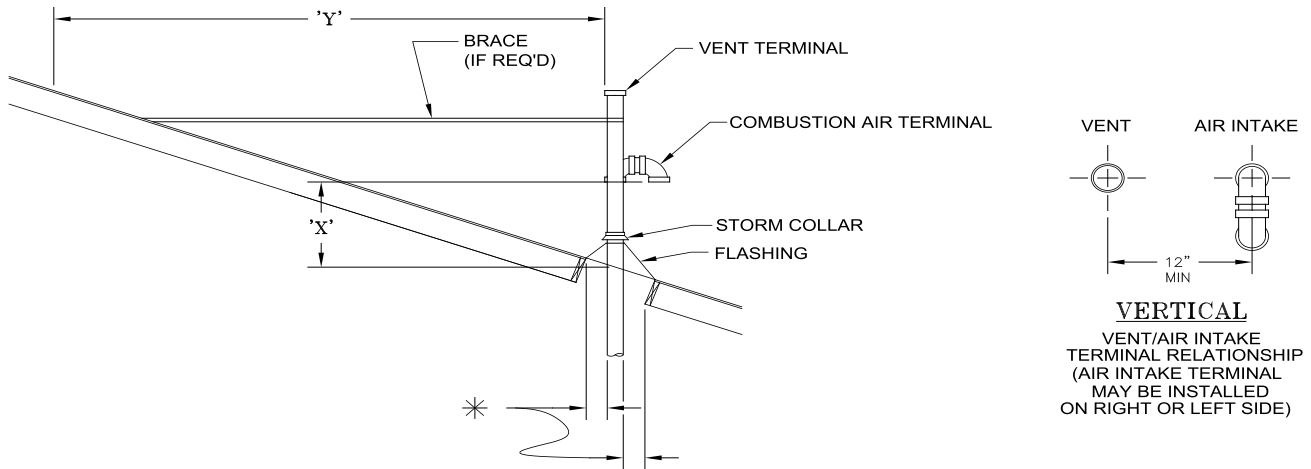
- Install fire stops where vent passes through floors, ceilings or framed walls. The fire stop must close the opening between the vent pipe and the structure.
- Whenever possible, install vent straight through the roof. Refer to Figures 11 and 12.
 - Size roof opening to maintain minimum clearance of 1" from combustible materials.
 - Extend vent pipe to maintain minimum vertical and horizontal distance of twelve (12) inches from roof surface. additional vertical distance for expected snow accumulation. Provide brace as required.

CAUTION

Vertical venting and combustion air roof penetrations (where applicable) require the use of roof flashing and storm collar, which are not supplied with boiler, to prevent moisture from entering the structure.

- Install storm collar on vent pipe immediately above flashing. Apply Dow Corning Silastic 732 RTV Sealant between vent pipe and storm collar to provide weather-tight seal.

IV. Venting (continued)



* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS ONE (1) INCH. COMBUSTION AIR PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS ZERO (0) INCHES.

Figure 12: Direct Vent - Vertical Terminations with Sloped Roof

Extend vent/combustion air piping to maintain minimum vertical ('X') and minimum horizontal ('Y') distance of twelve (12) inches (18 inches Canada) from roof surface. Allow additional vertical ('X') distance for expected snow accumulation.

- Install Rodent Screen and Vent Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
 - Brace exterior piping if required.
- ii. **Combustion Air Piping**
- Locate combustion air termination on the same roof location as the vent termination to prevent nuisance boiler shutdowns. Combustion air terminal can be installed closer to roof than vent.
 - Size roof opening to allow easy insertion of combustion air piping and allow proper installation of flashing and storm collar to prevent moisture from entering the structure.
 - Use appropriately designed vent flashing when passing through roofs. Follow flashing manufacturers' instructions for installation procedures.
 - Extend combustion air pipe to maintain minimum vertical and horizontal distance of twelve (12) inches from roof surface. Allow additional vertical distance for expected snow accumulation. Provide brace as required.
 - Install storm collar on combustion air pipe immediately above flashing. Apply Dow Corning Silastic 732 RTV Sealant between combustion air pipe and storm collar to provide weather-tight seal.
 - Install Rodent Screen and Combustion Air Terminal (supplied with boiler), see Figure 9 for appropriate configuration.
 - Brace exterior piping if required.

WARNING

All CPVC supplied with the vent kit must be used prior to connection of the vent system to this terminal. If the vent system is too short to permit this, do not use this terminal.

Do not operate boiler without the rain cap in place.

Methods of securing and sealing terminals to the outside wall must not restrain the thermal expansion of the vent pipe.

IV. Venting (continued)

C. Stainless Steel Venting

CAUTION

Vent systems made by Heat Fab, Protech and Z-Flex rely on gaskets or proper sealing. When these vent systems are used, take the following precautions:

- Make sure that gasket is in position and undamaged in the female end of the pipe.
- Make sure that both the male and female pipes are free of damage prior to assembly.
- Only cut vent pipe as permitted by the vent manufacturer in accordance with their instructions. When pipe is cut, cut end must be square and carefully de-burred prior to assembly.

WARNING

All condensate that forms in the vent must be able to drain back to the boiler.

1. Vent Length Restrictions

- a. Vent length restrictions are based on equivalent length of vent/combustion air pipe (total length of straight pipe plus equivalent length of fittings). Maximum vent/combustion air lengths are listed in Table 7. Do not exceed maximum vent/combustion air lengths. Do not include vent/combustion air terminals in equivalent feet calculations. See "Combustion Air/Vent, Equivalent Length Work Sheet".
- b. The vent termination location is restricted as per 'General Guidelines', Section A.5. (Refer to Figure 3)
- c. Where the use of "silicone" is called for in the following instructions, use GE RTV 106 or equivalent for the vent collar. Air inlet piping sections are sealed with any general-purpose silicone sealant such as GE RTV102. PVC air inlet piping sections are connected with PVC cement.
- d. Longitudinal welded seams should not be placed at the bottom of horizontal sections of exhaust pipe.
- e. Do not drill holes in vent pipe.
- f. Do not attempt to mix vent components of different vent system manufacturers.

2. Near Boiler Connection

To install the stainless steel vent adapter [P/N 102219-01 (3"), 102220-01 (4")]:

- a. Push the stainless steel vent adapter onto the CPVC/PVC connector with a slight twisting motion. Make sure that the stainless steel vent adapter is inserted at least 1" (refer to Figure 13).

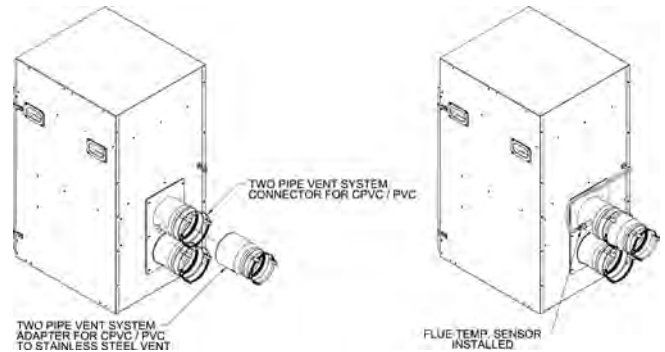


Figure 13: Field Installation of Two-Pipe Vent System Adapter for Stainless Steel

- b. Secure the adapter to the CPVC/PVC connector by tightening the metal strap.
- #### 3. System Assembly
- a. Plan venting system to avoid possible contact with plumbing or electrical wires. Start at vent connector at boiler and work towards vent termination.
 - b. Refer to Tables 8A and 8B for approved AL29C Vent Systems.
 - c. Do not exceed maximum Vent/Combustion air length. Refer to Table 7.
 - d. Follow all manufacturer instructions and warnings when preparing pipe ends for joining and using the primer and the cement.
 - e. Assemble the air intake system using either galvanized or PVC pipe.
 - i. If PVC piping is used, use PVC cement to assemble the PVC intake system components. See Part B for air intake installation instructions.
 - ii. If galvanized piping is used, use at least two sheet metal screws per joint. Seal the outside of all joints.
- #### 4. Horizontal Vent Termination
- a. Standard Two-Pipe Termination
Refer to Figure 8.
 - i. Vent Termination
 - Use U.S. Boiler stainless exhaust terminal [P/N 8110701 (3"), or P/N 100184-01 (4")]. The outer edge of this terminal must be between 6" and 12" from the surface of the wall.
The joint between the terminal and the last piece of pipe must be outside of the building.

IV. Venting (continued)

- Male end of terminal will fit into the female end of any of the approved stainless vent systems.
 - Apply a heavy bead of silicone to the male end of the terminal before inserting it into the last piece of pipe. Orient the terminal so that the seam in the terminal is at 12:00.
 - Smooth the silicone over the seam between the terminal and the last piece of pipe, applying additional silicone if necessary to ensure a tight seal.
 - Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.
- ii. Combustion Air Termination
 - Horizontal intake terminal is a tee in the upright position. Tee should protrude the same distance from the wall as the exhaust terminal. See Figure 8.
 - Install a rodent screen (not supplied) in the inlet terminal. Use a screen having 1/2" (2 x 2) or larger mesh.

b. Optional Two-Pipe Snorkel Termination

Refer to Figure 10.
This installation will allow a maximum of seven (7) feet vertical exterior run of the vent/combustion air piping to be installed on the approved AL29C Stainless Steel horizontal venting application.

Table 8A: U.S. Boiler Vent System Components (Stainless Steel)

Vent System Component	Part Numbers		Equivalent Feet of Pipe
	ALP080 - 210	ALP285 - 500	
	3" Vent	4" Vent	
SS Vent Kit	102501-01	102501-02	N/A
Horizontal Vent Terminal (Included in Kit)	8116310	8116313	
PVC to SS Vent Adapter (Included In Kit)	102219-01	102220-01	
Vertical Vent Terminal	102680-01	102680-02	N/A
Pipe x 1 Ft.	8116296U	100176-01	1
Pipe x 3 Ft.	8116298U	100177-01	3
Pipe x 5 Ft.	8116300U	100178-01	5
Pipe x Adjustable	8116319U	100179-01	Equal to Installed Length (1.06 to 1.64)
90° Elbow	8116294U	100180-01	5.5 (3") 8.0 (4")
45° Elbow	8116292U	100181-01	4.0 (3") 4.5 (4")
Horizontal Drain Tee	8116302U	100182-01	2
Vertical Drain Tee	8116304U	100183-01	7½
Single Wall Thimble	8116116	100184-01	N/A

i. Vent Termination

- After penetrating wall, install the appropriate manufacturer's 90° elbow so that the elbow leg is in the up direction.
- Install maximum vertical run of seven (7) feet of appropriate manufacturer's vent pipe. See Figure 10.
- At top of vent pipe length install another appropriate manufacturer's 90° elbow so that the elbow leg is opposite the building's exterior surface.
- Install horizontal vent terminal.
- Brace exterior piping if required.

ii. Combustion Air Termination

- After penetrating wall, install a 90° elbow so that the elbow leg is in the up direction.
- Install maximum vertical run of seven (7) feet of combustion air pipe. See Figure 10.
- At top of vent pipe length install another 90° elbow so that the elbow leg is opposite the building's exterior surface.

Table 8B: Alternate Vent Systems and Vent Components (Stainless Steel)

Manufacturer	Vent System	Size	Wall Thimbles	Horizontal Termination	Vertical Termination
Protech Systems Inc..	FasNseal	3	FSWT3	Tee: FSTT3	FSBS3
		4	FSWT4	Tee: FSTT4	FSBS4
Z-Flex	SVE Series III ("Z-Vent III")	3	2SVSWTEF03	Tee: 2SVSTTF03	24SVSTPF03
		4	2SVSWTEF04	Tee: 2SVSTTF04	24SVSTPF04
Flex-L Intl.	Star-34	3	SR03WT15	Tee: SRTT-03	S RTP-03
		4	SR04WT15	Tee: SRTT-04	S RTP-04

NOTE: See vent system manufacturer's literature for other part numbers that are required such as straight pipe, elbows, firestops and vent supports.

IV. Venting (continued)

- Install Rodent Screen (not supplied) and horizontal vent terminal.
- Brace exterior piping if required.

5. Vertical Vent Termination

a. Standard Two-Pipe Termination

Refer to Figures 11 and 12.

i. Vent Termination

- Use the terminal supplied by the vent system manufacturer shown in Table 8B. Follow manufacturer's instructions to attach terminal to vent system.

ii. Combustion Air Termination

- Install vertical combustion air terminal. Vertical combustion air terminal consists of an 180° bend (comprised of two (2) 90° elbows) as shown in Figure 11.
- Install rodent screen (not supplied) in the combustion air terminal. Use a screen having 1/2" (2 x 2) or larger mesh.

D. Concentric Polypropylene Venting

1. Vent Length Restrictions

- Vent length restrictions are based on equivalent length of vent pipe i.e. total length of straight pipe plus equivalent length of fittings. See Table 9 for specified vent length details. Do not exceed maximum vent length. Table 10 lists available concentric vent components and includes equivalent vent length for fittings.
- The vent termination location is restricted as per 'General Guidelines', Paragraph A, 5 (refer to Figure 3).

Table 9: Concentric Vent Length

Boiler Model	Inner/Outer Pipe Dia., mm	Vent Length (Equiv. Ft.)		Wall Opening Diameter
		Minimum	* Maximum	
ALP080	80/125 mm	21-7/8 in	60	5-1/2 in
ALP105				
ALP150				
ALP210				
ALP285	100/150 mm	32 in	60	6-1/2 in
ALP399				
ALP500				

* with optional concentric vent components, see Table 10 for details.

Table 10: Concentric Vent Components

Part Number	Component Description	Size	Component Equivalent Vent Length, Ft	Comments
101493-01	90° Elbow – Long Radius	80/125 mm	5.5	
101491-01	45° Elbow - Long Radius	80/125 mm	3.0	
101163-01	Cut -To-Length Extension, 500 mm (19-1/2")	80/125 mm	1.63	**Can be cut
101162-01	Cut -To-Length Extension, 1000 mm (39")	80/125 mm	3.25	**Can be cut
101485-01	Fixed Extension, 2000 mm (78")	80/125 mm	3.25	***Must not be cut
101808-01	Horizontal (Wall) Terminal	80/125 mm	*NA	Supplied with boiler
101495-01	Vertical Roof Terminal	80/125 mm	*NA	See Note 1
101496-01	Flat Roof Flashing	80/125 mm		
101497-01	Sloped Roof Flashing	80/125 mm		See Note 2
101492-01	Support Elbow with Chimney Chase Bracket	80/125 mm	8.5	See Note 3
101498-01	Hanger Wall Bracket	80/125 mm		
101909-01	Locking Clamp	80/125 mm		
101548-01	90° Elbow – Long Radius	100/150 mm	8.0	
101549-01	45° Elbow - Long Radius	100/150 mm	3.0	
101550-01	1 Cut -To-Length Extension, 500 mm (19-1/2")	100/150 mm	1.63	** Can be cut
101551-01	Cut -To-Length Extension, 1000 mm (39")	100/150 mm	3.25	** Can be cut
101553-01	Fixed Extension, 2000 mm (78")	100/150 mm	6.5	*** Must not be cut
101809-01	Horizontal (Wall) Terminal	100/150 mm	* NA	Supplied with boiler
101557-01	Vertical (Roof) Terminal	100/150 mm	* NA	See Note 1
101558-01	Flat Roof Flashing	100/150 mm		
101559-01	Sloped Roof Flashing	100/150 mm		See Note 2
101560-01	Support Elbow with Chimney Chase Bracket	100/150 mm	10.0	See Note 3
101561-01	Hanger Wall Bracket	100/150 mm		
103097-01	Locking Clamp	100/150 mm		

Notes:

- * NA – do not include vent terminal into total vent length calculations.
 - ** These sections have plain male end and beaded female end. See Figure 15 for details.
 - *** These sections have beaded male end and beaded female end. See Figure 16 for details.
- Vertical terminal can be used with either of the roof flashings listed beneath it.
 - Sloped roof flashing suitable for roof angles between 25° and 45°.
 - Used at base of vertical run inside unused masonry chimney.

IV. Venting (continued)

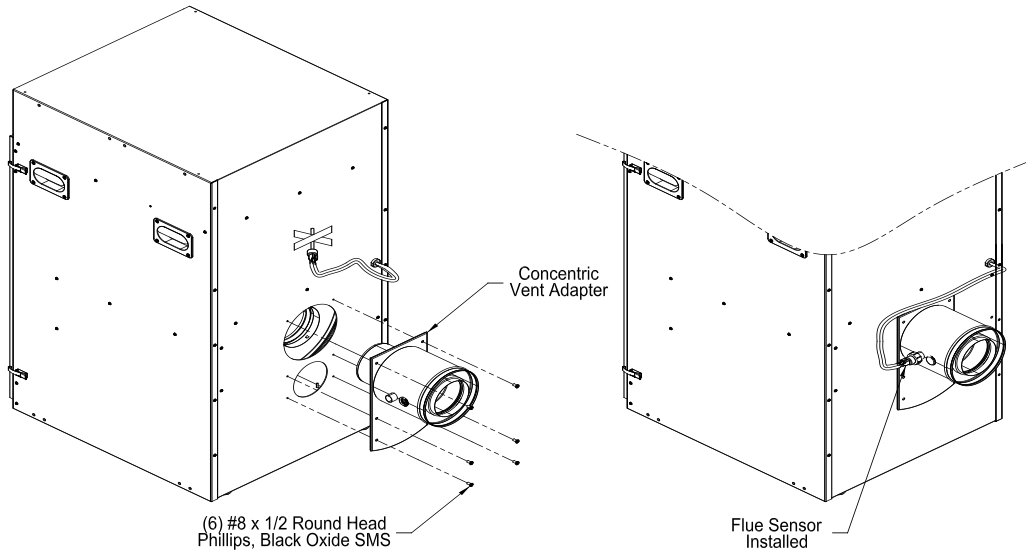


Figure 14: Field Installation of Boiler Concentric Vent Collar

2. Field Installation of Boiler Concentric Vent Collar

- Locate and remove six mounting screws from the Miscellaneous Parts Carton.
- Position the Collar onto jacket combination rear/bottom panel and insert collar inner stainless steel vent pipe into the heat exchanger vent outlet.
- Align collar plate clearance holes with rear/bottom panel engagement holes; then secure the collar to rear/bottom panel with six mounting screws. See Figure 14.
- Flue temperature sensor, factory attached to the boiler wiring harness, is secured to the left boiler jacket panel with tape.

- Remove the tape and push the sensor rubber plug into Concentric Vent Collar sensor port until the plug is securely engaged. See Figure 14.

The installation of the Concentric Vent Collar is now completed.

3. System Assembly

- Plan venting system to avoid possible contact with plumbing or electrical wires. Start at vent connector at boiler and work towards vent termination.
- Do not exceed maximum Concentric vent length. Refer to Table 9.
- If additional concentric vent piping is needed:
 - Concentric Vent Cut-To-Length Extension pipes, **identified in Table 10 CAN BE CUT** to required length when used as an extension. **These pipes have plain male end and beaded female end. Always cut the pipe from plain male end.** See Figure 15 ‘Cut-To-Length Extension (Cutttable)’.

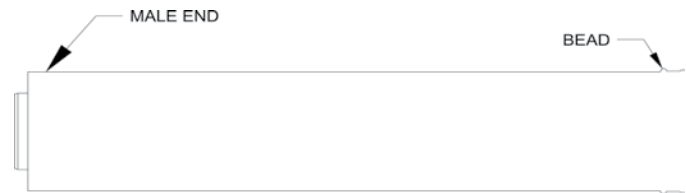


Figure 15: Cut-To-Length Extension (Cutttable)

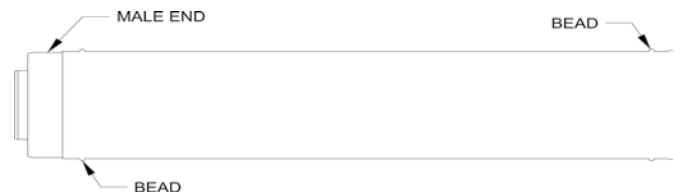


Figure 16: Fixed Extension (Non-Cutttable)

- The remaining Concentric Vent Fixed Extensions shown in Table 10 **CANNOT BE CUT**. These pipes have beaded male and beaded female ends. See Figure 16 ‘Fixed Extension (Non-Cutttable)’.
- To cut the Concentric Vent Straight pipe to required length refer to Figure 17 ‘Cutting Straight Pipe’ and the following procedure:
 - Determine the required length of the outer pipe. When doing this allow an additional 1” of length for insertion into the female end of the adjoining pipe. Mark the cut line on the outer pipe.
 - Remove the plastic inner pipe by pulling it out from the female end.
 - Cut the **OUTER PIPE ONLY** at the point marked in Step (a) using aviation shears, a hacksaw, or an abrasive wheel cutter. Be careful to cut the pipe square. De-burr the cut end with a file or emery cloth.

IV. Venting (continued)

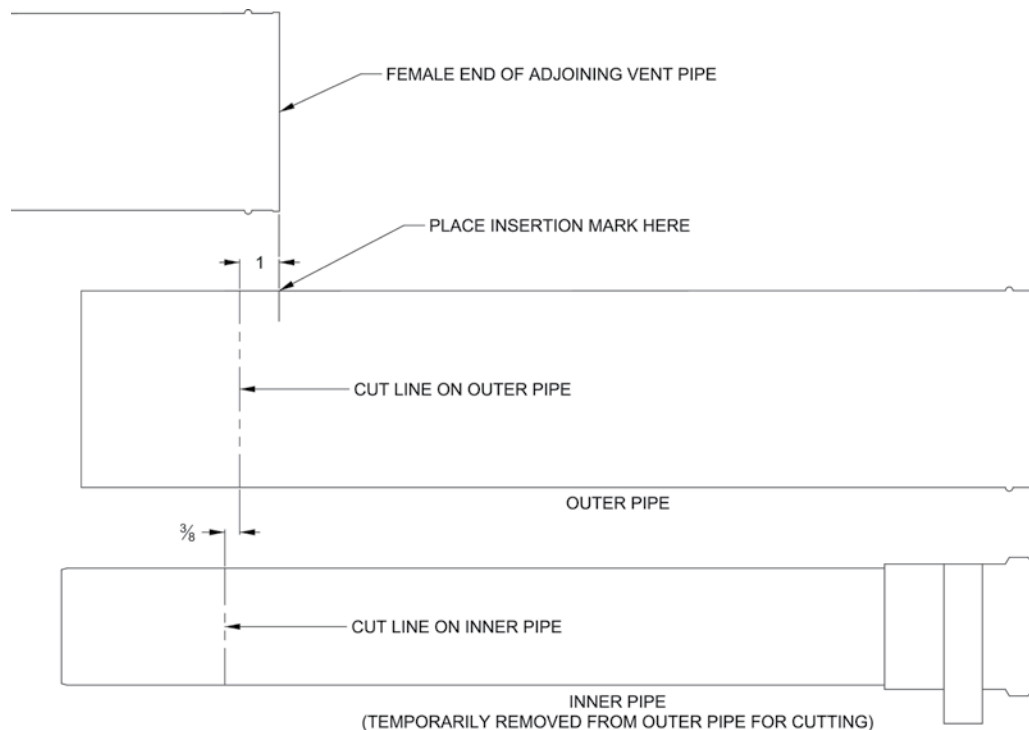


Figure 17: Cutting Straight Pipe

- iv. Make an insertion mark 1" from the male end of the outer pipe.
 - v. Cut the plastic inner pipe so that it will protrude 3/8" beyond the male end of the outer pipe when reinstalled in the outer pipe. Use a fine tooth hacksaw or a PVC saw to cut the plastic pipe and be careful to cut the pipe square. De-burr the cut edge of the plastic pipe with a file, razor blade or fine sandpaper.
 - vi. Reinstall the inner pipe.
- e. To join Concentric Vent Pipe refer to Figure 18 "Joining Cuttable Pipe" and Figure 19 "Joining Non-Cuttable Pipe" and follow the procedure below:

- i. Start assembly of the vent system at the boiler. Lubricate the brown gasket in the boiler vent collar with a few drops of water.
- ii. Push the male end of the first fitting into the boiler collar until it bottoms out. The male end of cuttable sections should go 1" into the collar until the insertion mark (made in Step 4 above) is covered. On other fittings, the bead on the male pipe will be bottom out on the collar (see Figure 19).
- iii. The male end of cuttable fittings must be held to the collar with three (3) #10 x 1/2" sheet metal screws. Drill a 1/8" hole through both outer pipes to start this screw. **Use a drill stop or other means to ensure that**

the drill bit does not penetrate more than 3/8" into the outer pipe. Do not use a sheet metal screw longer than 1/2" (see Figure 18).

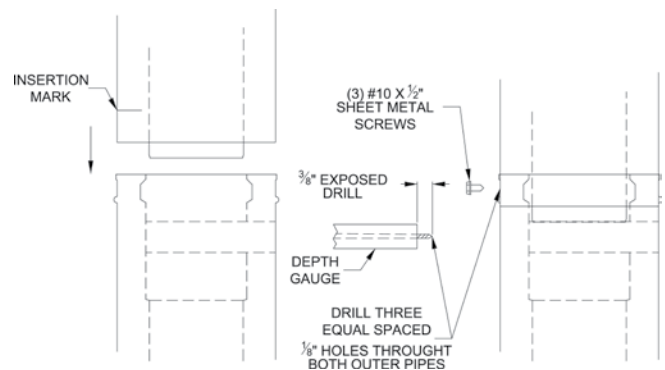


Figure 18: Joining Cuttable Pipe

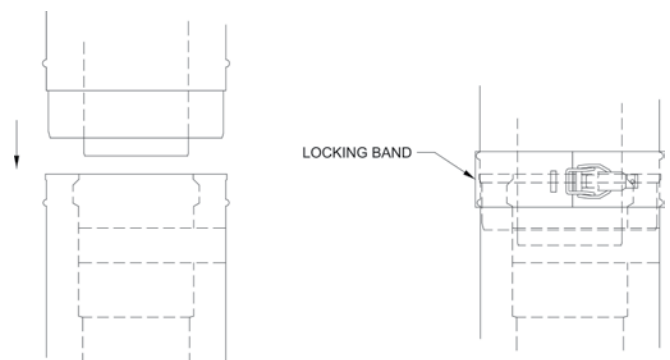


Figure 19: Joining Non-Cuttable Pipe

IV. Venting (continued)

- iv. Use locking bands (provided with all fittings) to secure non-cutable pipe, as well as fittings, to the boiler collar (see Figure 19).
- v. Use the same method to join all remaining vent components except for the terminal.

4. Horizontal Vent Termination

- a. Standard Concentric Termination
Refer to Figure 20.

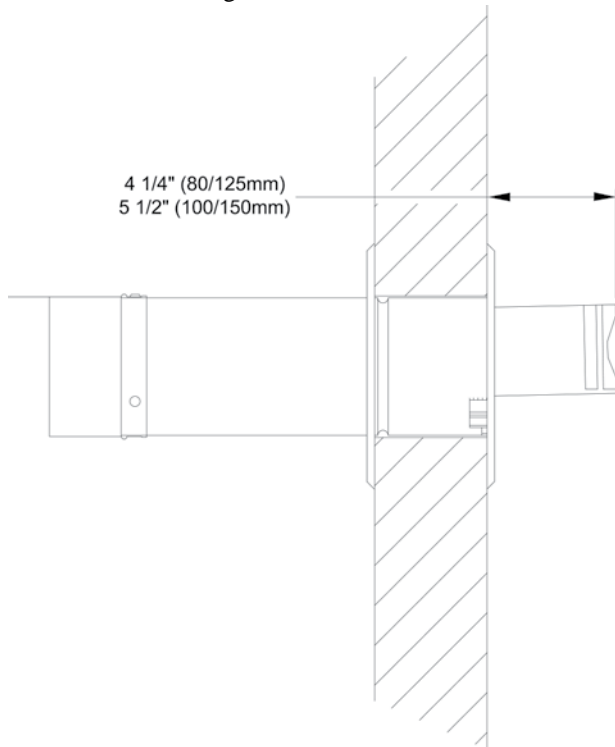


Figure 20: Horizontal Concentric Venting

- i. Permitted terminals for horizontal venting: Horizontal (Wall) Terminal, [80/125 mm (P/N 101808-01), 100/150 mm (P/N 101809-01)] - see Table 10.
- ii. Concentric Vent components supplied with the boiler are packed inside boiler carton and include the following:
 - Horizontal (Wall) Terminal,
 - Horizontal (Wall) Terminal consists of Straight section having plain male end with locking band clamp installed; Terminal Assembly with offset vent termination, and Outside Wall Plate, both riveted on the opposite end; overall length is approximately 28-1/8".
 - Separate Inside Wall Plate
 - Two Hardware Bags (each bag contains four screws and four anchors) to attach vent terminal Outside Wall Plate to exterior wall and Inside Wall Plate to interior wall.

- iii. For horizontal (sidewall) installation, the Horizontal (Wall) Terminal will extend past outer wall surface by 4 1/4" (80/125 mm) or 5 1/2" (100/150 mm). See Figure 20 "Horizontal Concentric Venting".
- iv. Install the Horizontal (Wall) Terminal:
 - Cut a 5 1/2" diameter hole through the exterior wall opening (for 80/125 mm concentric vent) or 6 1/2" (for 100/150 mm) at the planned location of the horizontal terminal.
 - Measure dimension "L" from exterior wall outer surface to the end of the last fitting. See Figure 21 'Dimension "L"'.
 - iii. For horizontal (sidewall) installation, the Horizontal (Wall) Terminal will extend past outer wall surface by 4 1/4" (80/125 mm) or 5 1/2" (100/150 mm). See Figure 20 "Horizontal Concentric Venting".
 - iv. Install the Horizontal (Wall) Terminal:
 - Cut a 5 1/2" diameter hole through the exterior wall opening (for 80/125 mm concentric vent) or 6 1/2" (for 100/150 mm) at the planned location of the horizontal terminal.
 - Measure dimension "L" from exterior wall outer surface to the end of the last fitting. See Figure 21 'Dimension "L"'.
 - When factory Horizontal (Wall) Terminal needs to be shortened, measure dimension "L" plus 1/4" from inside of the attached Outside Wall Plate and mark the Horizontal (Wall) Terminal outer pipe. To achieve a square cut of the outer pipe, place several marks around the outer pipe to establish a cut line. See Figure 22 'Cutting Vent Terminal Pipe'.
 - Carefully cut the outer pipe at the marked line using aviation shears, a hacksaw etc. Ensure the pipe is cut square and cut end is de-burred.
 - Mark the end of the Horizontal (Wall) Terminal inner polypropylene vent pipe to extend 3/8" past the cut end of the outer pipe. To achieve a square cut of the inner pipe, place several marks around the inner pipe to establish a cut line.
 - Cut off the marked end of inner polypropylene vent pipe with a fine tooth blade hacksaw etc. and de-burr. See Figure 22 "Cutting Vent Terminal Pipe". This pipe can be removed from the terminal to ease cutting, if desired.

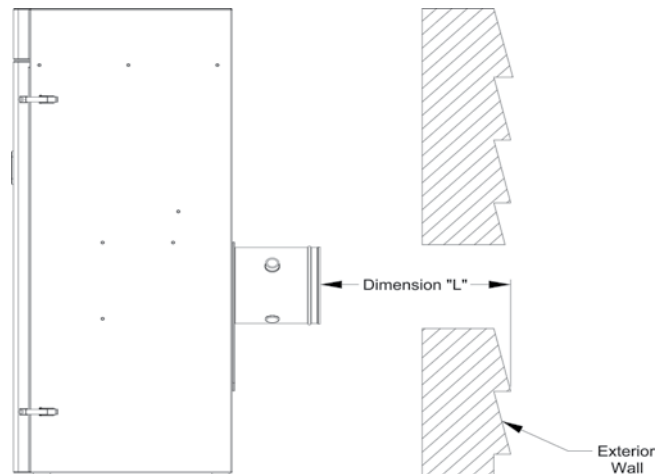


Figure 21: Dimension "L"

- When factory Horizontal (Wall) Terminal needs to be shortened, measure dimension "L" plus 1/4" from inside of the attached Outside Wall Plate and mark the Horizontal (Wall) Terminal outer pipe. To achieve a square cut of the outer pipe, place several marks around the outer pipe to establish a cut line. See Figure 22 'Cutting Vent Terminal Pipe'.
- Carefully cut the outer pipe at the marked line using aviation shears, a hacksaw etc. Ensure the pipe is cut square and cut end is de-burred.
- Mark the end of the Horizontal (Wall) Terminal inner polypropylene vent pipe to extend 3/8" past the cut end of the outer pipe. To achieve a square cut of the inner pipe, place several marks around the inner pipe to establish a cut line.
- Cut off the marked end of inner polypropylene vent pipe with a fine tooth blade hacksaw etc. and de-burr. See Figure 22 "Cutting Vent Terminal Pipe". This pipe can be removed from the terminal to ease cutting, if desired.

IV. Venting (continued)

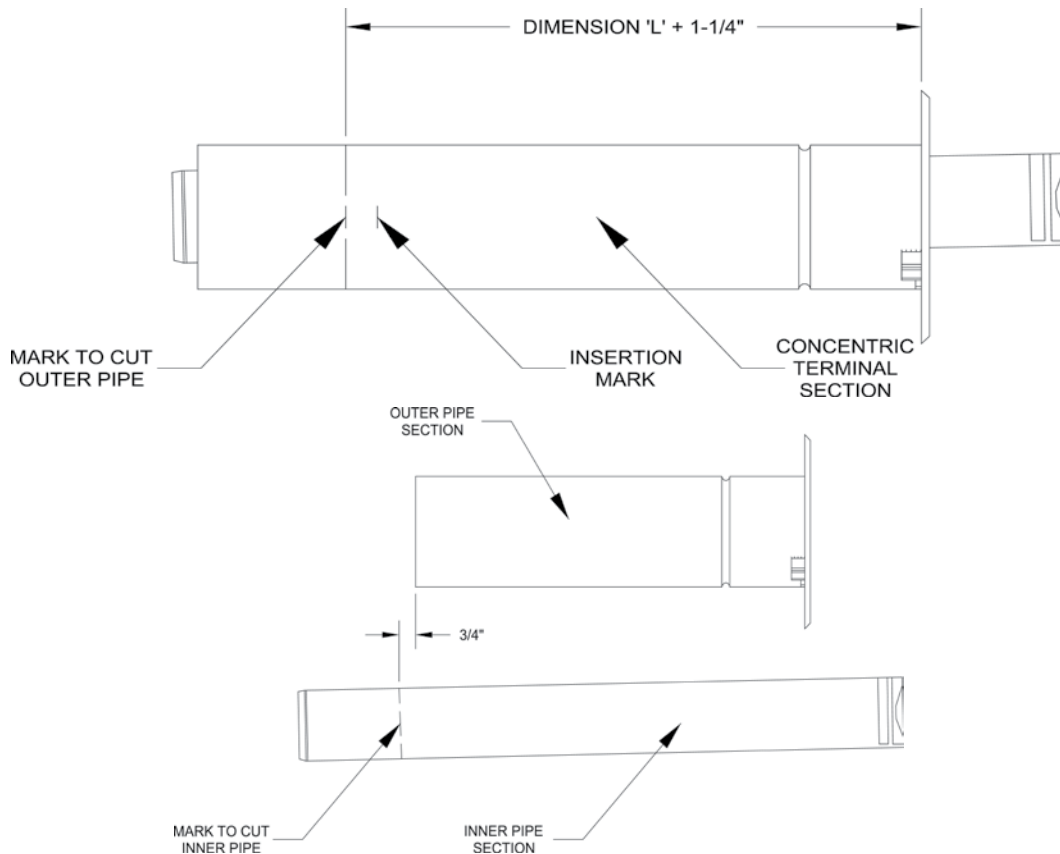


Figure 22: Cutting Vent Terminal Pipe

CAUTION

Exterior wall surface must be reasonably flat to attach the Outside Wall Plate. When exterior wall surface is not flat (covered with vinyl or wood shingle siding etc.) the siding must be removed, and a flat surface build up flash or above siding exterior surface to secure/seal the terminal Outside Wall Plate.

- Install the supplied Inside Wall Plate onto the shortened Horizontal (Wall) Terminal interior end and move the plate to cover interior wall cut opening. Secure the plate with provided fasteners, then, apply the sealant around plate sides to seal it to interior wall (refer to Figure 23).
- Lubricate the brown gasket inside boiler concentric vent collar or the last section of the vent pipe with small amount of water.
- Ensure that inner pipe of the terminal is evenly engaged into the gasket all around, then push the termination male end inside boiler concentric vent collar or the last section of the vent pipe, until the mark (see Step v) is no longer visible.

- Re-install locking band clamp onto the joint to secure the terminal to the collar or the last section of the vent pipe.

5. Vertical Vent Termination

- a. Standard Concentric Termination
Refer to Figures 24 thru 28.
 - i. In addition to the vertical terminal, either a Flat Roof Flashing or Sloped Roof Flashing is required for this installation. Refer to Table 10 'Concentric Vent Components' for details.
- Determine the centerline of the terminal location on the roof. For flat roof, cut $5\frac{1}{2}$ " diameter hole (80/125 mm concentric vent size) or $6\frac{1}{2}$ " (100/150 mm) for the terminal. For sloped roof, cut a hole in the roof large enough for the terminal to pass through the roof while remaining plumb.

CAUTION

If the boiler is located directly under the hole, cover it while cutting the hole to prevent debris from falling onto boiler.

IV. Venting (continued)

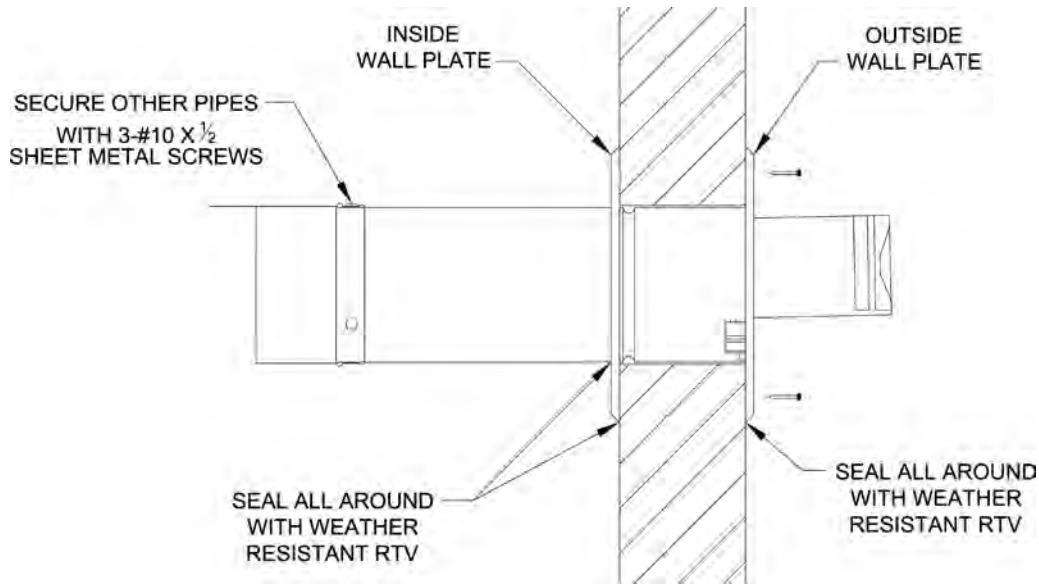


Figure 23: Completing Horizontal (Wall Terminal Installation)

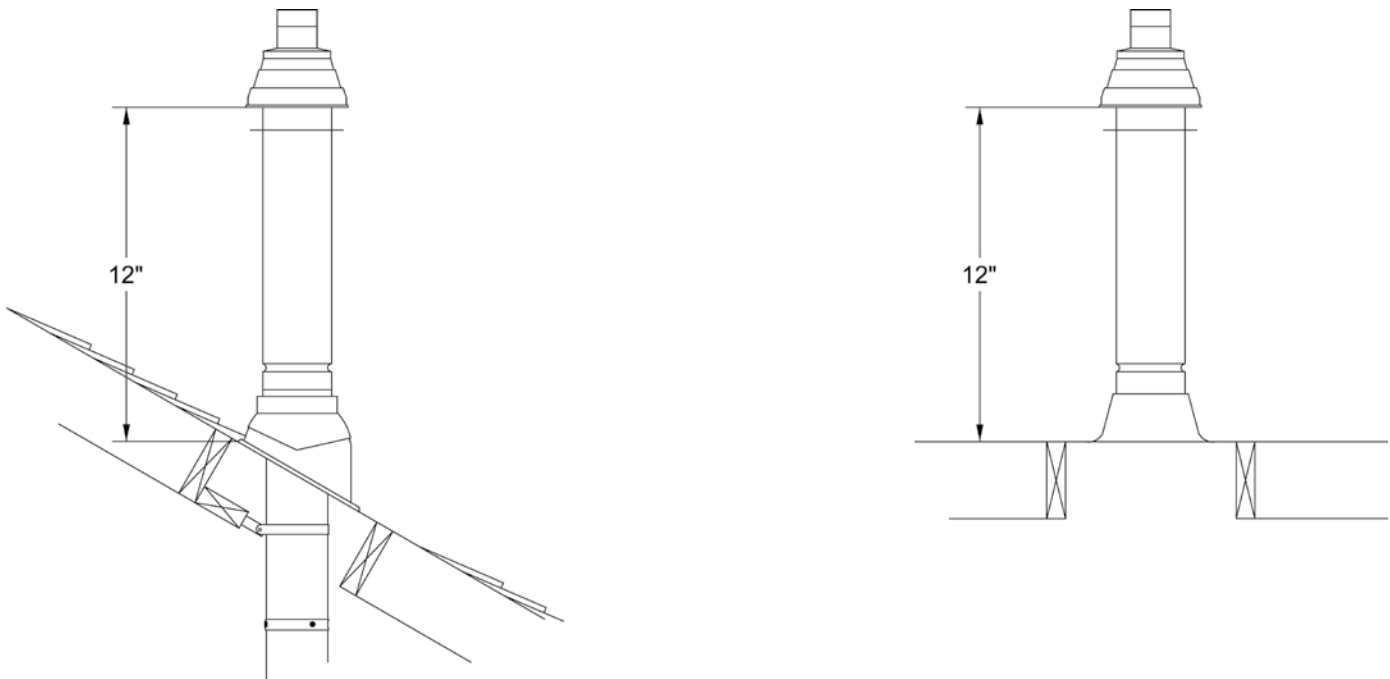


Figure 24: Vertical Concentric Vent Installation

- Install the roof flashing using standard practice on the roofing system of the structure.
- If not already done, assemble the venting system inside the building. The last section of pipe needs to be on the same center line as the terminal and within 19-1/4" of the top edge of the roof flashing.
- Measure distance "H" from the top edge of the storm collar to the end of the last fitting as shown in Figure 25.
- Add 1" to distance "H". Carefully mark this length on the pipe as shown in Figure 26.
- Cut the **outer pipe only** at the point marked in Step (e) using aviation shears, a hacksaw, or an abrasive wheel cutter. Be careful to cut the pipe square. De-burr the cut end with a file or emery cloth.
- Place a mark on the plastic inner pipe 3/8" beyond the end of the outer pipe (Figure 26). Use a fine tooth hacksaw to cut the plastic pipe and be careful to cut the pipe square. De-burr the cut edge of the plastic pipe with a file or emery cloth.
- Make a mark on the terminal section 1" from the cut end of the outer pipe as shown in Figure 26.

IV. Venting (continued)

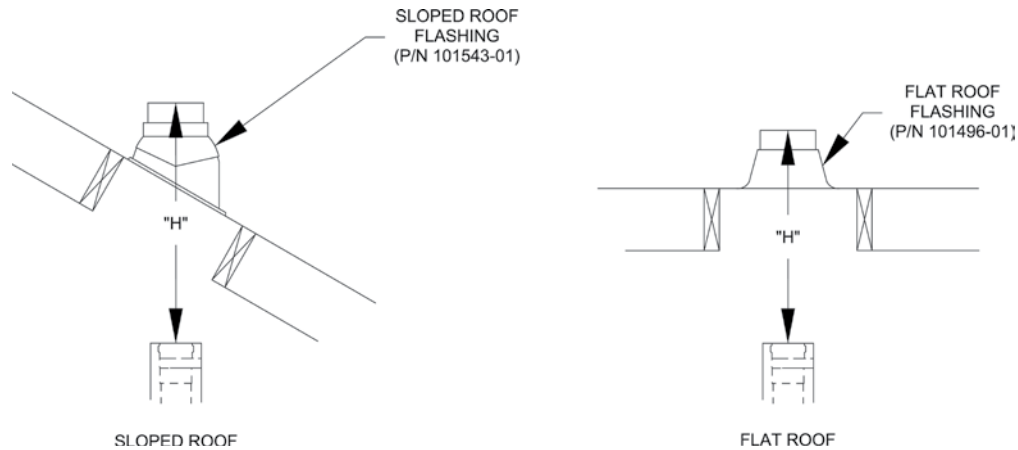


Figure 25: Dimension "H"

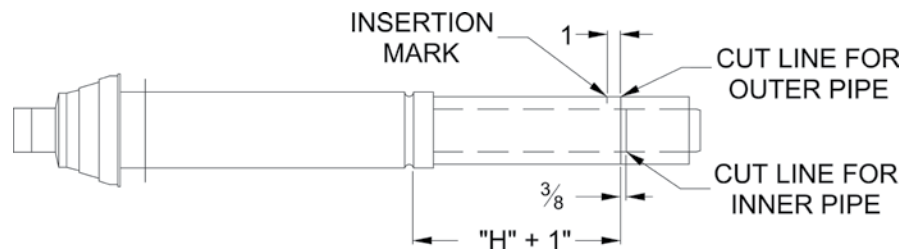


Figure 26: Cutting Vertical Terminal

- Slip the terminal section through the roof from the outside. Push into the last section of vent pipe until the mark made in Step (h) is not longer visible. Secure the terminal to the last piece of pipe with three #10 x 1/2" sheet metal screws. Drill a 1/8" hole through both outer pipes to start these screws. **Use a drill stop or other means to ensure that the drill bit does not penetrate more than 3/8" into the outer pipe. Do not use a sheet metal screw longer than 1/2".**
 - Secure the terminal section to the inside of the roof structure using the mounting bracket provided with the terminal (Figure 27).
- b. Optional Concentric Chimney Chase Installation
Refer to Figure 28.

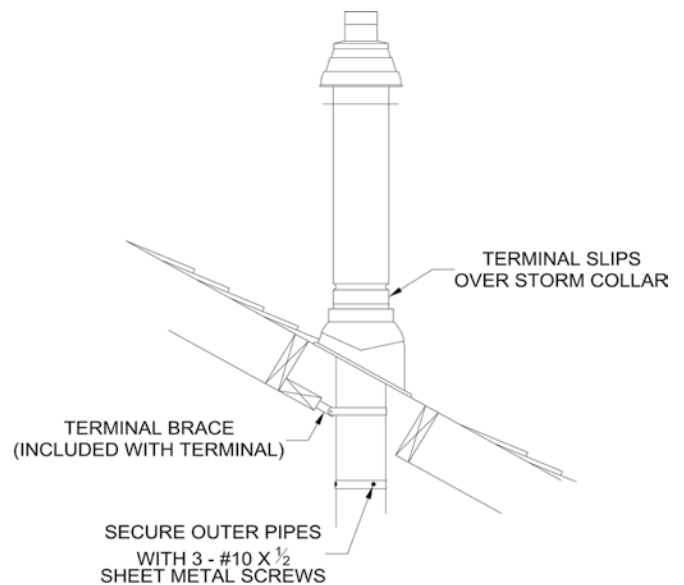


Figure 27: Completing Vertical Terminal Installation

- i. A vertical concentric vent system can be installed in an UNUSED masonry chimney.
- The Chimney chase Support Elbow with attached Mounting Bracket is used at the base of the chimney. Refer to Table 10 'Concentric Vent Components' for details. Slip the elbow over the M10 x 35 screw in the support bracket. Determine the desired vertical location of the support elbow in the chimney and mark the location of the pin, positioned on the back of the support bracket, onto the chimney rear wall. Drill

a 7/16" diameter x 3-1/2" deep hole in the marked location, then, insert the back bracket pin into the hole. The front of the elbow mounting bracket should be supported either by bottom of the opening into chimney or installer supplied spacer.

- Construct a weather-tight flat roof to cover the top of the old chimney. Install the vertical terminal through this roof using the flat roof flashing.

IV. Venting (continued)

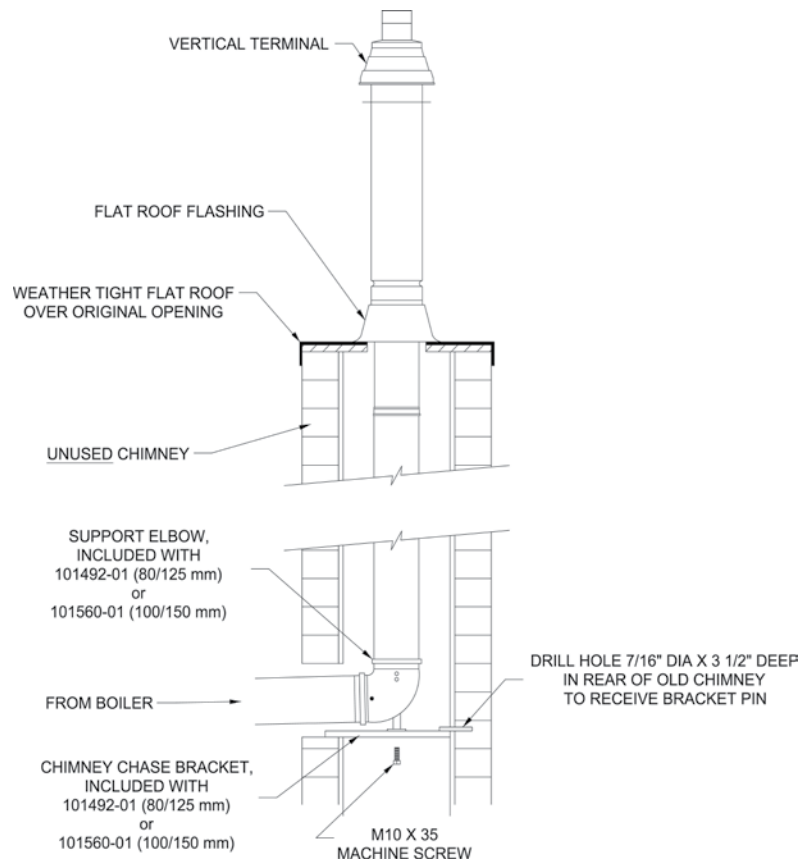


Figure 28: Chimney Chase Installation

E. Removing the Existing Boiler

For installations not involving the replacement of an existing boiler, proceed to Step B.

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances. 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.
4. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after five (5) minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part II in the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

V. Condensate Disposal

A. Condensate Trap and Drain Line.

1. All condensate, which forms in the boiler or vent system, collects in the sump under heat exchanger and leaves the boiler through factory installed condensate trap.
2. The trap allows condensate to drain from sump while retaining flue gases in the boiler. The trap has factory installed overflow switch, which shuts down the boiler in the event the drain line becomes obstructed, preventing proper condensate removal. Refer to Section XIII "Service and Maintenance" for condensate trap and condensate overflow switch removal and replacement procedure, if required.
3. Note the following when disposing of the condensate:
 - a. Condensate is slightly acidic, typical pH around 3.5 - 4.5. Do not use metallic pipe or fittings in the condensate drain line. Do not route the drain line through areas that could be damaged by leaking condensate.
 - b. Do not route or terminate the condensate drain line in areas subject to freezing temperatures.
 - c. If the point of condensate disposal is above the trap, a condensate pump is required to move the condensate to the drain. Select a condensate pump approved for use with condensing furnaces. If overflow from the pump would result in property damage, select a pump with an overflow switch. Wire this switch in series with installer provided external high limit, to shut off the boiler, and, if desired, in series with installer-supplied alarm, to trigger an alarm in the event of overflow.
 - d. Do not attempt to substitute another trap for one provided with the boiler.
 - e. In order for boiler to work properly, the boiler must be leveled during installation.
4. The condensate trap stub is located at boiler left side, below inlet and outlet water pipe connections. Refer to Figures 1A thru 1D.
5. Condensate trap must be filled up with water, prior to boiler start-up and before connecting any condensate line to the boiler, to insure combustion products cannot escape from operating boiler. To fill the trap, inject water in the amount of 1 cup (8 fluid ounces) through condensate trap stub opening. Do not overfill the trap.

6. If any additional condensate drain line is needed, construct the extension from PVC or CPVC Schedule 40 pipe. The factory supplied $\frac{3}{4}$ " x 5-5/8" long PVC coupling, located in the Part Carton, must be used to connect drain line to the condensate trap stub. Do not over tighten coupling compression nuts when connecting drain line and condensate trap stub.

WARNING

Failure to install the condensate trap and condensate drain in accordance with the above instructions could cause flue gas to enter the building, resulting in personal injury or death.

CAUTION

Boiler condensate is corrosive. Route condensate drain line in a manner such that any condensate leakage will not cause property damage.

Some jurisdictions may require that condensate be neutralized prior to disposal.

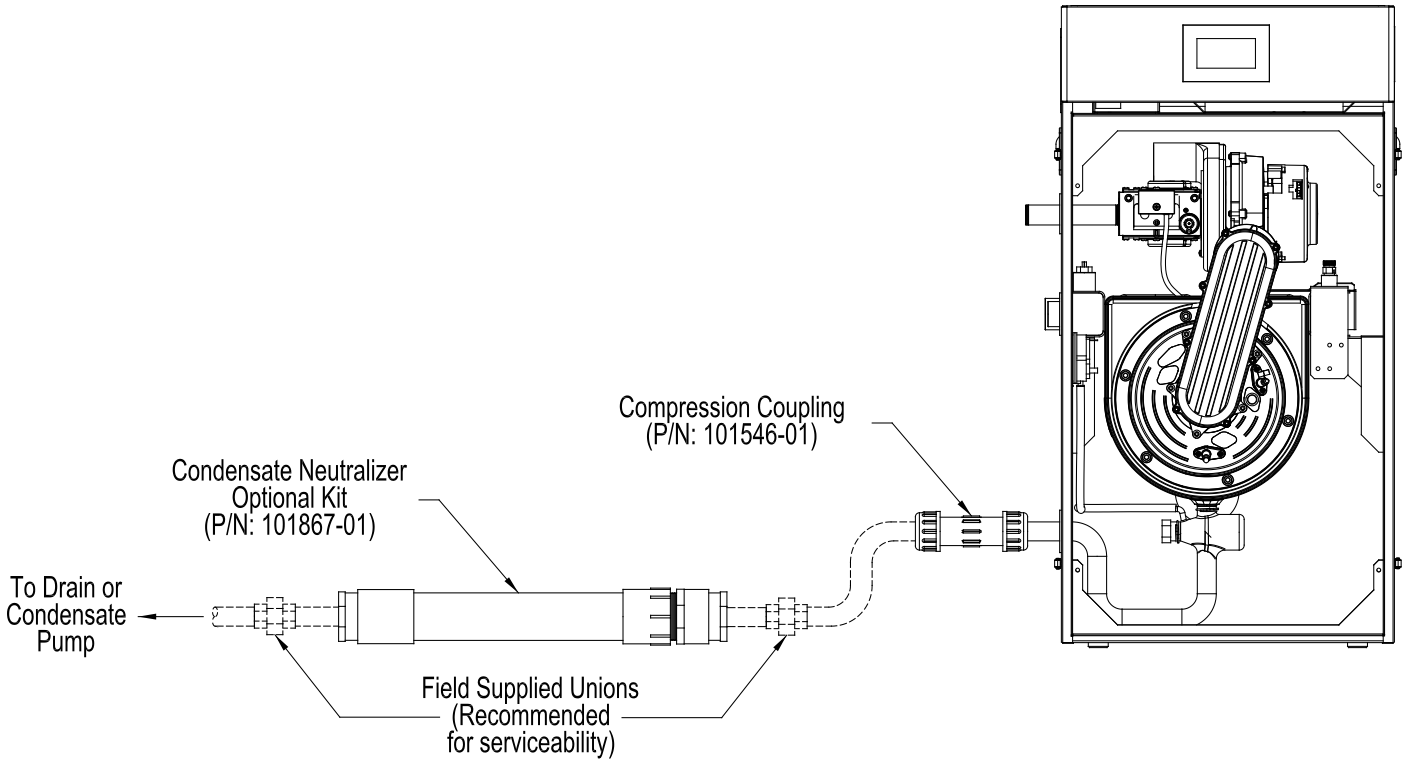
NOTICE

Use materials approved by the authority having jurisdiction.

B. Condensate Neutralizer Installation

1. Some jurisdictions may require that the condensate be neutralized before being disposed of. Follow local codes pertaining to condensate disposal.
2. A Condensate Neutralizer Kit (P/N 101867-01) is available as optional equipment. Follow local codes and instructions enclosed with the kit for Condensate Neutralizer installation.
3. Limestone chips will get coated by neutral salts (product of chemical reaction between limestone and acidic condensate) and lose neutralizing effectiveness over time. Therefore, periodic condensate neutralizer maintenance and limestone chip replacement must be performed. A pH test or acid test kits are available from HVAC/plumbing distributors and should be used to measure condensate acidity before/after neutralizer thus indicating a need for service and chip replacement.

V. Condensate Disposal (continued)



Dashed line parts are field supplied.

Figure 29: Condensate Trap and Drain Line

VI. Water Piping and Trim

WARNING

Failure to properly pipe boiler may result in improper operation and damage to boiler or structure.

Install boiler so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, etc.).

Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure. U.S. Boiler's Standard Warranty does not cover problems caused by oxygen contamination of boiler water or scale (lime) build-up caused by frequent addition of water.

Do not fill boiler with softened water to prevent chloride contamination.

A. Installation of Factory Supplied Piping and Trim Components

Alpine (ALP) boilers have factory supplied Miscellaneous Part Carton (P/N 102942-01 – ALP080 thru ALP210; 102942-02 – ALP285; 102942-03 – ALP399 thru ALP500), which includes supply piping components, gas piping components, Temperature & Pressure Gauge, Pressure Relief Valve and Drain Valve. See Figure 30 “Factory Supplied Piping and Trim Installation”.

Install these components prior to connecting boiler to system piping as follows:

1. Relief Valve Piping, ALP080 thru ALP285 Boiler Models
 - a. Locate and remove $\frac{3}{4}$ " NPT x close black nipple, $\frac{3}{4}$ " NPT black tee, $\frac{3}{4}$ " MPT x $\frac{3}{4}$ " FPT Pressure Relief Valve, $\frac{3}{4}$ " NPT Drain Valve.
 - b. Install close nipple into tee branch, then, screw the assembly into boiler left side front $\frac{3}{4}$ " tapping making sure tee run outlets are in vertical plane and parallel to boiler side.
 - c. Mount $\frac{3}{4}$ " MPT x $\frac{3}{4}$ " FPT Pressure Relief Valve into the tee top outlet.
 - d. Install Drain Valve into the tee bottom outlet.

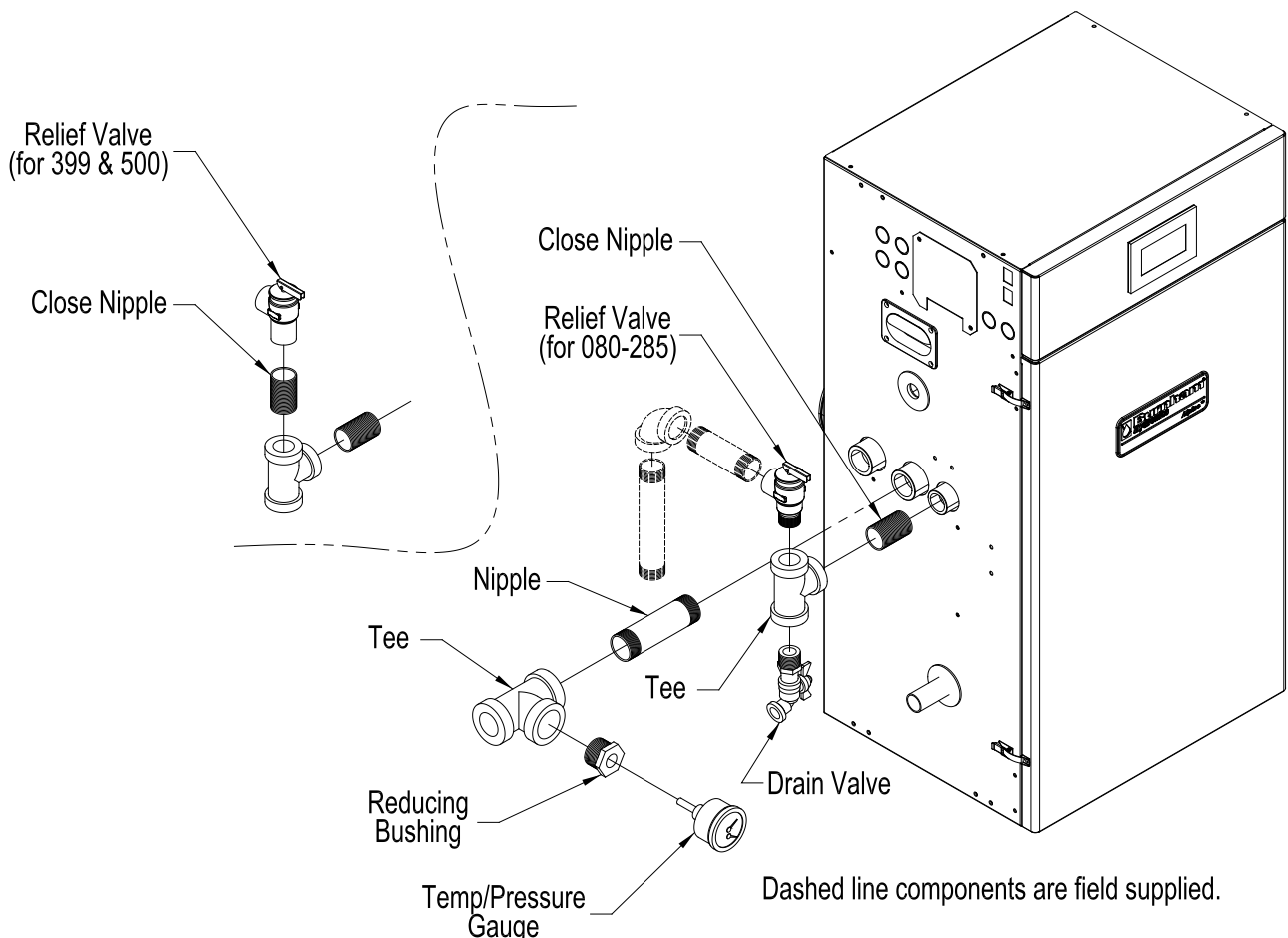


Figure 30: Factory Supplied Piping and Trim Installation

VI. Water Piping and Trim (continued)

2. Relief Valve Piping, ALP399 and ALP500 Boiler Models
 - a. Locate and remove (2) 3/4" NPT x close black nipples, 3/4" NPT black tee, 3/4" FPT x 3/4" FPT Pressure Relief Valve, 3/4" NPT Drain Valve.
 - b. Install close nipple into tee branch, then, screw the assembly into boiler left side front 3/4" tapping making sure tee run outlets are in vertical plane and parallel to boiler side.
 - c. Install the second close nipple into tee run top outlet.
 - d. Mount 3/4" FPT x 3/4" FPT Pressure Relief Valve into the tee top outlet.
 - e. Install Drain Valve into the tee bottom outlet.
3. Temperature /Pressure Gauge Piping, ALP080 thru ALP210 Boiler Models
 - a. Locate and remove 1" NPT x 4" long black nipple, 1" x 1" x 1" NPT black tee, 1" x 1/4" NPT black reducing bushing and Temperature & Pressure Gauge.
 - b. Mount the nipple into 1" boiler supply tapping (see Figures 1A and 1B), then, install the tee onto the nipple, making sure 1" branch outlet is in horizontal plane and facing the boiler front.
 - c. Install 1" x 1/4" NPT black reducing bushing into the tee branch, then, put in Temperature & Pressure Gauge.
4. Temperature /Pressure Gauge Piping, ALP285 Boiler Model
 - a. Locate and remove 1/4" NPT x 2" long black nipple, 1/4" x 1/4" x 3/4" NPT black tee, 3/4" x 1/4" NPT black reducing bushing and Temperature & Pressure Gauge.
 - b. Mount the nipple into 1/4" boiler supply tapping (see Figures 1B and 1C), then, install the tee onto the nipple, making sure 3/4" branch outlet is in horizontal plane and facing the boiler front.
 - c. Install 3/4" x 1/4" NPT black reducing bushing into the tee branch, then, put in Temperature & Pressure Gauge.
5. Temperature /Pressure Gauge Piping, ALP399 and ALP500 Boiler Models
 - a. Locate and remove 1/2" NPT x 2" long black nipple, 1/2" x 1/2" x 3/4" NPT black tee, 3/4" x 1/4" NPT black reducing bushing and Temperature & Pressure Gauge.

- b. Mount the nipple into 1/2" boiler supply tapping (see Figures 1B and 1D), then, install the tee onto the nipple, making sure 3/4" branch outlet is in horizontal plane and facing the boiler front.
- c. Install 3/4" x 1/4" NPT black reducing bushing into the tee branch, then, put in Temperature & Pressure Gauge.

B. Piping System To Be Employed.

Alpine (ALP) boilers are designed to operate in a closed loop pressurized system. Minimum pressure in the boiler must be 12 PSI. Proper operation of the Alpine (ALP) boiler requires that the water flow through the boiler remain within the limits shown in Table 11, any time the boiler is firing.

NOTICE

Failure to maintain the flow through boiler within specified limits could result in erratic operation or premature boiler failure.

1. **Near boiler piping must isolate ALP boiler from system piping via closely spaced tees** to insure specified flow range through boiler any time the boiler is firing:
 - a. The flow rate through the isolated near-boiler loop is maintained by factory recommended and installer supplied boiler circulator.
 - b. The flow rate through the isolated near-boiler loop **is completely independent** of the flow rate through the heating system loop(s).
 - c. The flow rate through the heating system loop(s) is controlled by installer sized/provided system loop circulator(s).
 - d. This piping arrangement can be used either for space heating-only applications or space heating with indirect water heater(s) applications.
 - i. **Space heating only** - refer to Table 12 and Figure 31 "Near Boiler Piping - Heating Only" as applicable.
 - ii. **Space heating plus indirect water heater(s)** - refer to Table 12 and Figure 32 "Near Boiler Piping - Heating Plus Indirect Water Heater" as applicable.

VI. Water Piping and Trim (continued)

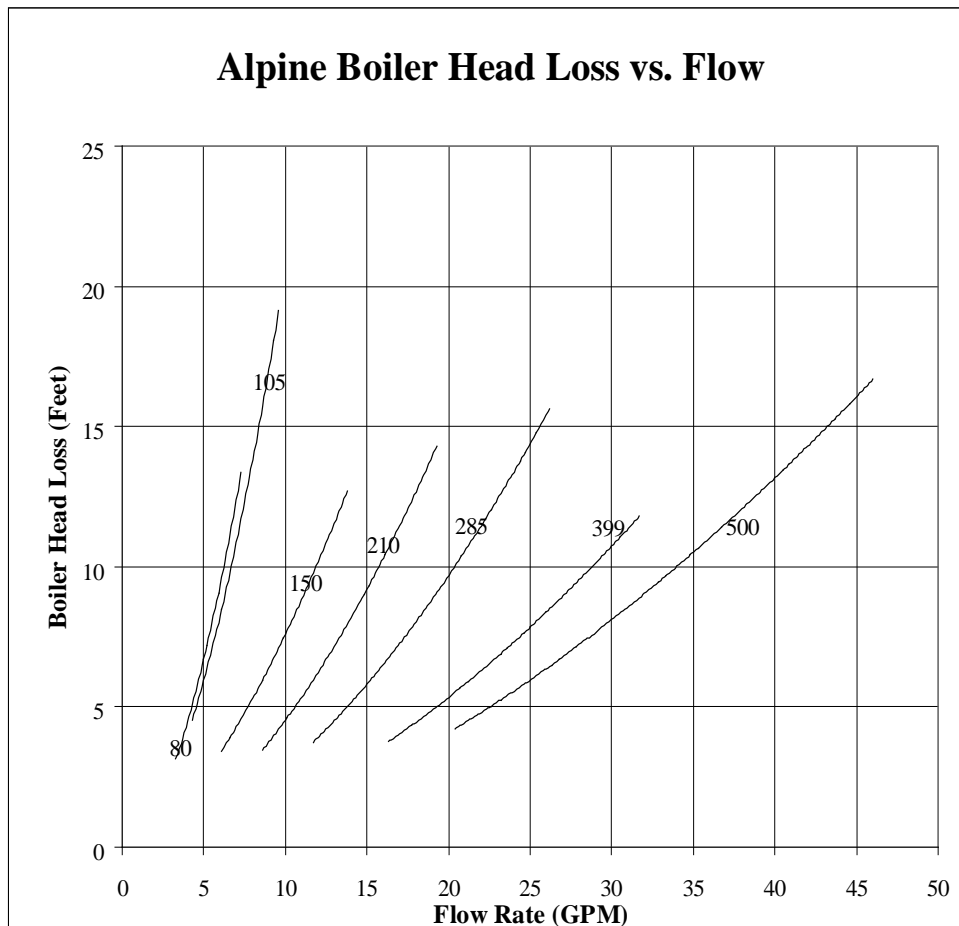
Table 11: Flow Range Requirement Through Boiler

Boiler Model	Boiler Supply Connection, Inch, FPT	Boiler Return Connection, Inch, FPT	Minimum Required Flow (GPM) @ 35°F ΔT	Boiler Head Loss, Ft. @ 35°F ΔT	Required Flow, (GPM) @ 30°F ΔT	Boiler Head Loss, Ft. @ 30°F ΔT	Required Flow, (GPM) @ 25°F ΔT	Boiler Head Loss, Ft. @ 25°F ΔT	Maximum Required Flow (GPM) @ 20°F ΔT	Boiler Head Loss, Ft. @ 20°F ΔT
ALP080	1	1	4.2	4.8	4.9	6.4	5.8	8.9	7.3	13.4
ALP105	1	1	5.5	7.0	6.4	9.3	7.7	12.8	9.6	19.1
ALP150	1	1	7.9	5.2	9.2	6.6	11.0	8.9	13.8	12.7
ALP210	1	1	11.1	5.4	12.9	7.1	15.5	9.8	19.4	14.4
ALP285	1¼	1¼	15.1	5.9	17.7	7.8	21.2	10.7	26.5	16.0
ALP399	1½	1½	21.5	6.1	25.1	7.9	30.2	10.8	37.7	15.9
ALP500	1½	1½	27.0	6.8	31.5	8.8	37.8	12.0	47.2	17.4

Notes: Required Flow (GPM) = ** Output (MBH) x 1000/500 x ΔT

** Output (MBH) - Select Value for specific Boiler Model from Tables 2A or 2B

Using boiler antifreeze will result in higher fluid density and may require larger circulators.



VI. Water Piping and Trim (continued)

Table 12: Recommended Circulator Models for Alpine (ALP) Boilers Based on 25°F Temperature Differential and Up to 75 ft. Equivalent Length Near-Boiler Piping - Space Heating Circulator

Boiler Model	Boiler Supply Connection, Inch, FPT	Boiler Return Connection, Inch, FPT	Near-Boiler Piping Supply Pipe Size, Inch	Near-Boiler Piping Return Pipe Size, Inch	Flow, GPM @ 25°F Temp. Differential	Combined Boiler & Piping Loop Head Loss, Ft.	* Recommended Circulator Make & Model
ALP080	1	1	1	1	5.8	10.3	Taco 0010 Grundfos UPS 15-58 FRC
ALP105	1	1	1	1	7.7	15.1	Taco 0014 Grundfos UPS 26-99 FC (second speed)
ALP150	1	1	1	1	11.0	13.1	Taco 0014 Grundfos UP 26-99 FC (first speed)
ALP210	1	1	1¼	1¼	15.5	12.7	Taco 0014 Grundfos UP 26-99 FC (first speed)
ALP285	1¼	1¼	1½	1½	21.5	13.0	Taco 0013 Grundfos UP 26-99 FC (third speed)
ALP399	1½	1½	2	2	30.2	12.0	Taco 1400-20 Grundfos UPS 32-80/2 F (second speed)
ALP500	1½	1½	2	2	37.8	13.9	Taco 1400-30 Grundfos UPS 32-80/2 F (third speed) or 40-80/2 F (second speed)

Notes:

- * Circulator Models shown are not equipped with internal flow check valve (IFC).
- When selecting Circulators with IFC contact Circulator Manufacturer for sizing information.
- Near-Boiler Piping Size shown is based on 2 to 5.5 Ft/Sec. velocity range to avoid potential noise and pipe erosion.

NOTICE

Where it is not possible to install a separate boiler loop, the system circulator must be sized to ensure that the flow through boiler stays within the defined parameters to prevent overheating when the boiler is fired at its full rated input. Install a flow meter to measure the flow, or fire the boiler at full rate and ensure the boiler ΔT does not exceed 35°F.

2. **Direct connection of Alpine (ALP) boiler to heating system**, similar to a conventional boiler, is NOT RECOMMENDED because:
 - a. The flow rate through system must be the same as through boiler and fall within limits specified in Table 11.
 - b. Pressure drop through entire system must be known, added to pressure drop through boiler, and, a circulator selected to provide required flow at total calculated pressure drop.
 - c. It is often very difficult to accurately calculate the pressure drop through the system.
 - d. In replacement installations, it may be nearly impossible to get an accurate measurement of piping amount and number of fittings in the system. If system is zoned, the system flow rate may drop well below recommended minimum flow when only a single zone is calling for heat.

C. Piping Standard Installation Requirements.

Observe the following guidelines when making the actual installation of the boiler piping:

1. **Pressure Relief Valve (Required)** - The relief valve is packaged loose with boiler and must be installed in the location shown in Figure 30 "Factory Supplied Piping and Trim Installation". The relief valve must be installed with spindle in vertical position. Installation of the relief valve must comply with ASME Boiler and Pressure Vessel Code, Section IV. The standard factory shipped relief valve is rated for 30 PSI maximum working pressure for ALP080 thru ALP285 and 50 PSI for ALP399 and ALP500. Optional 50 PSI, 80 PSI and 100 PSI maximum working pressure rated relief valves are available. If the valve is to be replaced, the replacement valve must have a relief capacity equal or exceeding the boiler DOE Heating Capacity (models ALP080 thru ALP285) or the boiler I=B=R Gross Output rating (model ALP399 and ALP500). Pipe the relief valve discharge to a location where hot water or steam will not create hazard or property damage if the valve opens. The end of the discharge pipe must terminate in an unthreaded pipe. If the relief valve is not piped to a drain, it must terminate at least 6" above the floor. Do not run relief valve discharge piping through an area prone to freezing. The termination of discharge piping must be in an area where it will not become plugged by debris.

VI. Water Piping and Trim (continued)

Table 13: Fitting and Valve Equivalent Length

Copper Fitting and Sweat Valve Equivalent Length (Ft)				
Fitting or Valve Description	Copper Pipe or Valve Size			
	1	1¼	1½	2
90° Elbow	2.5	3.0	4.0	5.5
45° Elbow	1.0	1.2	1.5	2.0
Tee (thru flow)	0.5	0.6	0.8	1.0
Tee (Branch flow)	4.5	5.5	7.0	9.0
Diverter Tee (typical)	23.5	25.0	23.0	23.0
Gate Valve	0.3	0.4	0.5	0.7
Globe Valve	25.0	36.0	46.0	56.0
Angle Valve	5.3	7.8	9.4	12.5
Ball Valve (standard port)	4.3	7.0	6.6	14.0
Ball Valve (full port)	1.9	1.4	2.2	1.3
Swing Check Valve	4.5	5.5	6.5	9.0
Flow-Check Valve (typical)	54.0	74.0	57.0	177.0
Butterfly Valve	2.7	2.0	2.7	4.5

Table 13: Fitting and Valve Equivalent Length (cont'd)

Threaded Fitting and Valve Equivalent Length (Ft)				
Fitting or Valve Description	Black Threaded Pipe or Valve Size			
	1	1¼	1½	2
90° Elbow	2.6	3.5	4.0	5.2
Long Radius Elbow (45° or 90°)	1.4	1.8	2.2	2.8
Tee (thru flow)	1.8	2.3	2.7	3.5
Tee (Branch flow)	5.3	6.9	8.1	10.0
Close Return Bend	4.4	5.8	6.7	8.6
Gate Valve (full open)	0.7	0.9	1.1	1.4
Globe Valve (full open)	30.0	39.0	46.0	59.0
Angle Valve (full open)	13.0	17.0	20.0	26.0
Swing Check Valve (full open)	8.7	12.0	13.0	17.0
Flow-Check Valve (typical)	42.0	60.0	63.0	83.0

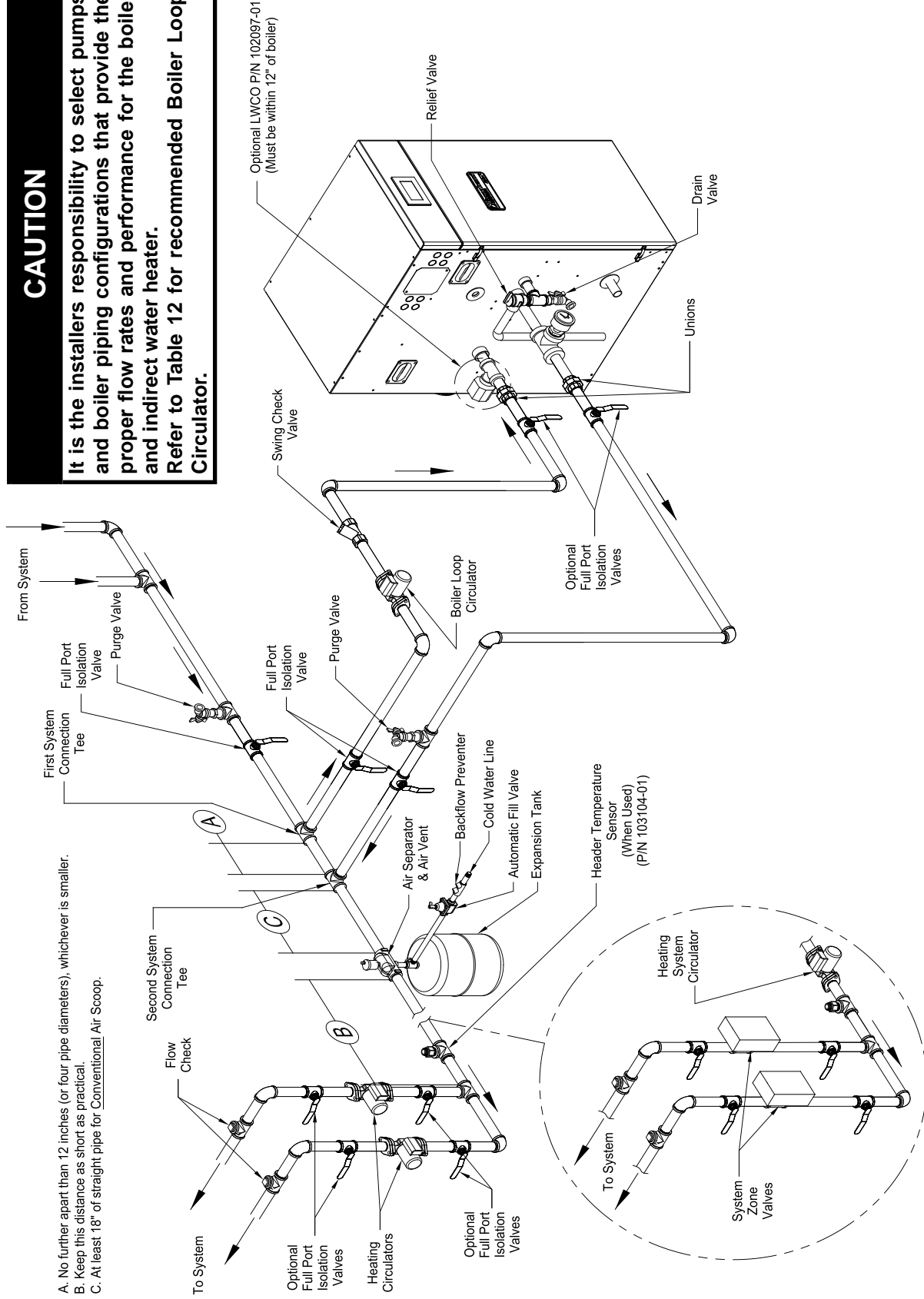
NOTE: Table 13 is provided as reference to assist in piping design and specifies equivalent length of typical piping fittings and valves.

NOTICE

The Alpine (ALP) boiler heat exchanger is made from stainless steel tubular coil having relatively narrow waterways. Once filled with water, it will be subject to the effects of corrosion. Failure to take the following precautions to minimize corrosion and heat exchanger waterways overheating could result in severe boiler damage.

- Before connecting the boiler, insure the system is free of impurities, grease, sediment, construction dust, sand, copper dust, flux and any residual boiler water additives. Flush the system thoroughly and repeatedly, if needed, with clear water mixed with concentrated rinse agent to remove these contaminants completely.
- Iron oxide (red oxide sludge Fe_2O_3) is produced during oxygenation. To minimize any oxygen presence in the system, the system must be air free and leak tight. Do not connect the boiler to radiant tubing without an oxygen barrier. Using automatic water refill is not recommended, however, if such refill is employed, a water meter must be added to evaluate the makeup water volume taken after initial fill and eliminate any water leakage as early as possible.
- Maintain the water pressure in the boiler at a minimum of 12 PSI.
- The boiler water pH must be within $8.2 < pH < 9.5$. If the system contains any aluminum components, pH must be less than 8.5.
- Black oxide sludge (magnetite Fe_3O_4) forms as the result of continuous electrolytic corrosion in any system not protected by an inhibitor.
- Scale deposit is made up of lime scale contained in most distributed water and settles over the warmest surfaces of boiler heat exchanger causing subsequent overheating and eventual failure. Water hardness must be maintained within 3 to 9 grain/gal range.
- Refer to Section XIII "Service and Maintenance" for recommended heating system water treatment products (corrosion/scale inhibitors, cleaners etc) and their suppliers.

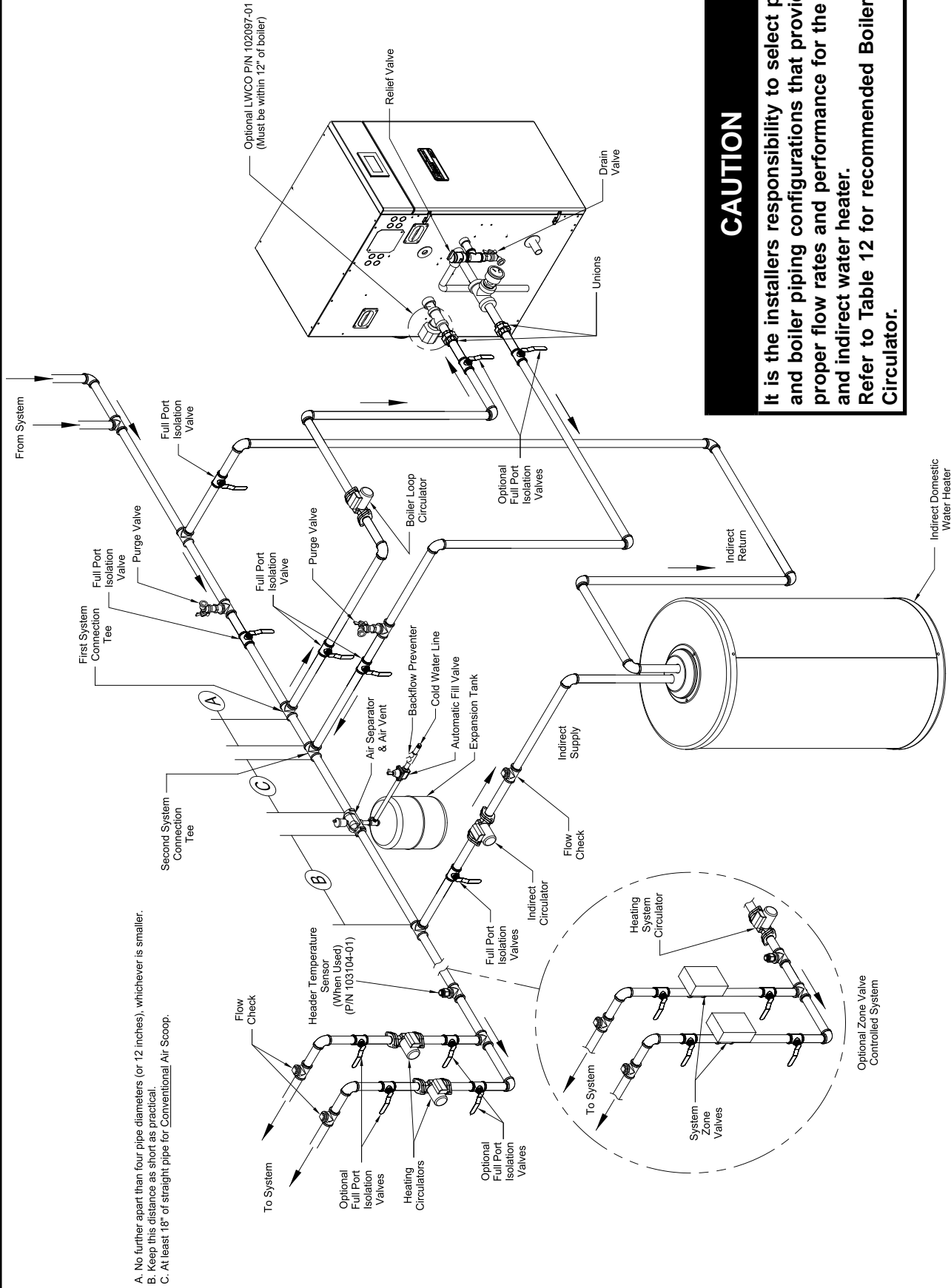
CAUTION
 It is the installers responsibility to select pumps and boiler piping configurations that provide the proper flow rates and performance for the boiler and indirect water heater.
 Refer to Table 12 for recommended Boiler Loop Circulator.



- A. No further apart than 12 inches (or four pipe diameters), whichever is smaller.
- B. Keep this distance as short as practical.
- C. At least 18" of straight pipe for Conventional Air Scoop.

Figure 31: Near Boiler Piping - Heating Only

VI. Water Piping and Trim (continued)



- A. No further apart than four pipe diameters (or 12 inches), whichever is smaller.
- B. Keep this distance as short as practical.
- C. At least 18" of straight pipe for Conventional Air Scoop.

CAUTION
 It is the installer's responsibility to select pumps and boiler piping configurations that provide the proper flow rates and performance for the boiler and indirect water heater. Refer to Table 12 for recommended Boiler Loop Circulator.

Figure 32: Near Boiler Piping - Heating Plus Indirect Water Heater

VI. Water Piping and Trim (continued)

WARNING

Pressure relief valve discharge piping must be piped such that the potential of severe burns is eliminated. DO NOT pipe in any area where freezing could occur. DO NOT install any shut-off valves, plugs or caps. Consult Local Codes for proper discharge piping arrangement.

2. **Circulator (Required)** – Usually at least two circulators will be required to properly install a Alpine™ Series boiler. See Paragraph B above for information on sizing the circulators.
3. **Expansion Tank (Required)** - If this boiler is replacing an existing boiler with no other changes in the system, the old expansion tank can generally be reused. If the expansion tank must be replaced, consult the expansion tank manufacturer's literature for proper sizing.
4. **Fill Valve (Required)** – Either manual (recommended) or automatic fill valve may be used. However, if automatic refill is employed, a water meter must be added to evaluate the makeup water volume taken after initial fill and eliminate any water leakage as early as possible.
5. **Automatic Air Vent (Required)** -At least one automatic air vent is required. Manual vents will usually be required in other parts of the system to remove air during initial fill.
6. **Manual Reset High Limit (Required by some Codes)** - This control is required by ASME CSD-1 and some other codes. Install the high limit in the boiler supply piping just above the boiler with no intervening valves. Set the manual reset high limit to 200°F. Wire the limit per Figures 35 and 37A in Section VIII "Electrical".
7. **Flow Control Valve (Strongly Recommended)** - The flow control valve prevents flow through the system unless the circulator is operating. Flow control valves are used to prevent gravity circulation or "ghost flows" in circulator zone systems through zones that are not calling for heat.
8. **Isolation Valves (Strongly recommended)** - Isolation valves are useful when the boiler must be drained, as they will eliminate having to drain and refill the entire system.

9. **Drain Valve (Required)** – Drain valve is packaged loose with boiler and must be installed in the location shown in Figure 30 "Factory Supplied Piping and Trim Installation".
10. **Low Water Cutoff (Required by some Codes)** – LWCO with harness and LWCO transformer are available as optional components. Order Complete Kit (Part No. 102097-01) when required.

D. Special Situation Piping Installation Requirements

Observe the following guidelines when making the actual installation of the boiler piping for special situations:

1. Systems containing high level of dissolved oxygen – Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to Alpine (ALP) boiler heat exchanger. Some examples include but not limited to:
 - Radiant systems employing tubing without oxygen barrier
 - Systems with routine additions of fresh water
 - Systems open to atmosphereIf the boiler is used in such a system, it must be separated from oxygenated water being heated with a heat exchanger as shown in Figure 33. Consult the heat exchanger manufacturer for proper heat exchanger sizing as well as flow and temperature requirements. All components on the oxygenated side of the heat exchanger, such as the pump and expansion tank, must be designed for use in oxygenated water.
2. Piping with a Chiller - If the boiler is used in conjunction with a chiller, pipe the boiler and chiller in parallel. Use isolation valves to prevent chilled water from entering the boiler.
3. Boiler Piping with Air Handlers - Where the boiler is connected to air handlers through which refrigerated air passes, use flow control valves in the boiler piping or other automatic means to prevent gravity circulation during the cooling cycle.

VI. Water Piping and Trim (continued)

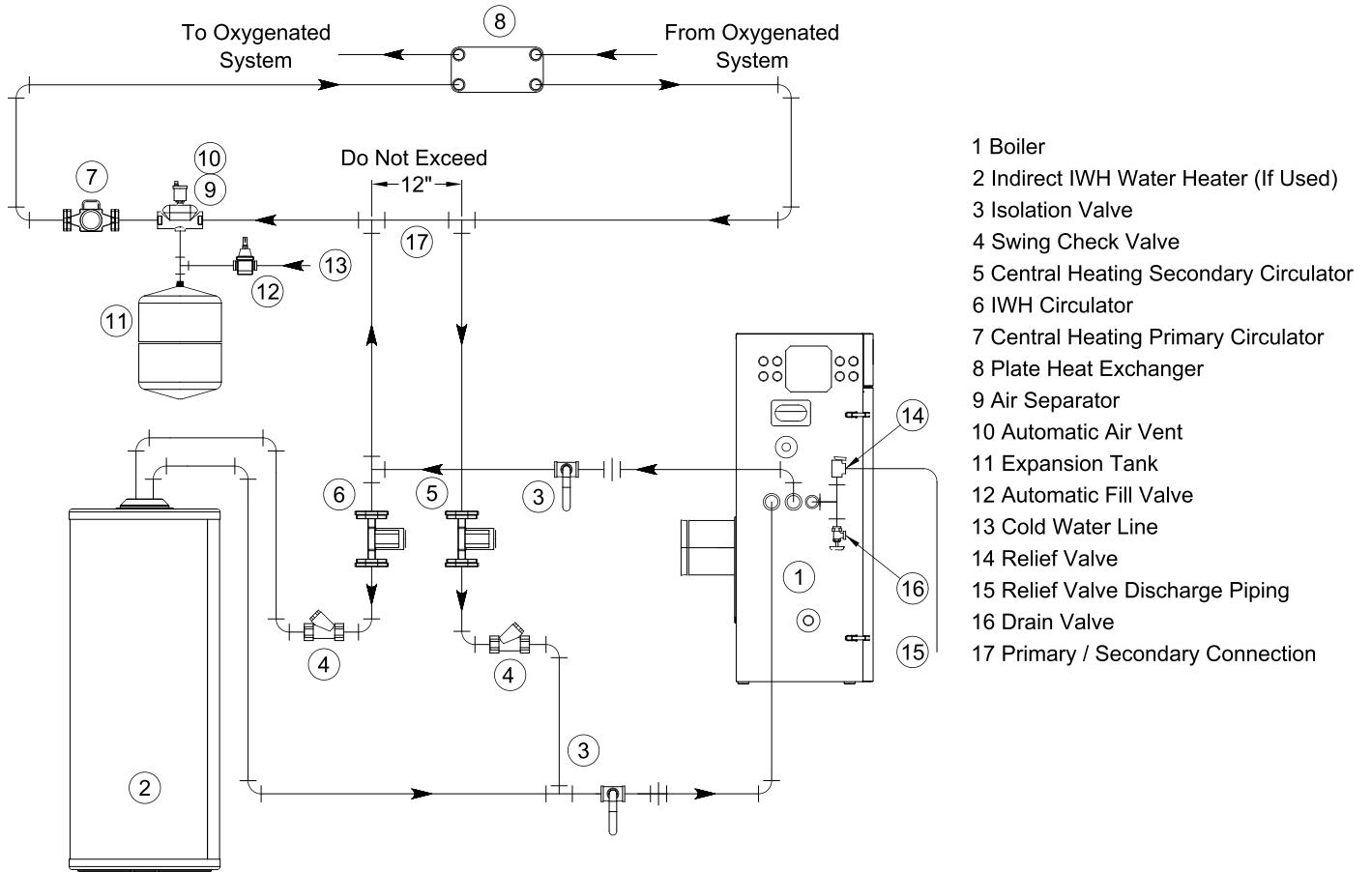


Figure 33: Isolation of the Boiler From Oxygenated Water with A Plate Heat Exchanger

VII. Gas Piping

WARNING

Failure to properly pipe gas supply to boiler may result in improper operation and damage to the boiler or structure. Always assure gas piping is absolutely leak free and of the proper size and type for the connected load.

An additional gas pressure regulator may be needed. Consult gas supplier.

WARNING

Size corrugated stainless steel tubing (CSST) to ensure proper capacity and minimize flow restrictions.

A. Size gas piping. Design system to provide adequate gas supply to boiler. Consider these factors:

1. Allowable pressure drop from point of delivery to boiler. Maximum allowable system pressure is ½ psig. Actual point of delivery pressure may be less; contact gas supplier for additional information. Minimum gas valve inlet pressure is stamped on the rating label located in the boiler's vestibule compartment.

2. Maximum gas demand. Refer to the boiler's input as printed on its rating label. Also consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).
3. Length of piping and number of fittings. Refer to Tables 14A (natural gas) or 14B (LP gas) for maximum capacity of Schedule 40 pipe. Table 15 lists equivalent pipe length for standard fittings.
4. Specific gravity of gas. Gas piping systems for gas with a specific gravity of 0.60 or less can be sized directly from Tables 14A or 14B, unless authority having jurisdiction specifies a gravity factor be applied. For specific gravity greater than 0.60, apply gravity factor from Table 16. If exact specific gravity is not shown choose next higher value.

For materials or conditions other than those listed above, refer to *National Fuel Gas Code*, NFPA54/ANSI Z223.1, or size system using standard engineering methods acceptable to authority having jurisdiction.

B. Connect boiler gas valve to gas supply system.

Table 14A: Maximum Capacity of Schedule 40 Black Pipe in CFH* (Natural Gas) For Gas Pressures of 0.5 psig or Less

Inlet Pressure 0.5 PSI or less; 0.3 Inch W.C. Pressure Drop											
Nominal Pipe Size, In.	Inside Diameter, In.	Length of Pipe, Ft.									
		10	20	30	40	50	60	70	80	90	100
½	0.622	131	90	72	62	55	50	46	42	40	38
¾	0.824	273	188	151	129	114	104	95	89	83	79
1	1.049	514	353	284	243	215	195	179	167	157	148
1¼	1.380	1056	726	583	499	442	400	368	343	322	304
1½	1.610	1582	1087	873	747	662	600	552	514	482	455
2	2.067	3046	2094	1681	1439	1275	1156	1063	989	928	877
2½	2.469	4856	3337	2680	2294	2033	1842	1695	1576	1479	1397
3	3.068	8584	5900	4738	4055	3594	3256	2996	2787	2615	2470

Inlet Pressure 0.5 PSI or less; 0.5 Inch W.C. Pressure Drop											
Nominal Pipe Size, In.	Inside Diameter, In.	Length of Pipe, Ft.									
		10	20	30	40	50	60	70	80	90	100
½	0.622	172	118	95	81	72	65	60	56	52	50
¾	0.824	360	247	199	170	151	137	126	117	110	104
1	1.049	678	466	374	320	284	257	237	220	207	195
1¼	1.380	1392	957	768	657	583	528	486	452	424	400
1½	1.610	2085	1433	1151	985	873	791	728	677	635	600
2	2.067	4016	2760	2217	1897	1681	1523	1402	1304	1223	1156
2½	2.469	6401	4400	3533	3024	2680	2428	2234	2078	1950	1842
3	3.068	11316	7778	6246	5345	4738	4293	3949	3674	3447	3256

* 1 CFH of Natural Gas is approximately equal to 1 MBH; contact your gas supplier for the actual heating value of your gas.

VII. Gas Piping (continued)

WARNING

Failure to use proper thread compounds on all gas connectors may result in leaks of flammable gas.

WARNING

Gas supply to boiler and system must be absolutely shut off prior to installing or servicing boiler gas piping.

Table 14B: Maximum Capacity of Schedule 40 Black Pipe in CFH* (LP Gas) For Gas Pressures of 0.5 psig or Less

Inlet Pressure 11.0 Inch W.C.; 0.3 Inch W.C. Pressure Drop											
Nominal Pipe Size, In.	Inside Diameter, In.	Length of Pipe, Ft.									
		10	20	30	40	50	60	70	80	90	100
½	0.622	88	60	48	41	37	33	31	29	27	25
¾	0.824	184	126	101	87	77	70	64	60	56	53
1	1.049	346	238	191	163	145	131	121	112	105	100
1¼	1.380	710	488	392	336	297	269	248	231	216	204
1½	1.610	1064	732	588	503	446	404	371	346	324	306
2	2.067	2050	1409	1131	968	858	778	715	666	624	590
2½	2.469	3267	2246	1803	1543	1368	1239	1140	1061	995	940
3	3.068	5776	3970	3188	2729	2418	2191	2016	1875	1760	1662

Inlet Pressure 11.0 Inch W.C.; 0.5 Inch W.C. Pressure Drop											
Nominal Pipe Size, In.	Inside Diameter, In.	Length of Pipe, Ft.									
		10	20	30	40	50	60	70	80	90	100
½	0.622	116	80	64	55	48	44	40	38	35	33
¾	0.824	242	166	134	114	101	92	85	79	74	70
1	1.049	456	314	252	215	191	173	159	148	139	131
1¼	1.380	937	644	517	442	392	355	327	304	285	269
1½	1.610	1403	964	775	663	588	532	490	456	427	404
2	2.067	2703	1858	1492	1277	1131	1025	943	877	823	778
2½	2.469	4308	2961	2377	2035	1803	1634	1503	1399	1312	1239
3	3.068	7615	5234	4203	3597	3188	2889	2658	2472	2320	2191

* 1 CFH of LP Gas is approximately equal to 2.5 MBH; contact your gas supplier for the actual heating value of your gas.

Table 15: Equivalent Lengths of Standard Pipe Fittings & Valves

Nominal Pipe Size, Inc.	Inside Diameter, In.	Valves (Screwed) - Fully Open				Screwed Fittings				
		Gate	Globe	Angle	Swing Check	45° Elbow	90° Elbow	180 Close Return Bend	90 Tee Flow Thru Run	90 Tee, Flow Thru Branch
½	0.622	0.4	17.3	8.7	4.3	0.7	1.6	3.5	1.6	3.1
¾	0.824	0.5	22.9	11.4	5.7	1.0	2.1	4.6	2.1	4.1
1	1.049	0.6	29.1	14.6	7.3	1.2	2.6	5.8	2.6	5.2
1¼	1.38	0.8	38.3	19.1	9.6	1.6	3.5	7.7	3.5	6.9
1½	1.61	0.9	44.7	22.4	11.2	1.9	4.0	9.0	4.0	8.0
2	2.067	1.2	57.4	28.7	14.4	2.4	5.2	11.5	5.2	10.3
2½	2.469	1.4	68.5	34.3	17.1	2.9	6.2	13.7	6.2	12.3
3	3.068	1.8	85.2	42.6	21.3	3.6	7.7	17.1	7.7	15.3

VII. Gas Piping (continued)

Table 16: Specific Gravity Correction Factors

Specific Gravity	Correction Factor	Specific Gravity	Correction Factor
0.60	1.00	0.90	0.82
0.65	0.96	1.00	0.78
0.70	0.93	1.10	0.74
0.75	0.90	1.20	0.71
0.80	0.87	1.30	0.68
0.85	0.81	1.40	0.66

- Use methods and materials in accordance with local plumbing codes and requirements of gas supplier. In absence of such requirements, follow *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.
- Use thread (joint) compounds (pipe dope) resistant to action of liquefied petroleum gas.
- Alpine (ALP) boilers have factory supplied Miscellaneous Part Carton (P/N 101777-01 - ALP080 thru ALP210; 101777-02 - ALP285; 1012942-03 - ALP399 and ALP500), which includes gas piping components to connect boiler gas valve to gas supply system. Install these components prior to connecting boiler to gas supply system piping as follows:
 - Locate and remove either ½" NPT x 6" long black nipple and ½" NPT external gas shutoff valve (ALP080 thru ALP210), or ¾" NPT x 6" long black nipple and ¾" NPT external gas shutoff valve (ALP285 thru ALP500).
 - Feed the appropriate nipple through factory installed jacket left side panel grommet (refer to Figure 1A or 1B for gas supply connection identification) and screw the nipple into boiler gas valve inlet port.
 - Mount the appropriate external gas shutoff valve onto the threaded nipple end outside of the jacket left side panel.
 - Install sediment trap, ground-joint union and manual shut-off valve upstream of mounted factory supplied manual shut-off valve. See Figure 34A.
- All above ground gas piping upstream from manual shut-off valve must be electrically continuous and bonded to a grounding electrode. Do not use gas piping as grounding electrode. Refer to *National Electrical Code*, NFPA 70.

- Protect boiler gas control valve. For all testing over ½ psig, boiler and its individual shutoff valve must be disconnected from gas supply piping. For testing at ½ psig or less, isolate boiler from gas supply piping by closing boiler's individual manual shutoff valve.
- Locate leaks using approved combustible gas non-corrosive leak detector solution.

Table 17: Min./Max. Pressure Ratings

Boiler Model No.	Natural/LP Gas Max. Pressure (in. w.c.)	Natural Gas Min. Pressure Inlet to Gas Valve (in. w.c.)	LP Gas Min. Pressure Inlet to Gas Valve (in. w.c.)
ALP080	14	4.0	11.0
ALP105			
ALP150			
ALP210			
ALP285			
ALP399	13.5	4.5	
ALP500			

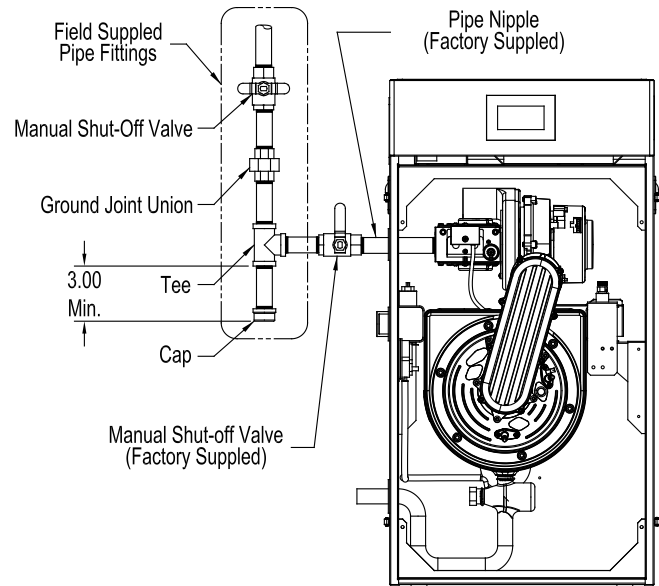


Figure 34A: Recommended Gas Piping

C. Pressure test. See Table 17 for Alpine Min./Max. Pressure Ratings. The boiler and its gas connection must be leak tested before placing boiler in operation.

VII. Gas Piping (continued)

DANGER

Do not use matches, candles, open flames or other ignition source to check for leaks.

D. Alpine Model 500 only (if equipped with optional low and high gas pressure switches):

1. The low gas pressure switch must be reset after the boiler is piped to the gas supply and before it is fired.

2. For the low and high gas pressure switches proper operation, the boiler inlet gas pressure must be within 4.5" w.c. to 13.5" w.c. range.
3. The gas pressure can be measured at the gas valve inlet pressure port. Refer to Figure 34B.
4. If either pressure switch is tripped, it must be manually reset before the boiler can be restarted.

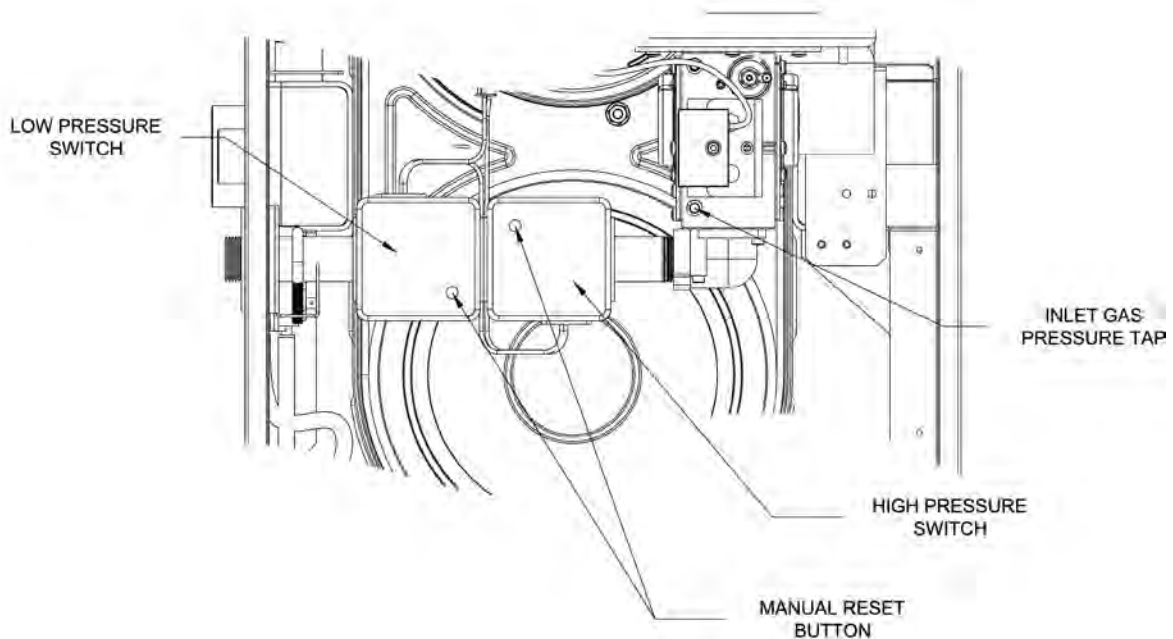


Figure 34B: Gas Inlet Pressure Switch Location

VIII. Electrical

DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the boiler or building. Lock out all electrical boxes with padlock once power is turned off.

WARNING

Failure to properly wire electrical connections to the boiler may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

Each boiler must be protected with a properly sized over-current device.

Never jump out or make inoperative any safety or operating controls.

The wiring diagrams contained in this manual are for reference purposes only. Each boiler is shipped with a wiring diagram attached to the front door. Refer to this diagram and the wiring diagram of any controls used with the boiler. Read, understand and follow all wiring instructions supplied with the controls.

NOTICE

This boiler is equipped with a high water temperature limit located inside the internal wiring of the boiler. This limit provides boiler shutdown in the event the boiler water temperature exceeds the set point of the limit control. Certain Local Codes require an additional water temperature limit. In addition, certain types of systems may operate at temperatures below the minimum set point of the limit contained in the boiler.

If this occurs, install an additional water temperature limit (Honeywell L4006 Aquastat). Wire as indicated in the Electrical Section of this manual.

NOTICE

All wire, wire nuts, controls etc. are installer supplied unless otherwise noted.

A. General. Install wiring and electrically ground boiler in accordance with authority having jurisdiction or, in the absence of such requirements, follow the *National Electrical Code*, NFPA 70, and/or CSA C22.1 Electrical Code.

B. A separate electrical circuit must be run from the main electrical service with an over-current device/disconnect in the circuit. A service switch is recommended and may be required by some local jurisdictions. Install the service switch in the line voltage “Hot” leg of the power supply. Locate the service switch such that the boiler can be shut-off without exposing personnel to danger in the event of an emergency. Connect the main power supply and ground to the three (3) boiler wires (black, white and green) located in the junction box at the inside top of the boiler jacket.

C. Refer to Figures 35 and 36 or details on the internal boiler wiring.

Line Voltage (120 VAC) Connections - see Figure 35.

1. The line voltage connections are located in the junction box on the left side of the vestibule. The terminal block TB-1 in conjunction with terminal screw identification label is attached to the junction box combination cover/inside high voltage bracket.
2. The conductor insulation colors are:
 - a. Black – L1 line voltage “Hot”
 - b. White – L2 line voltage “Neutral” for boiler and circulators
 - c. Red – Line voltage “Hot” for “Heating” circulator, “System” circulator and “DHW” circulator
 - d. Green – Ground connection

VIII. Electrical (continued)

Low Voltage (24 VAC) Connections - see Figure 35.

3. The terminal block TB-2 in conjunction with terminal screw identification label is attached to the junction box front and located inside Sage2.1 Control compartment on the left side.
4. The connections are (listed identification label top to bottom):
 - a. 1 – “Heating Thermostat”
 - b. 2 – “Heating Thermostat”
 - c. 3 – “DHW Temperature Switch”
 - d. 4 – “DHW Temperature Switch”
 - e. 5 – “Outdoor Sensor”
 - f. 6 – “Outdoor Sensor”
 - g. 7 – “Header Sensor”
 - h. 8 – “Header Sensor”
 - i. 9 – “Remote Firing Rate”
 - j. 10 – “Remote Firing Rate”
 - k. 11 – “External Limit”
 - l. 12 – “External Limit”
5. If the outdoor sensor is connected to terminals 5 and 6 “Outdoor Sensor”, the boiler will adjust the target space heating set point supply water temperature downwards as the outdoor air temperature increases. If used, this sensor should be located on the outside of the structure in an area where it will sense the average air temperature around the house. Avoid placing this sensor in areas where it may be covered with ice or snow. Locations where the sensor will pick up direct radiation from the sun should also be avoided. Avoid placing the sensor near potential sources of electrical noise such as transformers, power lines, and fluorescent lighting. Wire the sensor to the boiler using 22 gauge or larger wire. As with the sensor, the sensor wiring should be routed away from sources of electrical noise. Where it is impossible to avoid such noise sources, wire the sensor using a 2 conductor, UL Type CM, AWM Style 2092, 300Volt 60°C shielded cable. Connect one end of the shielding on this cable to ground.

WARNING

When making low voltage connections, make sure that no external power source is present in the thermostat or limit circuits. If such a power source is present, it could destroy the boiler’s Microprocessor Control (Sage2.1). One example of an external power source that could be inadvertently connected to the low voltage connections is a transformer in old thermostat wiring.

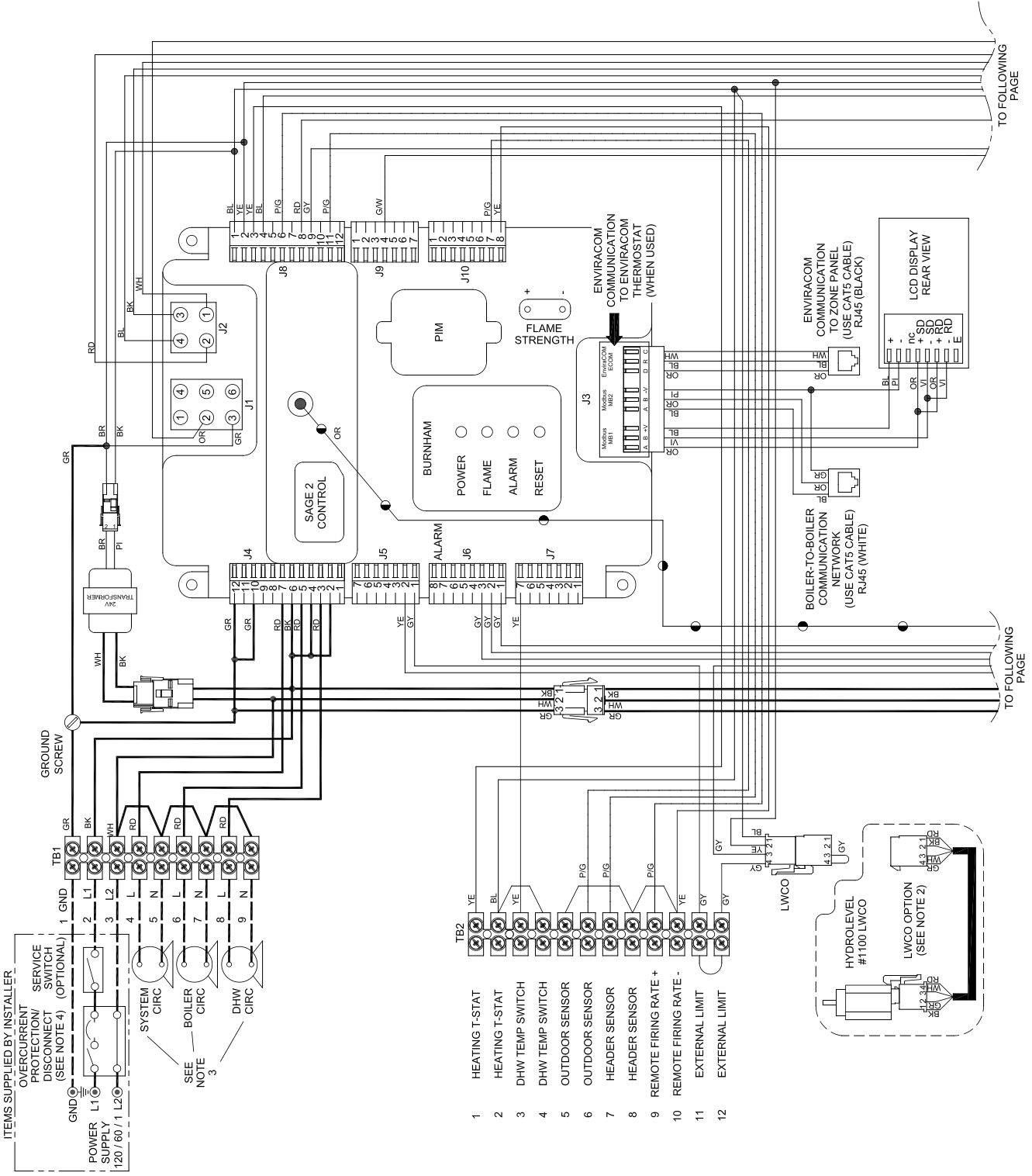
D. Power Requirements

Nominal boilers current draw is provided in Table 18. These values are for planning purposes only and represent only the boiler’s power consumption. To obtain total system power consumption add any selected circulator and component current draws.

Table 18: Boiler Current Draw

Model Number	Nominal Current (amps)
ALP080	<2
ALP105	<2
ALP150	<2
ALP210	<3
ALP285	<5
ALP399	<5
ALP500	<4

56 VIII. Electrical (continued)



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VIII. Electrical (continued)

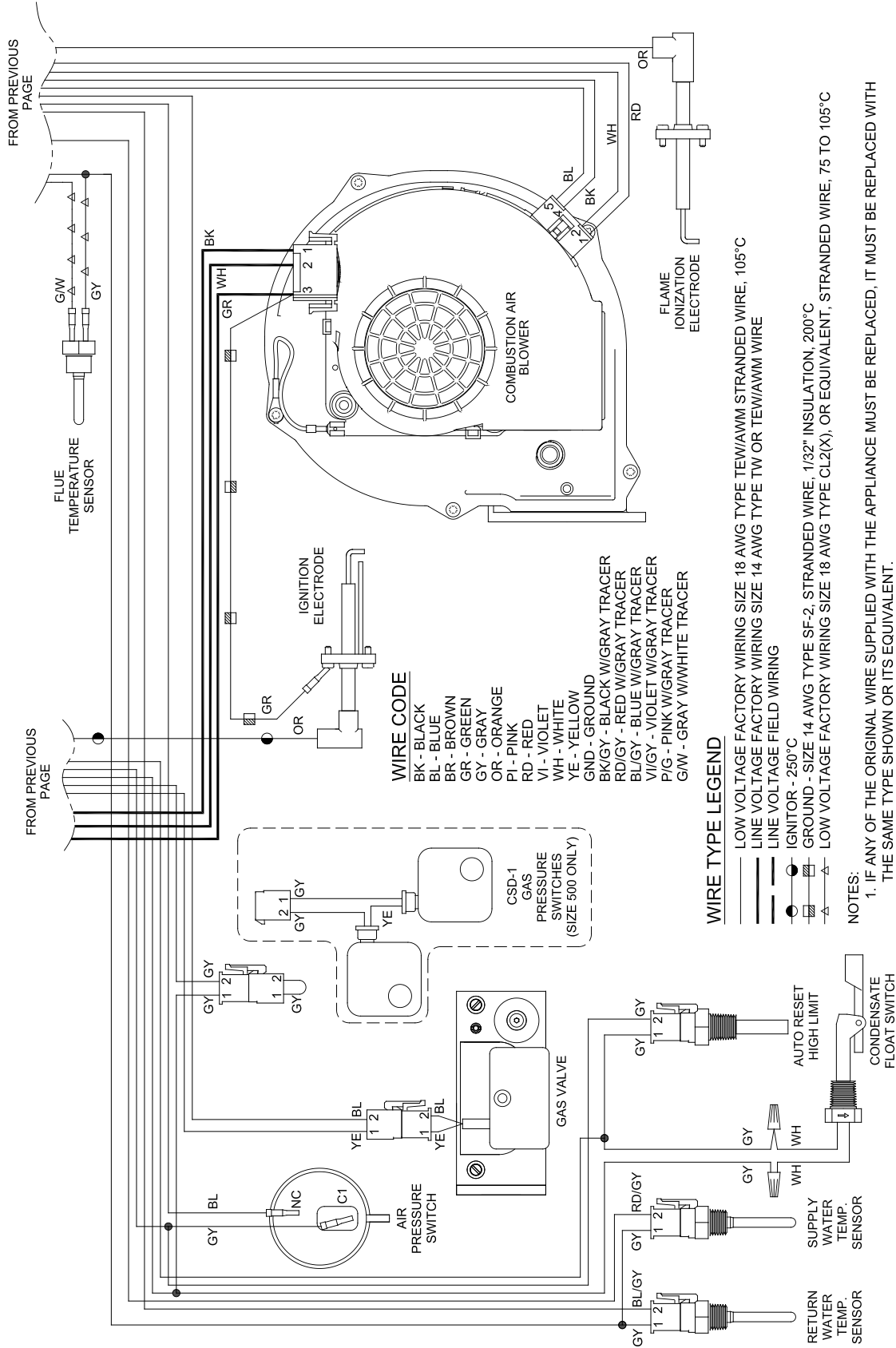


Figure 35: Wiring Connections Diagram

VIII. Electrical (continued)

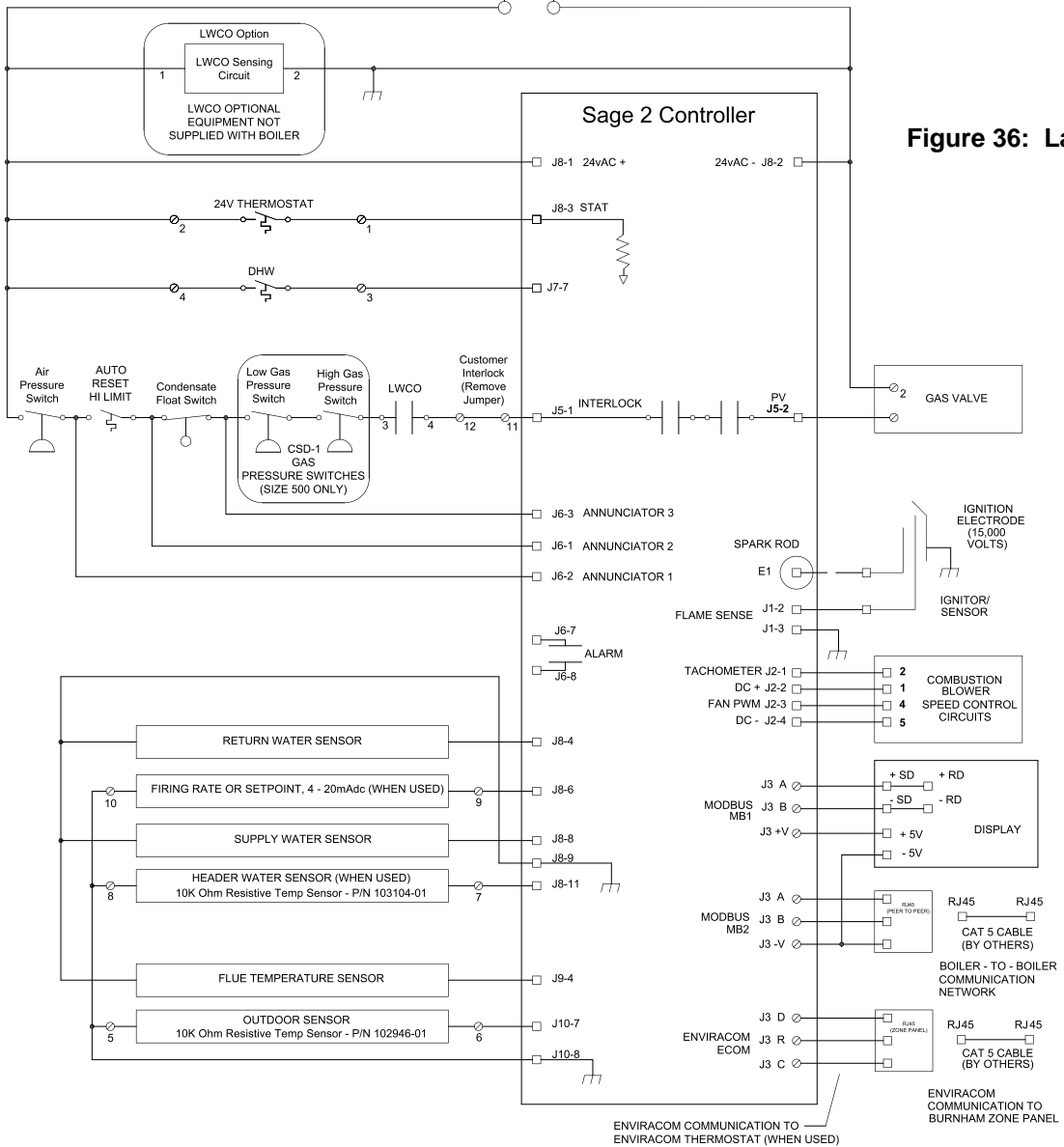
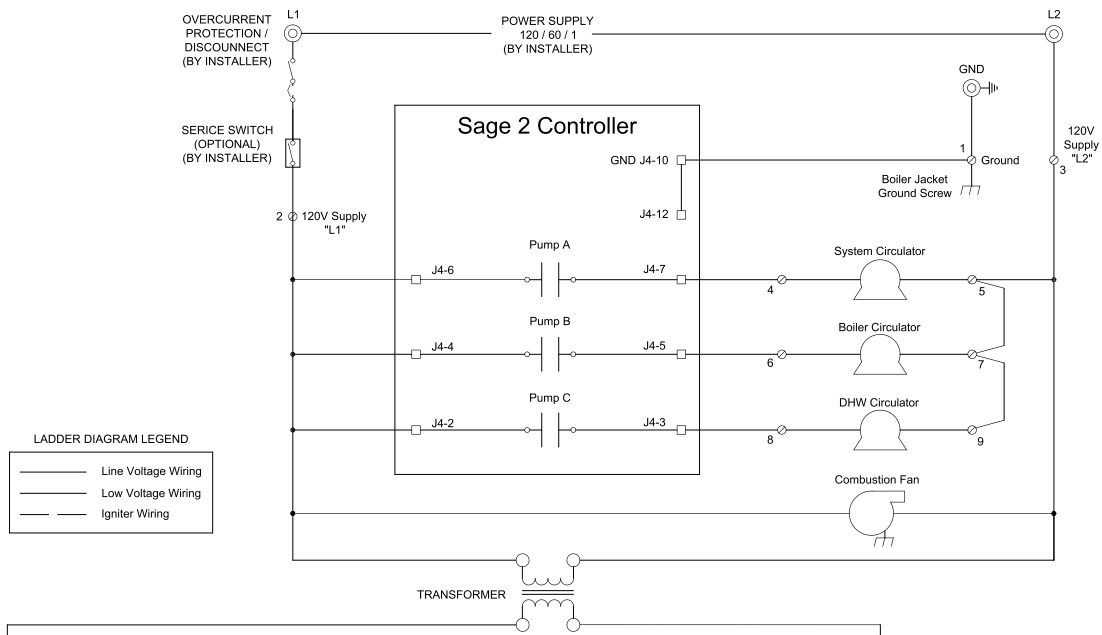
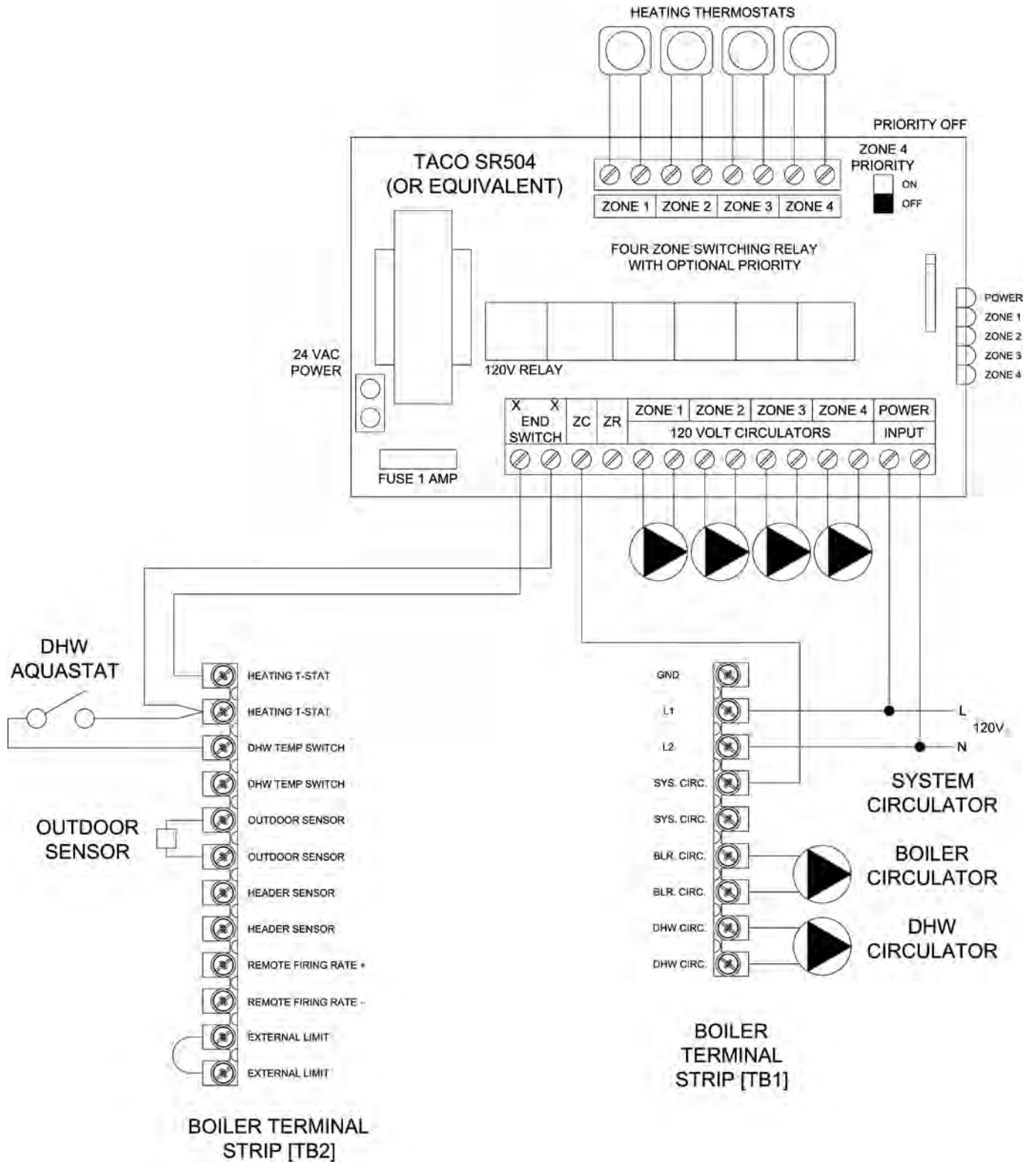


Figure 36: Ladder Diagram

VIII. Electrical (continued)



***USE SAME POWER SOURCE FOR ALL CONTROLS AND ENSURE POLARITY TO ALL CONTROL DEVICES IS CORRECT

Figure 37A: Modified Wiring For DHW Priority When Using Low Flow Circulator Piped Off System Header - Heating (with Central Heating Circulators) Plus Alternately Piped Indirect Water Heater

60 VIII. Electrical (continued)

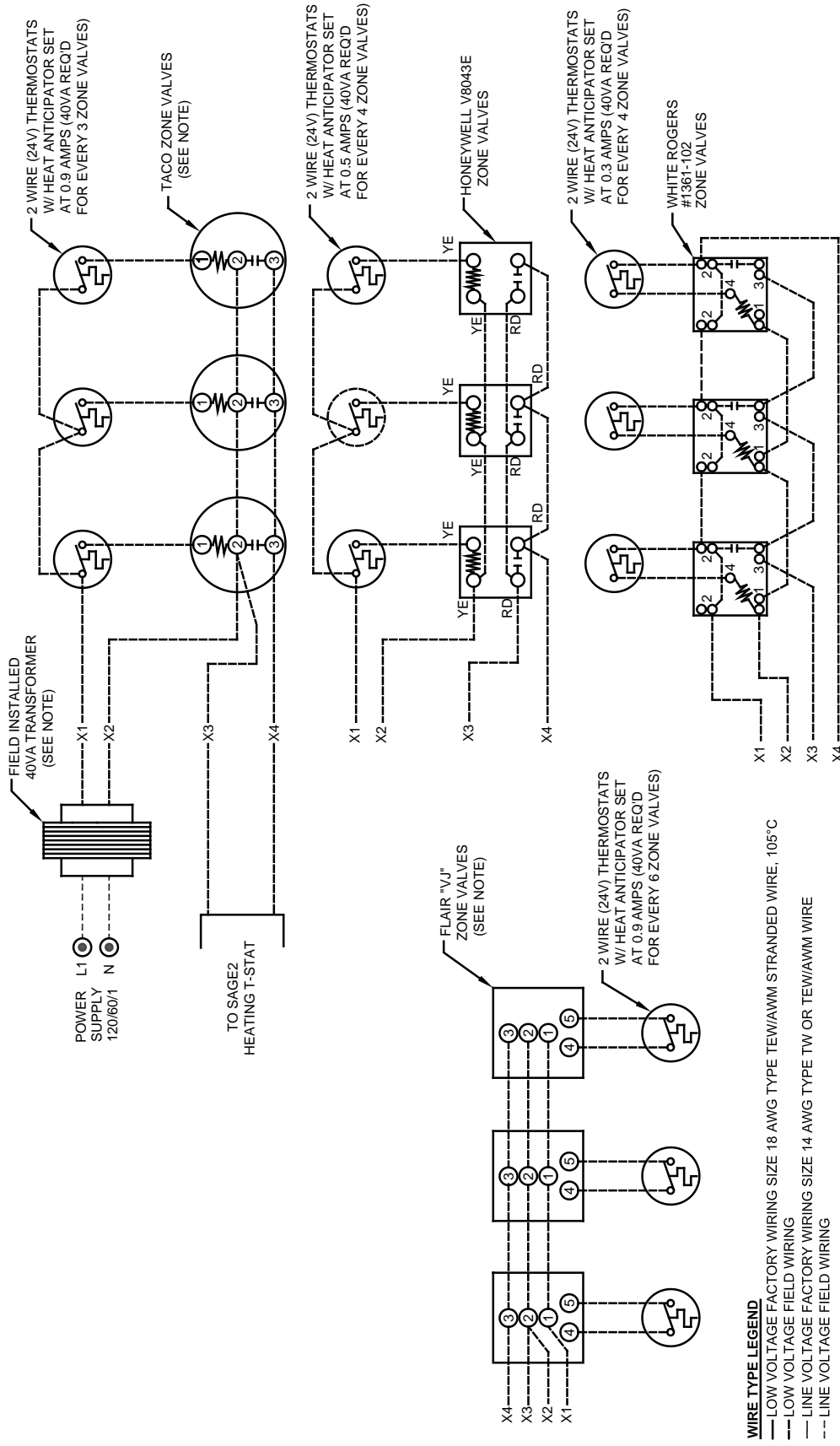


Figure 37B: Modified Wiring For DHW Priority When Using Low Flow Circulator Piped Off System Header - Heating (with Central Heating Zone Valves) Plus Alternately Piped Indirect Water Heater

IX. Boiler Stacking

For installations with unusually high space heating and/or domestic hot water heating loads, where employing two (2) Alpine (ALP) boilers will offer the benefits of greater operational efficiency, floor space savings and boiler redundancy, the Alpine (ALP) boilers may be installed stacked one on the top of the other. Refer to Table 19 “Alpine (ALP) Boiler Model Stacking Combinations” for details.

Table 19: Alpine (ALP) Boiler Model Stacking Combinations

Bottom Boiler Model	Top Boiler Model
ALP080	ALP080
ALP105	ALP080 or ALP105
ALP150	ALP080 thru ALP150
ALP210	ALP080 thru ALP210
ALP285	ALP080, ALP105, ALP150 and ALP285
ALP399	ALP080 thru ALP399
ALP500	ALP080 thru ALP500

A. To field assemble individual Alpine (ALP) boilers into a stackable configuration, use the steps below:

1. Position the bottom boiler first. Refer to Sections II “Pre-Installation & Boiler Mounting” and III “Unpacking Boiler” of the manual for details. **Always position higher input boiler model as bottom boiler.**
2. Each Alpine (ALP) boiler is factory packaged with two (2) Stacking Boiler Attachment Brackets (P/N 101679-01) and the bracket mounting hardware [six (6) self-drilling hex washer head plated #8 x ½” long screws, P/N 80860743]. Locate and remove the brackets and the hardware. The Stacking Boiler Attachments Bracket has three 7/32” diameter holes punched in a triangular pattern. See Figure 38 “Stacking Boiler Attachment Bracket Placement”.
3. Alpine (ALP) boiler left and right side panels have a series of dimples at panel top and bottom. These dimples are positioning dimples for Stacking Boiler Attachment Bracket mounting screws. Side panel bottom positioning dimples are evenly spaced from boiler front and back, while side panel top positioning dimples follow specific pattern to compensate for Alpine (ALP) boiler model variable depth.
4. Position the upper boiler on the top of the bottom boiler and align boiler front doors and sides flush with each other.
 - Place first Stacking Boiler Attachment Bracket onto the upper boiler left side panel, at the panel lower left corner and align bracket two upper holes with corresponding side panel lower dimples.

- The remaining lower bracket hole must align with a matching bottom boiler left side panel top positioning dimple.
 - Once bracket holes and side panel dimple alignment is verified, attach the bracket to top and bottom boiler left side panels with the mounting screws.
5. Repeat above procedure to install second Stacking Boiler Attachment Bracket and secure the stacked boiler right side panels together at the front right corner.
 6. Install the third Stacking Boiler Attachment Bracket to secure top and bottom boiler left side panels at the rear left corner. Align the bracket holes with corresponding positioning dimples in the top boiler and bottom boiler left side panels, then secure bracket with the screws.
 7. Repeat above procedure to install the forth Stacking Boiler Attachment Bracket to secure stacked boiler right side panels at the rear right corner.

B. When installing stackable boiler combinations

observe the following guidelines:

1. Venting - Top and bottom boilers must have their individual vent piping and vent terminals.

WARNING

No common manifolded venting is permitted.

For side-wall venting individual model vent terminals must terminate not closer than 12 inches horizontally and three (3) feet vertically from each other in order to prevent combustion air contamination. For vertical through the roof venting, individual vertical vent terminals, if level with each other, must be spaced no closer than 12 inches horizontally. If vertical terminals cannot end in one plane, they must be spaced no closer than three (3) feet horizontally.

Chimney chase concentric venting is permitted for modules, when stackable, providing concentric vertical (roof) vent terminals, if level with each other, are spaced no closer than 12 inches horizontally.

If vertical vent terminals cannot end in one plane, they must be spaced no closer than three (3) feet horizontally.

Follow instructions in Section IV “Venting” of the manual for specifics of individual boiler vent termination. Follow instructions in Section V “Condensate Disposal” for each individual boiler flue gas condensate line construction and condensate disposal. Terminating individual boiler condensate lines into common pipe prior to drain disposal is

IX. Boiler Stacking (continued)

permissible, providing common pipe has sufficient flow capacity to handle combined condensate volume of stackable combination.

2. Gas Piping - Follow instructions in Section VII “Gas Piping” of the manual for sizing and installation of an individual boiler. When common gas piping is sized, insure it will have **adequate capacity for combined input (GPH gas flow) of the selected stackable boiler combination.**

3. Water Piping and Trim - Follow instructions in Section VI “Water Piping and Trim” of the manual for system piping and boiler secondary piping selection/sizing based on **combined heating capacity and/or gross output of the selected stackable boiler combination.** Follow instructions of Section VI “Water Piping and Trim” for each individual boiler trim installation.
4. Electrical - Follow instructions in Section VIII “Electrical” of the manual to wire individual boilers.

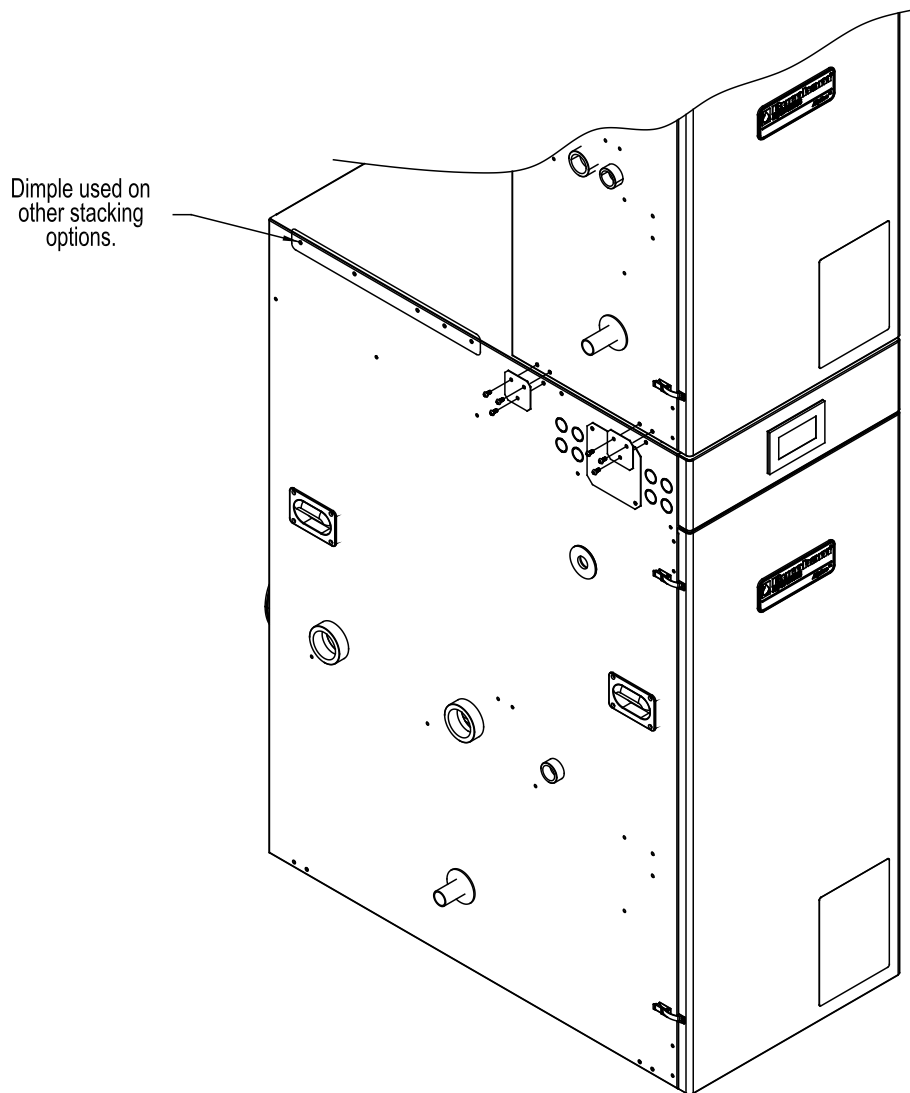


Figure 38: Stacking Boiler Attachment Bracket Placement

X. Modular Installation

A. General Guidelines

1. Read and follow all venting, combustion air, water piping, gas piping and electrical instructions contained in this manual, unless otherwise instructed in this section.
2. Consult Local Building Codes or National Fuel Gas Code, NFPA 54/ANSI Z222.3 for restrictions and instructions on modular boiler installations.

B. Venting

1. CPVC/PVC Venting

- a. Modular CPVC/PVC direct venting is shown in Figure 39.
- b. Each individual module (boiler) must have own vent pipe and vent terminal. Refer to Section IV “Venting” of this manual for individual module (boiler) venting guidelines and options.

WARNING

No common manifolded venting (vent piping and vent terminals) is permitted.

- c. The individual module (boiler) maximum vent length - see Section IV, “Venting”, Table 7.
- d. For sidewall venting the minimum horizontal distance between any adjacent individual module (boiler) vent terminations is twelve (12) inches. Additional horizontal spacing between any adjacent individual module (boiler) vent terminations as well as extending the distance from building surfaces to vent termination end are recommended to avoid frost damage to building surfaces where vent terminations are placed.

CAUTION

Installing multiple individual module (boiler) vent terminations too close together may result in combustion product water vapor condensation on building surfaces, where vent termination are placed, and subsequent frost damage. To avoid/minimize frost damage, extend the distance from building surfaces to vent termination end and increase the horizontal distance between adjacent vent terminations.

- e. Individual module (boiler) sidewall vent terminals must be placed at least twelve (12) inches above the ground plus the expected snow accumulation.
- f. Multiple individual module vertical vent pipes may be piped through a common conduit or chase so that one roof penetration may be made.

The minimum horizontal distance between any adjacent individual module (boiler) roof vent terminations is one (1) foot.

2. PVC Pipe Air Intake Piping

- a. Modular PVC air intake piping is shown in Figure 39.
- b. Each individual module (boiler) must have own combustion air intake pipe and combustion air intake terminal. Refer to Section IV “Venting” of this manual for individual module (boiler) combustion air intake guidelines and options.
- c. The individual module (boiler) maximum combustion air intake pipe length - see Section IV, “Venting”, Table 7.
- d. If possible, locate each individual module (boiler) both combustion air intake termination and vent termination on the same sidewall, to prevent nuisance boiler shutdowns.
However, if same sidewall placement is problematic, an individual module (boiler) may be installed using vertical venting and sidewall combustion air intake termination (or, vice versa)

3. Concentric Combination Venting/Combustion Air Intake Piping

- a. Concentric Combustion Venting and air intake is shown in Figure 40.
- b. Each individual module (boiler) must have own concentric vent pipe and vent termination. Follow Section IV “Venting” of this manual for individual module (boiler) concentric venting guidelines.

WARNING

No common manifolded concentric venting is permitted.

- c. The individual module (boiler) maximum concentric vent length - see Section IV, “Venting”, Table 7.
- d. For sidewall venting any adjacent individual module (boiler) concentric vent terminals must be spaced no closer than 12 inches horizontally and three (3) feet vertically from each other to prevent combustion air contamination. Additional horizontal spacing between any adjacent individual module (boiler) concentric vent terminations and increased distance from building surfaces to concentric vent termination end are recommended to avoid frost damage to building surfaces where vent terminations are placed.

64 X. Modular Installation (continued)

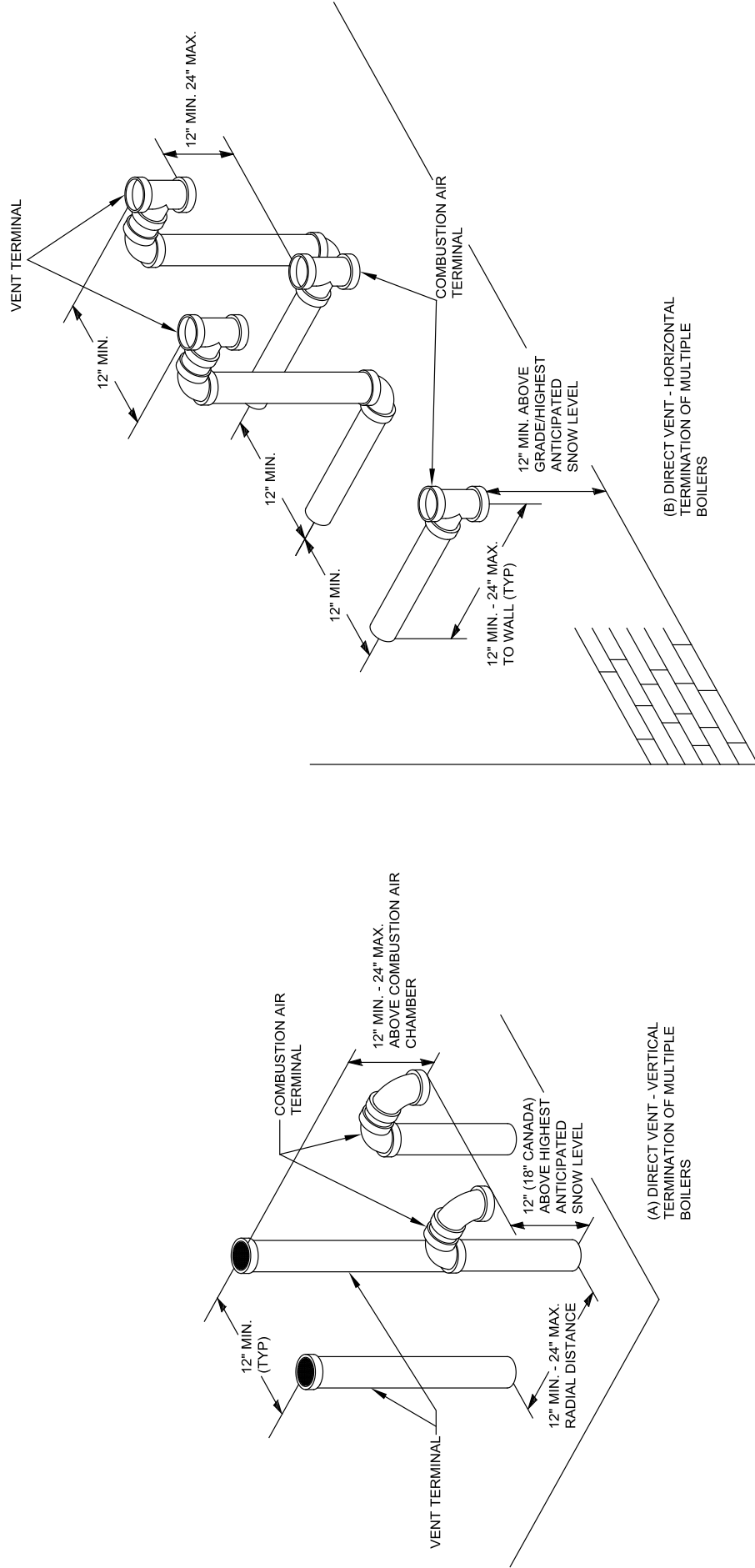


Figure 39: Modular Boiler Direct Vent Termination

X. Modular Installation (continued)

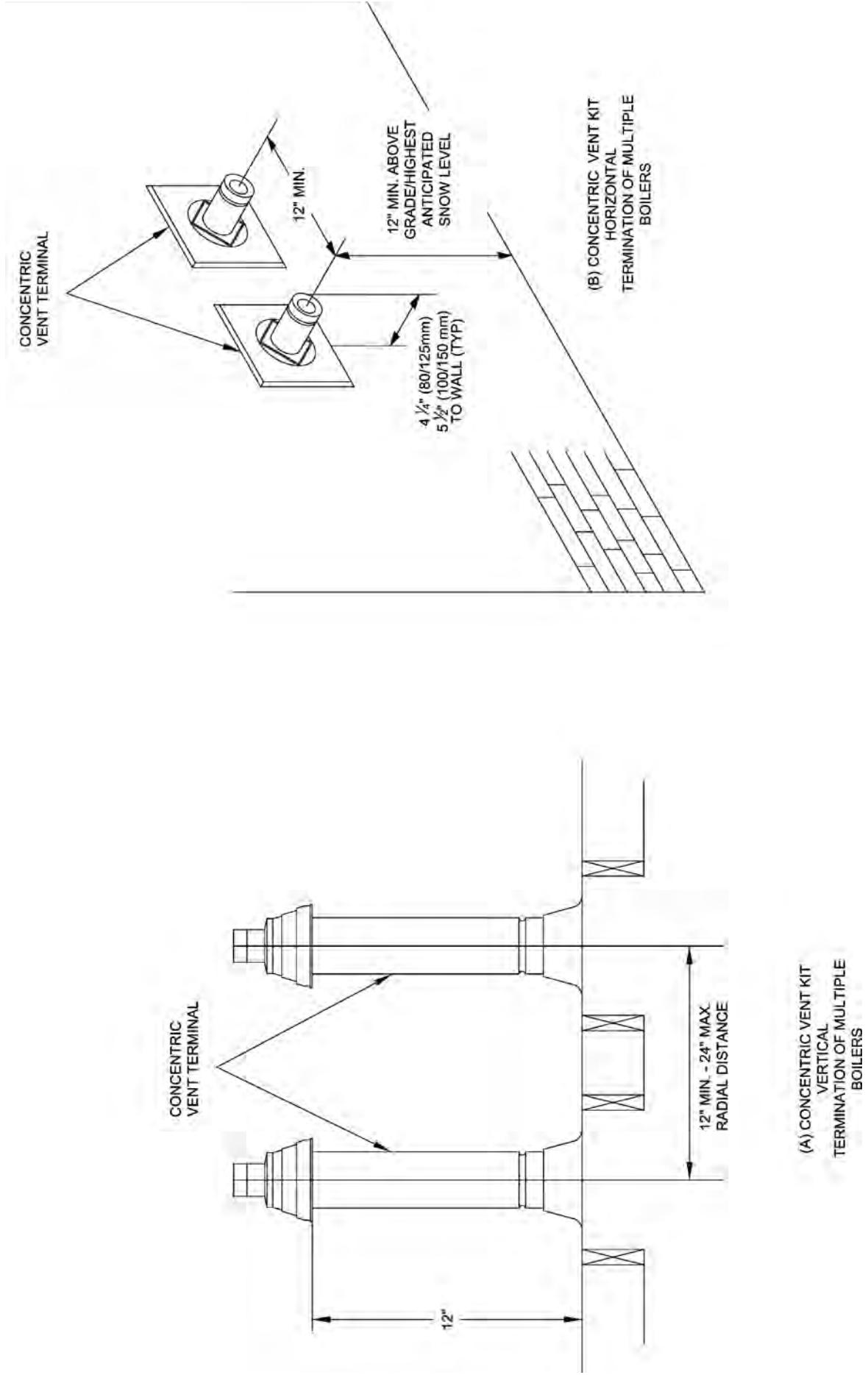


Figure 40: Modular Boiler Concentric Vent Termination

X. Modular Installation (continued)

- e. Individual module (boiler) sidewall concentric vent terminals must be placed at least twelve (12) inches above the ground plus the expected snow accumulation.
- f. For vertical through the roof venting any adjacent individual module (boiler) vertical vent terminals, if level with each other, must be spaced no closer than 12 inches horizontally.
If vertical vent terminals cannot end in one plane, they must be spaced no closer than three (3) feet horizontally.
- g. Chimney chase concentric venting is permitted for modules, when stackable, providing concentric vertical (roof) vent terminals, if level with each other, are spaced no closer than 12 inches horizontally.
If vertical vent terminals cannot end in one plane, they must be spaced no closer than three (3) feet horizontally.
- h. When individual modules (boilers) are installed in the same horizontal plane, chimney chase vertical concentric venting is permitted provided:
 - i. Sufficient inside space available at the base of the chimney to install multiple chimney chase brackets and support elbows.
 - ii. Spacing between adjacent vertical vent terminals is in accordance with paragraph g above.

CAUTION

Installing multiple individual module (boiler) concentric vent terminations too close together may result in combustion product water vapor condensation on building surfaces, where termination are placed, and subsequent frost damage. To avoid/minimize frost damage extend the distance from building surfaces to concentric vent termination end as well as increase the horizontal distance between adjacent concentric vent terminations.

Table 20: Modular Boiler Water Manifold Sizing

Boiler Model	Number of Units						
	2	3	4	5	6	7	8
	Recommended Minimum Common Water Manifold Size (NPT)						
ALP080	1¼"	1½"	1½"	2"	2"	2"	2½"
ALP105	1¼"	1½"	2"	2"	2½"	2½"	2½"
ALP150	1½"	2"	2½"	3"	3"	3"	3"
ALP210	2"	2½"	2½"	3"	3½"	3½"	3½"
ALP285	2"	3"	3"	3½"	4"	4"	5"
ALP399	2½"	3"	3"	4"	5"	5"	5"
ALP500	3"	4"	4"	5"	5"	6"	6"

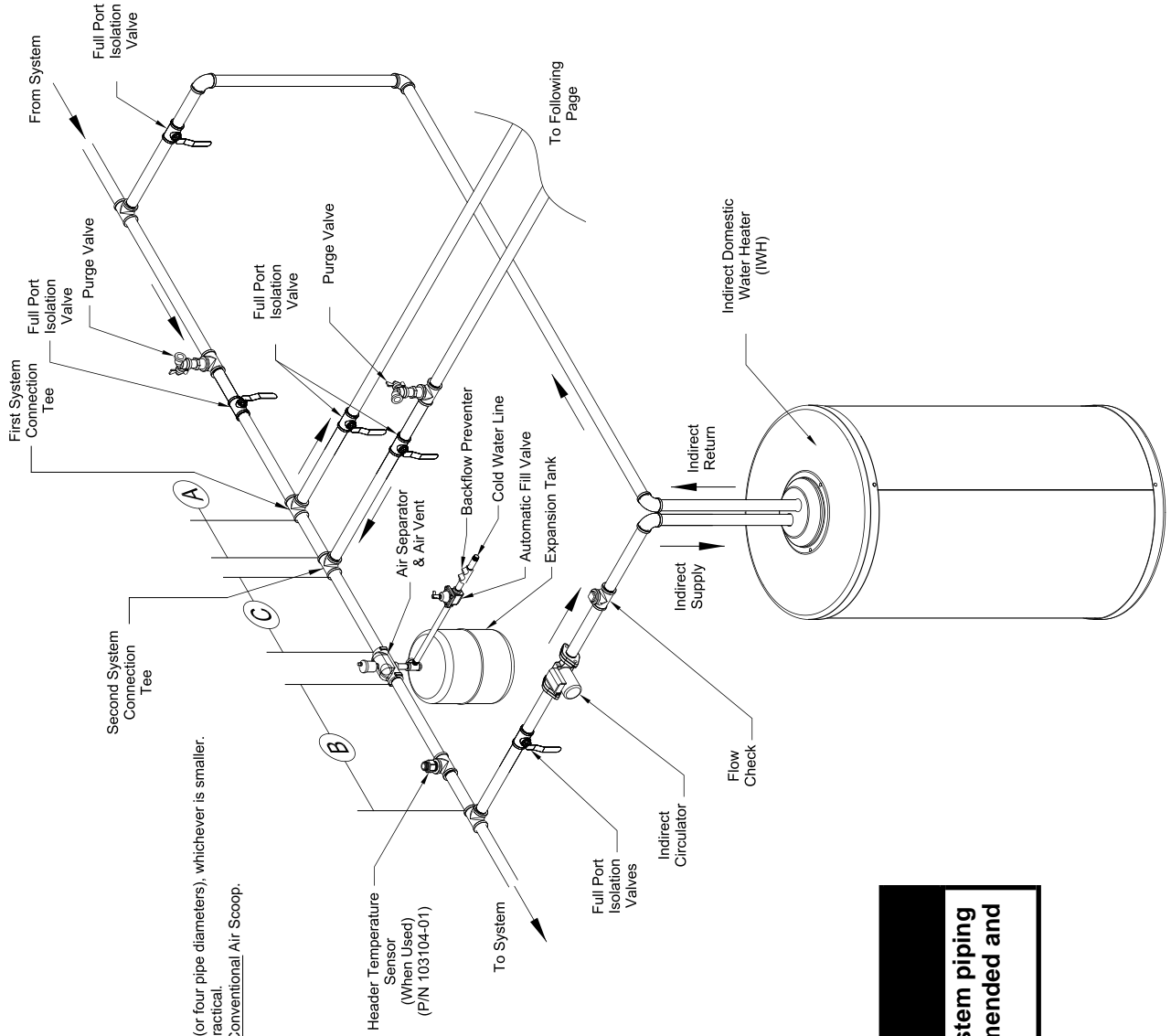
C. Water Piping – (See Table 20 and Figure 41)

1. Refer to Section VI “Water Piping and Trim” of this manual for:
 - a. Installation of Factory Supplied Piping and Trim Components for an individual module (boiler).
 - b. Regarding an individual module (boiler) piping system specific details.
 - c. Selection criteria for individual module (boiler) space heating and/or DHW circulators.
2. For installations where indirect domestic hot water heater is combined with space heating, when sizing an indirect water heater circulator, compare the specified flow range through an Alpine model boiler to an indirect water heater (Alliance SL™) model coil flow rate required to achieve water heater rating. Refer to Table 21.
 - a. When Alliance SL™ model coil flow rate, required to achieve water heater rating, **falls within the specified flow range** for Alpine boiler model, the Alliance SL™ model **can be piped as part of Alpine near-boiler piping**. Refer to Table 21.
 - b. When Alliance SL™ model coil flow rate, required to achieve water heater rating, **exceeds the specified flow range** for Alpine boiler model, the Alliance SL™/Alpine boiler combination may result in excessive noise and boiler heat exchanger erosion, and therefore, is **not recommended**. Refer to Table 21 for details.
 - c. When Alliance SL™ model coil flow rate, required to achieve water heater rating, **falls below the specified flow range** for Alpine boiler model, the Alliance SL™ model must be **pipied as a separate heating zone off the system header**. The circulator must be sized based on the Alliance SL™ model coil flow and combined coil pressure drop and the zone piping total equivalent length. Refer to Table 21 for details.

D. Gas Piping

1. Individual module (boiler) gas pipe sizing specific details
2. Individual module (boiler) recommended gas piping. See Figure 34A.
3. Requirement to install additional gas pressure regulators to properly regulate gas pressure at the input of the smallest individual module (boiler).

X. Modular Installation (continued)



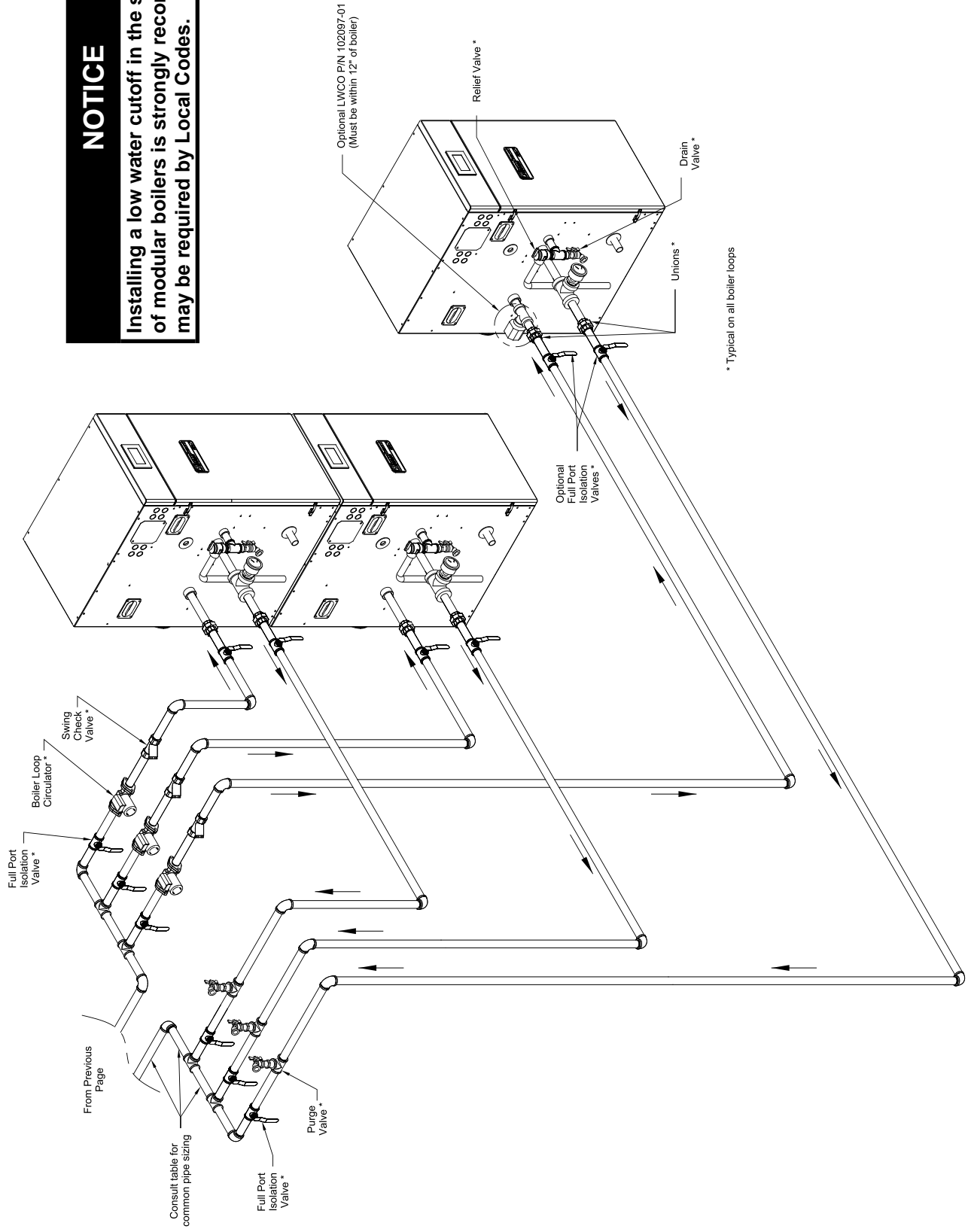
- A. No further apart than 12 inches (or four pipe diameters), whichever is smaller.
- B. Keep this distance as short as practical.
- C. At least 18" of straight pipe for Conventional Air Scoop.

NOTICE

Installing a low water cutoff in the system piping of modular boilers is strongly recommended and may be required by Local Codes.

Figure 41A: Modular Boiler Water Piping w/Domestic Hot Water Heater (Page 1 of 2)

68 X. Modular Installation (continued)



NOTICE

Installing a low water cutoff in the system piping of modular boilers is strongly recommended and may be required by Local Codes.

Figure 41B: Modular Boiler Water Piping w/Domestic Hot Water Heater (Page 2 of 2)

X. Modular Installation (continued)

CAUTION

It is the installers responsibility to select pumps and boiler piping configurations that provide the proper flow rates and performance for the boiler and indirect water heater. Refer to Table 12 for recommended Boiler Loop Circulator.

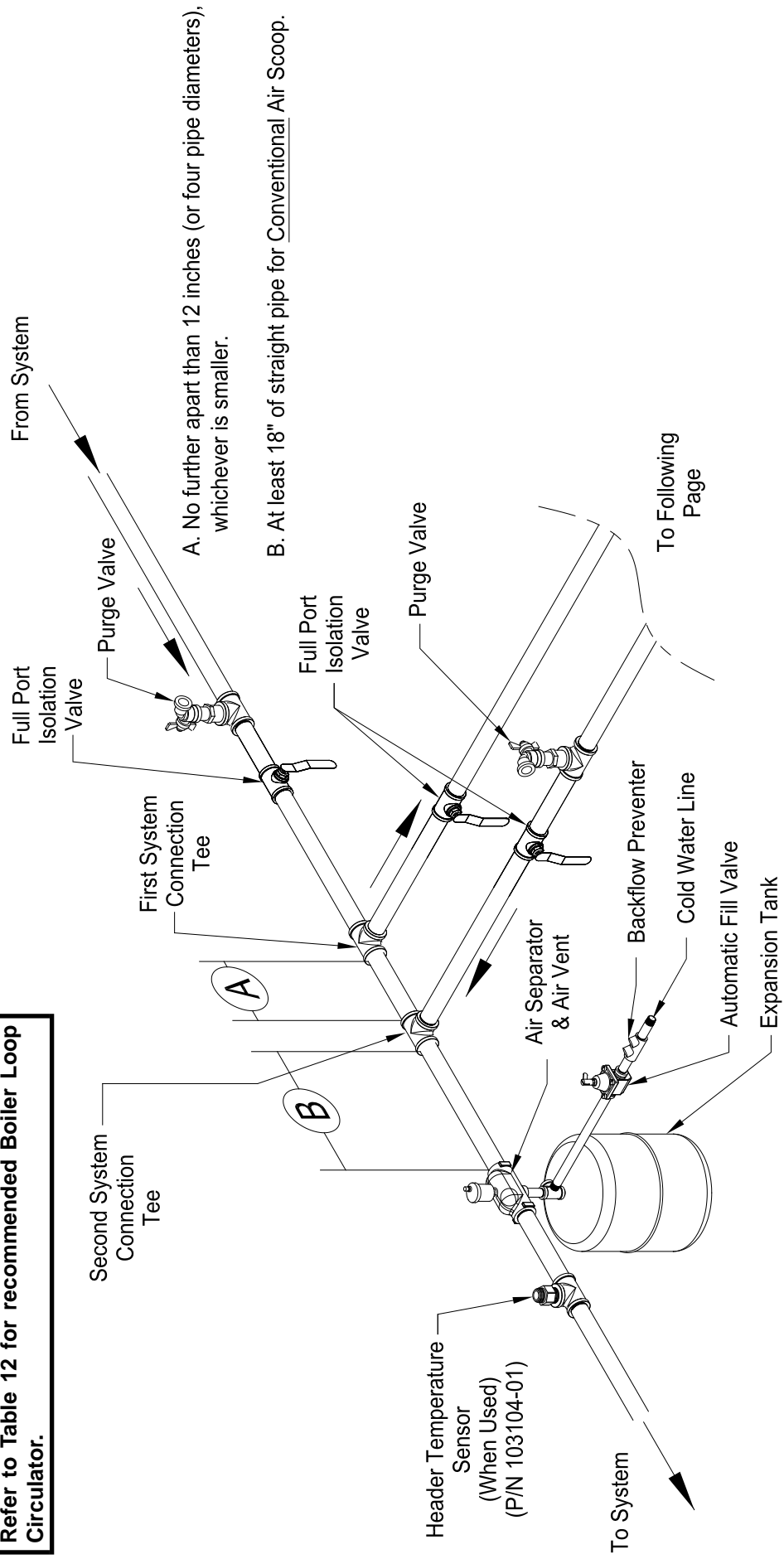
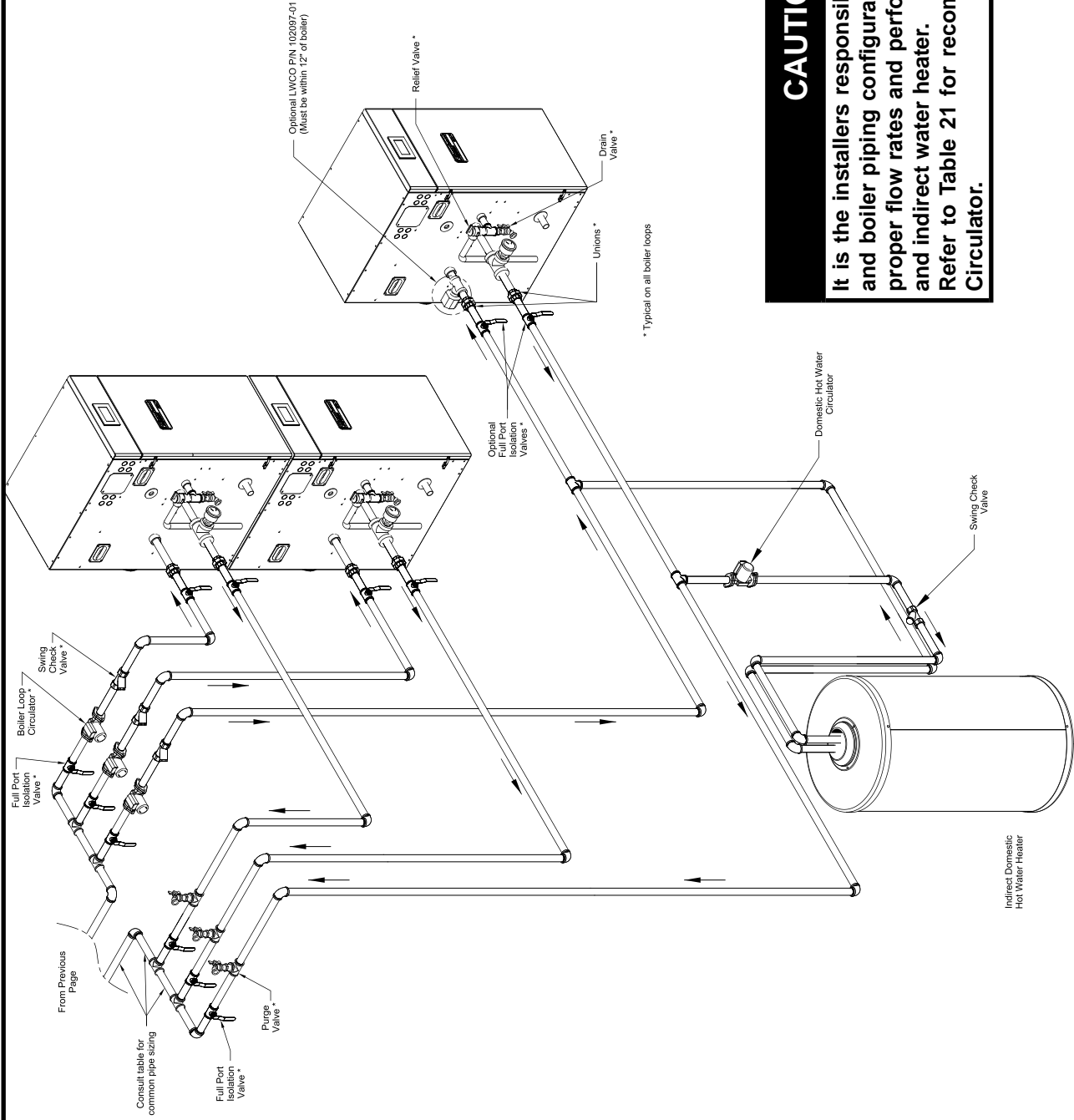


Figure 42A: Alternate Modular Boiler Water Piping w/ Indirect Domestic Hot Water Heater (Page 1 of 2)

70 X. Modular Installation (continued)



*Typical on all boiler loops

CAUTION
 It is the installers responsibility to select pumps and boiler piping configurations that provide the proper flow rates and performance for the boiler and indirect water heater. Refer to Table 21 for recommended Boiler Loop Circulator.

Figure 42B: Alternate Modular Boiler Water Piping w/Indirect Domestic Hot Water Heater (Page 2 of 2)

X. Modular Installation (continued)

Table 21: Recommended Circulator Models for Alpine (ALP) Boilers and Alliance SL Indirect Water Heaters Installed as Part of Near-Boiler Piping Up to 75 Ft. Equivalent Length - Domestic Hot Water Circulator

Boiler Model	Boiler Supply Connection, Inch, FPT	Boiler Return Connection, Inch, FPT	Near-Boiler Piping Supply Pipe Size, Inch	Near-Boiler Piping Return Pipe Size, Inch	Max Allowable Flow thru Boiler, GPM @ 20°F Delta T	Flow, GPM @ 25°F Delta T	Min Req'd Flow thru Boiler, GPM @ 35°F Delta T	Alliance SL Models to be installed As Part of Near-Boiler Piping	Alliance SL Coil Required Flow Rate, GPM	Alliance SL Coil Head Loss, Ft @ Required Flow Rate	Combined Boiler, Alliance SL & Piping Loop Head Loss, Ft	*Recommended Circulator Make & Model for Alliance SL installed as Part of Near-Boiler Piping	Reference Figure	Notes
ALP080	1	1	1	1	7.3	5.8	4.2	SL27	6	9	19.3	Taco 0014 Grundfos UPS26-99 FC (second speed)	42B	
								SL35	6	9	19.3			
								SL50	6	9.5	19.8			
								SL70	6	10	20.3			
ALP105	1	1	1	9.6	7.7	5.5	SL119	14	17	NA	Not Recommended	NA	Note 1	
							SL27	6	9	19.3	Taco 0014 Grundfos UPS26-99 FC (second speed)	42B		
							SL35	6	9	19.3				
							SL50	6	9.5	19.8				
SL70	6	10	20.3											
ALP150	1	1	1	13.8	11	7.9	SL119	14	17	NA	Not Recommended	NA	Note 1	
							SL27	6	9	NA	41A	Note 2		
							SL35	6	9					
							SL50	6	9.5					
SL70	6	10												
							SL119	14	17	36	Taco 1400-45 Grundfos UPS 32-80/2 (max speed)	42B		

NOTES:

Note 1: Required Alliance SL Coil Flow Rate exceeds Max Allowable Flow Rate thru Boiler; this Boiler/Alliance SL combination may result in boiler heat exchanger erosion and noise.

Note 2: Required Alliance SL Coil Flow Rate is below Min Required Flow Rate thru Boiler; this Model can only be installed as separate heating zone off system header - see Figure 41A for alternate IWH piping. Indirect Water Heater Circulator must be selected by an installer based on Alliance SL required coil flow and corresponding coil head loss shown as well as total equivalent length of such separate zone.

Note 3: Combined Head Loss shown corresponds to Min Required Flow Rate thru Boiler.

* Circulator Models shown are not equipped with internal flow check valve (IFC).

When selecting Circulators with IFC contact Circulator Manufacturer for sizing information.

Near-Boiler Piping Size shown is based on 2 to 5.5 Ft/sec velocity range to avoid potential noise and pipe erosion.

22 X. Modular Installation (continued)

Table 21 (continued): Recommended Circulator Models for Alpine (ALP) Boilers and Alliance SL Indirect Water Heaters Installed as Part of Near-Boiler Piping Up to 75 Ft. Equivalent Length - Domestic Hot Water Circulator

Boiler Model	Boiler Supply Connection, Inch, FPT	Boiler Return Connection, Inch, FPT	Near-Boiler Piping Supply Pipe Size, Inch	Near-Boiler Piping Return Pipe Size, Inch	Max Allowable Flow thru Boiler, GPM @ 20°F Delta T	Flow, GPM @ 25°F Delta T	Min Req'd Flow thru Boiler, GPM @ 35°F Delta T	Alliance SL Models to be installed As Part of Near-Boiler Piping	Alliance SL Coil Required Flow Rate, GPM	Alliance SL Coil Head Loss, Ft @ Required Flow Rate	Combined Boiler, Alliance SL & Piping Loop Head Loss, Ft	*Recommended Circulator Make & Model for Alliance SL installed as Part of Near-Boiler Piping	Reference Figure	Notes
ALP210	1	1	1-1/4	1-1/4	19.4	15.5	11.1	SL27	6	9	NA	Not Recommended	41A	Note 2
								SL35	6	9				
								SL50	6	9.5				
								SL70	6	10				
ALP285	1-1/4	1-1/4	1-1/2	1-1/2	26.5	21.2	15.1	SL119	14	17	29.7	Taco 1400-45 Grundfos UPS 32-80/2 (max speed)	42B	
								SL27	6	9	NA	Not Recommended	41A	Note 2
								SL35	6	9				
								SL50	6	9.5				
SL70	6	10												
ALP399	1-1/2	1-1/2	2	2	37.7	30.2	21.5	SL119	14	17.0	27.0	Taco 1400-45 Grundfos UPS 32-80/2 (max speed)	42B	Note 3
								SL27	6	9	NA	Not Recommended	41A	Note 2
								SL35	6	9				
								SL50	6	9.5				
SL70	6	10												
ALP500	1-1/2	1-1/2	2	2	47.2	37.8	27.0	SL119	14	17.0	NA	Not Recommended	41A	Note 2
								SL27	6	9	NA	Not Recommended	41A	Note 2
								SL35	6	9				
								SL50	6	9.5				
SL70	6	10												

NOTES:

Note 1: Required Alliance SL Coil Flow Rate exceeds Max Allowable Flow Rate thru Boiler; this Boiler/Alliance SL combination may result in boiler heat exchanger erosion and noise.

Note 2: Required Alliance SL Coil Flow Rate is below Min Required Flow Rate thru Boiler; this Model can only be installed as separate heating zone off system header - see Figure 41A for alternate IWH piping. Indirect Water Heater Circulator must be selected by an installer based on Alliance SL required coil flow and corresponding coil head loss shown as well as total equivalent length of such separate zone.

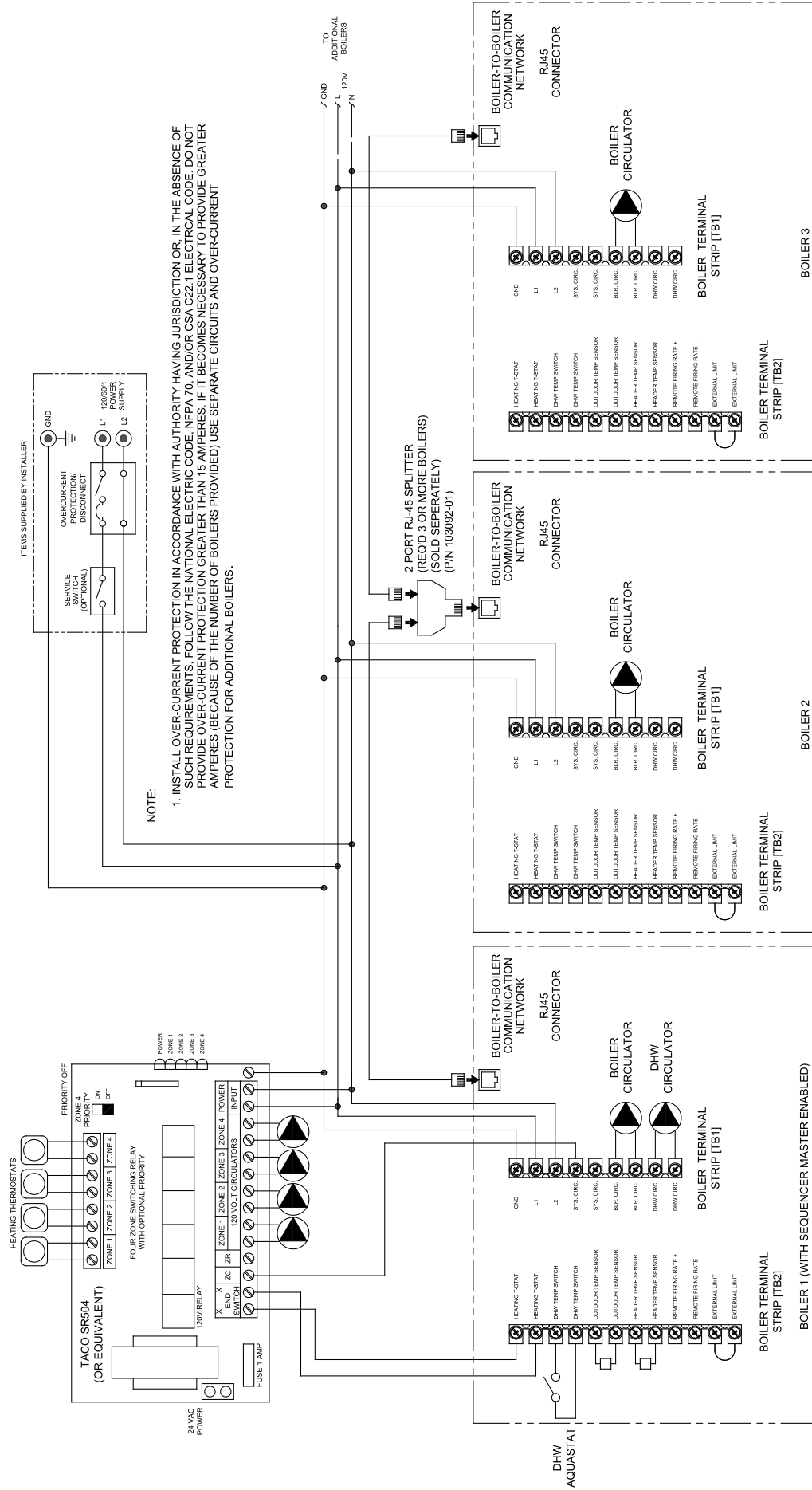
Note 3: Combined Head Loss shown corresponds to Min Required Flow Rate thru Boiler.

* Circulator Models shown are not equipped with internal flow check valve (IFC).

When selecting Circulators with IFC contact Circulator Manufacturer for sizing information.

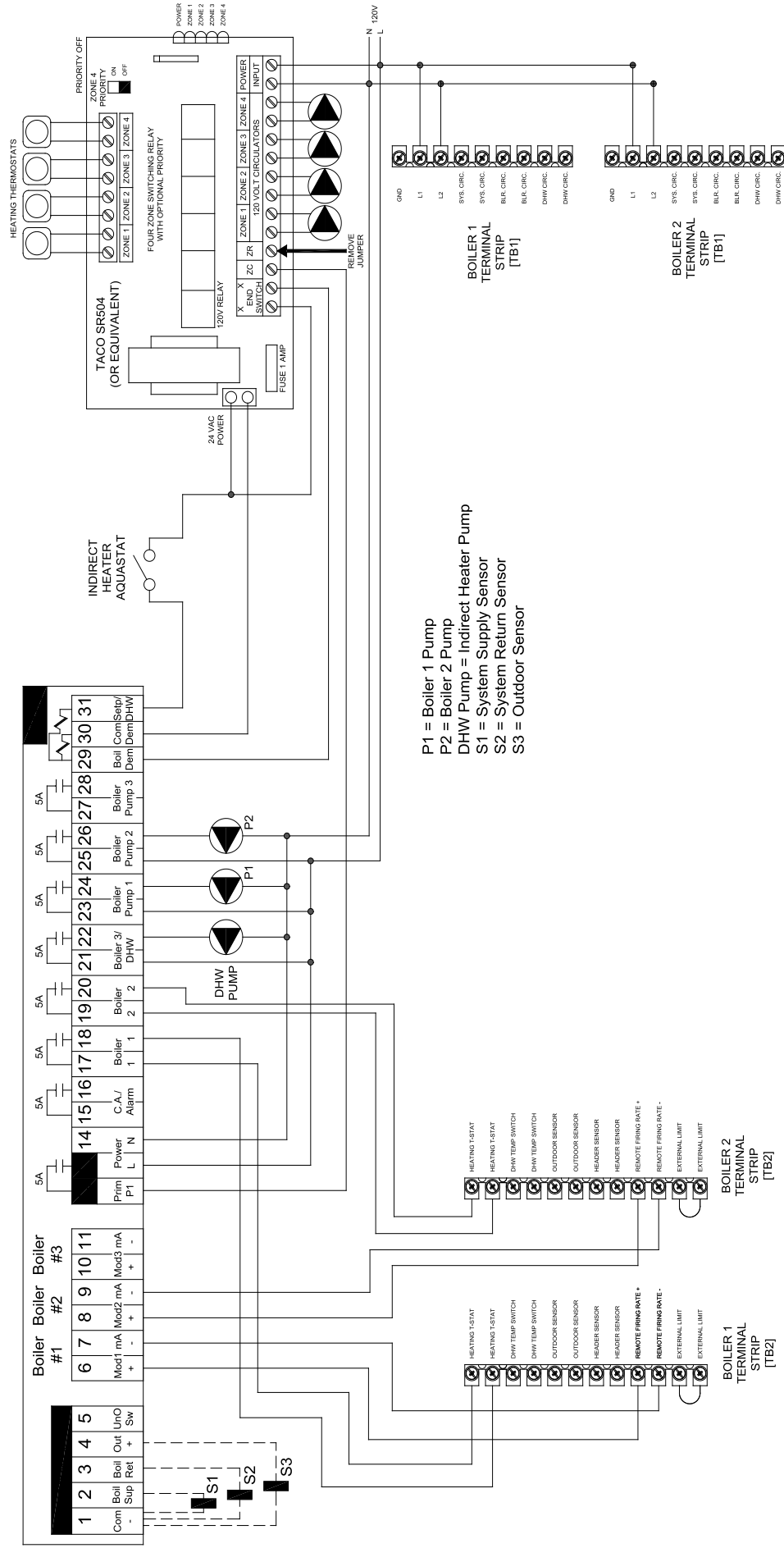
Near-Boiler Piping Size shown is based on 2 to 5.5 Ft/sec velocity range to avoid potential noise and pipe erosion.

X. Modular Installation (continued)



**Figure 43: Three Boiler Modular Wiring Diagram
Internal Sage2.1 Multiple Boiler Control Sequencer
(Three Boilers Shown, Typical Connections for up to Eight Boilers)**

74 X. Modular Installation (continued)

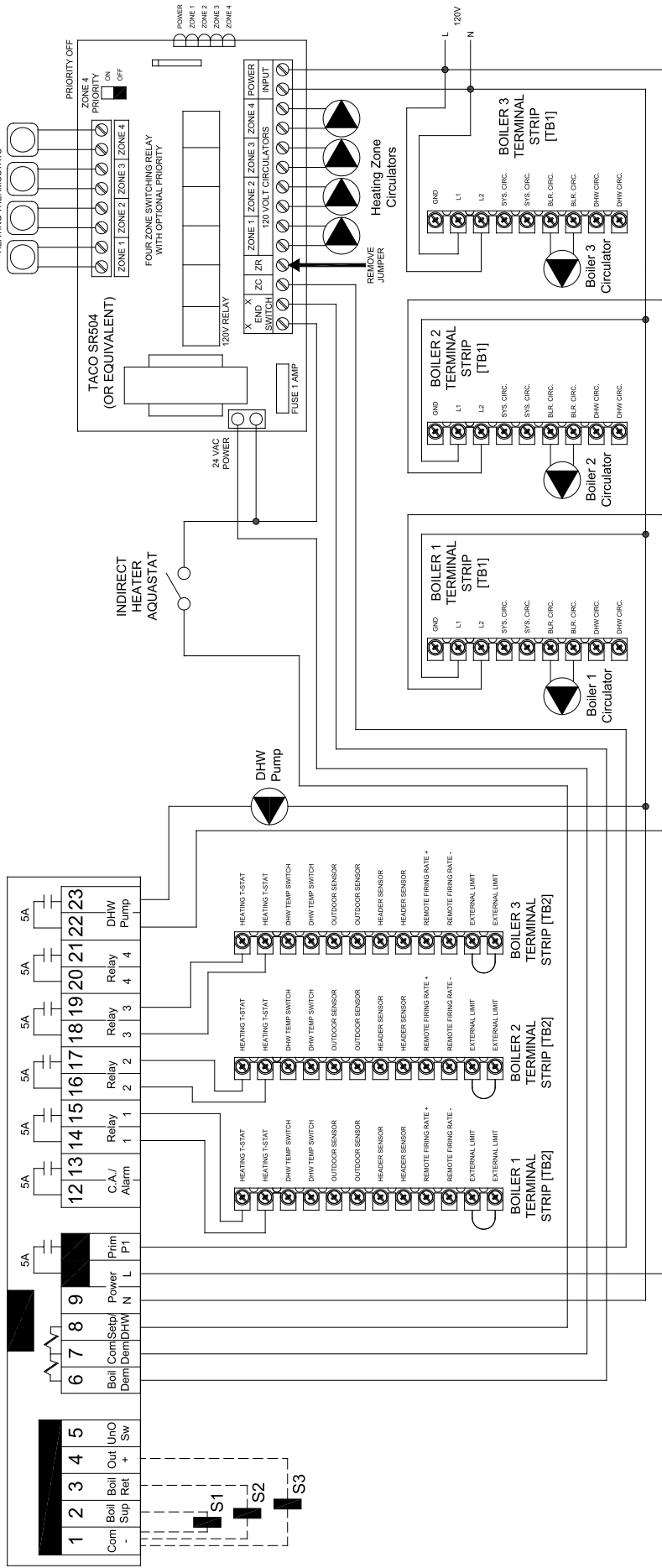


P1 = Boiler 1 Pump
 P2 = Boiler 2 Pump
 DHW Pump = Indirect Heater Pump
 S1 = System Supply Sensor
 S2 = System Return Sensor
 S3 = Outdoor Sensor

Figure 44A: Modular Wiring Diagram w/Tekmar 265 Control
Tekmar 265 Based Control System (or equal)
Sequence of Operation

The Tekmar 265 Control (or equal) can control up to three (3) boilers and an Indirect Water Heater. When a call for heat is received by the Tekmar 265 Control, the control will fire either one or more boilers in either parallel or sequential firing mode to establish a required reset water temperature in the system supply main based on outdoor temperature. The boilers will modulate based on an Analog communication signal established between the Tekmar 265 Control and each boiler's Sage2.1™ Control. The boiler(s) and system supply water temperature will be reset together to maintain the input that is needed to the system. When a call for Indirect Hot Water is generated to the Tekmar 265, the control will de-energize the zone pump control (ZC terminal), energize the Indirect pump and modulate the boiler firing to establish a setpoint temperature in the main for the Indirect Heater using Priority. The Tekmar 265 also controls each boiler's pump and a post purge of leftover temperature in the boilers will occur at the end of the call for Indirect Hot Water.

X. Modular Installation (continued)



DHW Pump = Indirect Heater Pump
 S1 = System Supply Sensor
 S2 = System Return Sensor
 S3 = Outdoor Sensor

Figure 44B: Modular Wiring Diagram w/Tekmar 264 Control Sequence of Operation

The Tekmar 264 Control (or equal) can control up to four (4) boilers and an Indirect Water Heater by utilizing stage firing. When a call for heat is received by the Tekmar 264 Control, the control will fire either one or more boilers in sequential firing mode to establish a required reset water temperature in the system supply main based on outdoor temperature. The boilers will modulate on their own based on each boiler's Sage2.1™ Control and will target a setpoint temperature to supply enough input to the system main to satisfy the desired reset water temperature in the main established by the Tekmar 264 Control. When a call for Indirect Hot Water is generated to the Tekmar 264, the control will de-energize the zone pump control (ZC terminal), energize the Indirect pump and sequentially fire the boilers to establish a setpoint temperature in the main for the Indirect Heater using Priority. The Tekmar 264 Control will disable the stage firing and post-purge the Indirect Pump to reduce the temperature in the Supply Main near the end of the Indirect Mode to a point where it will need to be when it changes back to Space Heating Mode. The Tekmar 264 Control also has the ability to rotate the lead-lag firing of the boilers to establish equal operating time for each boiler stage.

X. Modular Installation (continued)

WARNING

If gas pressure in the building is above ½ psig, an additional gas pressure regulator is required. Using one additional regulator for multiple boilers may result in unsafe boiler operation. The additional regulator must be able to properly regulate gas pressure at the input of the smallest boiler. If the regulator cannot do this, two or more additional regulators are required. Consult regulator manufacturer and/or local gas supplier for instructions and equipment ratings.

E. Electrical

Refer to Section VIII “Electrical” of this manual for:

1. Individual module (boiler) wiring specific details
2. Individual module (boiler) internal wiring details, high and low voltage connections

Each individual module (boiler) must be provided with own fused disconnect and own service switch.

Install modular boiler wiring in accordance with requirements of authority having jurisdiction. In absence of such requirements, follow the National Electric Code, NFPA 70 and/or CSA C22.1 Electric Code.

F. External Modular Boiler Control System

As an alternate to the Sage2.1 Control internal sequencer, the Sage2.1 Control also accepts an input from an external sequencer. Follow modular boiler control system manufacturer (Honeywell, Tekmar, etc.) instructions to properly apply a modular control system. The Tekmar Model 264 and Model 265 based control wiring diagrams (Figures 44A and 44B) are provided as examples of typical modular boiler control systems.

X. Modular Installation (continued)

G. Modular Boiler Operating Information

1. Major Features

a. **“Plug & Go” Multiple Boiler Control Sequencer**

When multiple boilers are installed, the Sage2.1's Sequencer may be used to coordinate and optimize the operation of up to eight (8) boilers. Boilers are connected into a “network” by simply “plugging in” standard ethernet cables into each boiler's “Boiler-To-Boiler Communication” RJ45 connection.

b. **Sequencer Master**

A single Sage2.1 Control is parameter selected to be the Sequencer Master. The call for heat, outdoor and header sensors, and common pumps are wired to the Sequencer Master “enabled” Sage2.1 Controller.

c. **Improved Availability**

The following Sage2.1 features help improve the heat availability:

- i. **Backup Header Sensor:** In the event of a header sensor failure the lead boiler's supply sensor is used by the Sequence Master to control firing rate. This feature allows continued coordinated sequencer control even after a header sensor failure.
- ii. **“Stand Alone” Operation Upon Sequence Master Failure:** If the Sequence Master Sage2.1 Control is powered down or disabled or if communication is lost between boilers, individual boilers may be setup to automatically resume control as a “stand alone” boiler.
- iii. **Slave Boiler Rate Adjustment:** Each slave boiler continues to monitor supply, return and flue gas temperatures and modifies the Sequence Master's firing rate demand to help avoid individual boiler faults, minimize boiler cycling and provide heat to the building efficiently.
- iv. **Slave Boiler Status Monitoring:** The Sequence Master monitors slave boiler lockout status and automatically skip over disabled boilers when starting a new slave boiler.

d. **Lead/Slave Sequencing & Equalized Run Time**

One boiler is a “Lead” boiler and the remaining networked boilers are “Slaves”. When demand is increasing, the Lead boiler is the first to start and the Slave boilers are started in sequential order (1,2,3,...) until the demand is satisfied. When demand is decreasing, the boilers are stopped in reverse order with the Lead boiler stopped last (... ,3,2,1). To equalize the run time the sequencer automatically rotates the Lead boiler after 24 hours of run time.

e. **Customized Sequences**

Normally, boilers are started and stopped in numerical order. However, custom sequences may be established to optimize the heat delivery. For example, in order to minimize boiler cycling, a large boiler may be selected to run first during winter months and then selected to run last for the remainder of the year. Refer to Paragraph G, 4 “Slave Selection Order” for more information.

f. **Multiple Demands**

The Sequence Master responds to Central Heat, DHW and frost protection demands similar to the stand alone boiler (refer to Operation Section XII, Paragraph A, 7 “Priority Demand” for additional information).

g. **Shared or Isolated DHW Demand**

When the Indirect Water Heater (IWH) parameter is set to “Primary Piped” the Sequence Master sequences all required boilers to satisfy the DHW setpoint (default 180 F). When “Boiler Piped” is selected only the individual slave boiler, with the wired DHW demand and pump, fires to satisfy the DHW setpoint.

h. **DHW Two boiler Start**

When the Indirect Water Heater (IWH) parameter is set to “Primary Piped” and the DHW Two Boiler Start parameter is set to “Enabled” two boilers are started without delay in response to a DHW call for heat. This feature allows rapid recovery of large IWH's and multiple IWH's.

i. **Optimized Boiler Modulation**

Boiler firing rate is managed to increase smoothly as boilers are started. For example, when a second boiler is started the initial firing rate is 100%/2 or 50%, when the third boiler is started the firing rate starts at 200%/3 or 66%. After the initial start, the Sequence Master develops a unison firing rate demand based on it's setpoint and sensed header temperature.

j. **Innovative Condensing Boiler Control**

During low loads, the Sequence Master limits firing rates to a “High Fire Limit” to ensure peak operating efficiency. Lower firing rates boost efficiency by helping increase the amount of flue gas water vapor condensation. The Sage2.1 maintains a “High Fire Limit” until the last lag boiler is started. At this point, the “High Fire Limit” is released to allow boilers to modulated as required to meet heat load. Refer to Figures 45A and 45B for additional information.

X. Modular Installation (continued)

k. Advanced Boiler Sequencing

After there is a Call For Heat input, both header water temperature and boiler firing rate percent are used to start and stop the networked boilers. The control starts and stops boilers when the water temperature is outside the user selected “Diff Above” and “Diff Below” settings. Also, in order to minimize temperature deviations, the control adjusts the number of boilers running based on the firing rate. This combination allows the boilers to anticipate slow load changes before they disrupt water temperature yet still respond quickly to sudden load changes. These special sequencer features help reduce energy wasting system temperature swings and the resulting unnecessary boiler cycling. Refer to Figure 45A and 45B for a graph of the following sequencer details:

- i. **Start Lead Boiler**
When water temperature is below the setpoint by more than the “Diff Below” setting, the Lead Boiler is started and modulates to satisfy the heat load.
- ii. **Start 1st Lag Boiler (fast load change example)**
When water temperature is below the setpoint by more than the “Diff Below” setting for longer than 2 minutes and firing rate is at the “High Fire Limit”, the second boiler is started and both modulate in unison to satisfy the heat load.
- iii. **Start Last Lag Boiler (slow load change example)**
When boiler firing rate has been next to the “High Fire Limit” for longer than 20 minutes the last boiler is started. After the last boiler is started the High Fire Limit is released and the boilers are free to modulate above the “High Fire Limit” as required to satisfy the home load.
- iv. **Stop Lag Boiler**
When boiler firing rate has been next to low fire limit for longer than 20 minutes or water temperature is above the setpoint by more than the “Diff Above” setting for 30 seconds the lag boiler is stopped.
- v. **Stop Lead Boiler**
When water temperature is above the setpoint by more than the “Diff Above” the lead boiler stops without delay.
- vi. **Stop All Boilers**
All boilers are stopped without delay if the Call for Heat input is removed or if the header temperature is higher than 195 F.

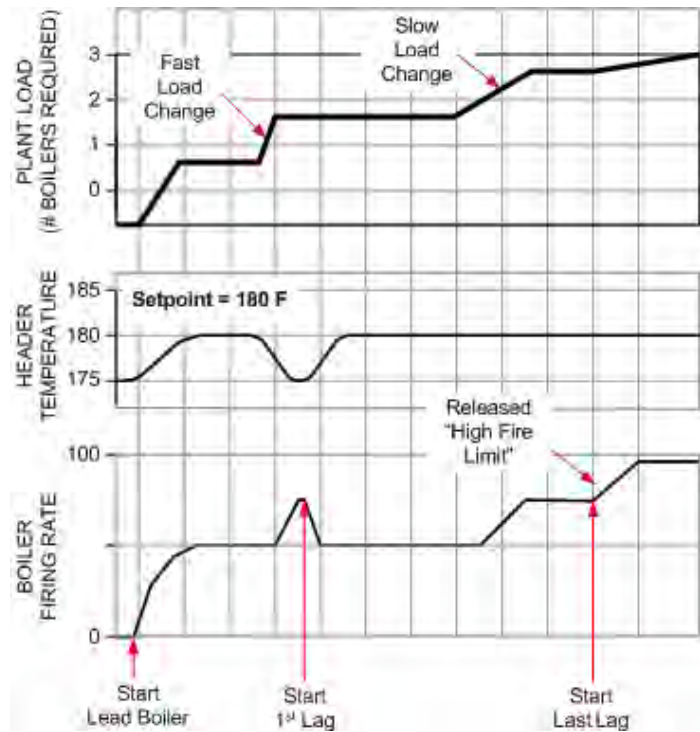


Figure 45A: Start Sequence Detail

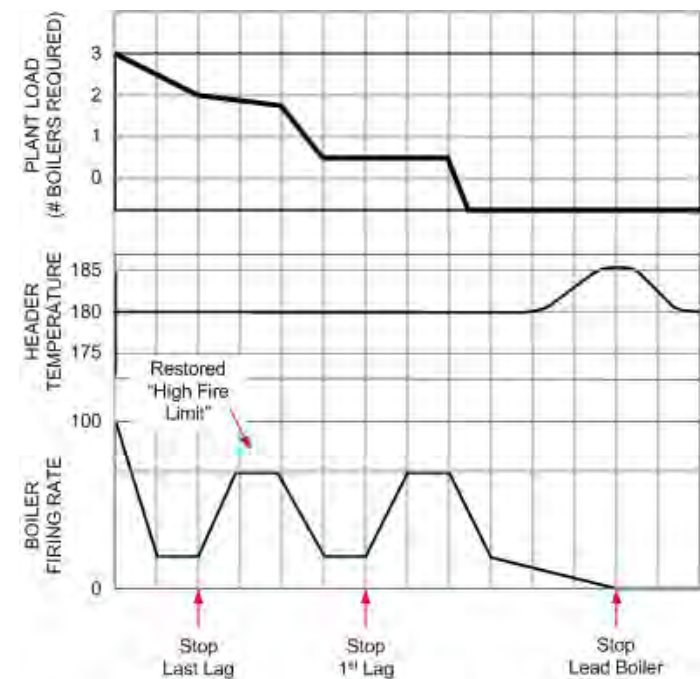


Figure 45B: Stop Sequence Detail

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

2. Operating Mode

a. Sequencer Status Screen

The “Sequencer Status” screen, shown in Figure 46, appears on the Sage2.1 Controller when the Sequence Master is enabled and the “Home” screen “Status” button is selected. The screen is added to the existing status screens already offered by the Sage2 controller. The following information is provided on this screen:

i. Networked Boiler Status

“Boiler Status” shown on the Sequencer Status Screen provides connected, start sequence and firing rate status information for all connected boiler addresses. The boiler number is underlined if the boiler is running and blinks if the boiler has the start sequence in progress. For example the status for boiler address 1 is provided as follows:

“Boiler Status” Display:

1 - Boiler 1 is connected

1 - “Blinking underline” -boiler 1 is starting

1 - “Solid underline” -boiler 1 is running

ii. Priority Demand

The Sage2.1 accepts a call for heat (demand) from multiple places and responds to each demand according to it’s relative importance. When multiple demands are present at one time, the more important demand is selected as the “priority” demand and is used to operate the networked boilers. The selected Priority Demand is shown on the “Sequencer Status” screen (Figure 46). Table 22 provides a list of demands in priority order.

iii. Priority Sensor and Setpoint

The Sequencer Master Priority Sensor is the header sensor. In the event that the header sensor fails, the lead boiler supply sensor is used as the Priority Sensor. The Priority Setpoint is the setpoint for the active priority, such as central heat or DHW setpoints.

Select “Status” button on home screen (when sequencer Master is enabled) to view:

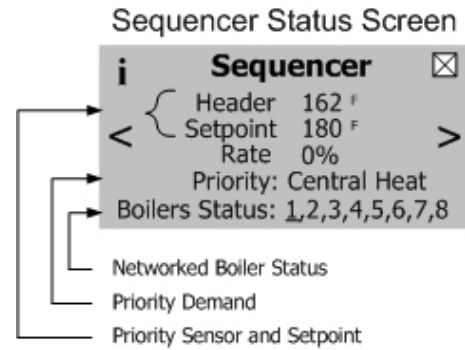


Figure 46: Sequencer Status Screen

Table 22: Sequence Master Priority

Priority Order	Status Screen Display “Priority”	Boiler Responding to:
1 st	Domestic HW	DHW demand has been received and selected as the priority demand.
2 nd	Central Heat	Central Heat call for heat is on and has been selected as priority.
3 rd	Frost Protection	Frost Protection is active and there is no other call for heat.
4 th	Warm Weather	Warm Weather Shutdown (WWSD) is active and the boiler will not respond to central heat demands. DHW demand is not blocked by WWSD.
Last	Standby	Boiler is not firing. There is no call for heat or there is a call for heat and the sensed temperature is greater than setpoint.

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

2. Operating Mode (continued)

b. Networked Boilers Detail Screens

The “Networked Boilers” detail screen, shown in Figure 47, is available on the Sage2.1 Controller when the Sequence Master is enabled and the “Home” screens “Detail” button is selected. The screen is added to the existing detail screens already offered by the Sage2 controller. The following information is provided on this screen:

i. Boiler Sequencer Status

The Boiler Sequencer Status provides the Slave boiler situation as follows:

- Available: The slave boiler is ready and waiting to be started by the Sequencer Master.
- Add Stage: The slave boiler has begun the start sequence but has not yet reached the boiler running status.
- Running: The slave boiler is running.
- On Leave: The Slave boiler has left the network to service a DHW demand.
- Recovering: The slave boiler is in the process of returning to the network. For example, the slave boiler is in the post-purge state.
- Disabled: The slave boiler has a lockout condition and is unable to become available to the Sequencer Master.

c. Sequencer Alarm

This alarm (shown in Figure 47) is active when the slave boiler has lost communication with the sequence master.

The possible causes are as follows:-

- Sage2.1 with the Sequence Master “Enabled” is powered down or damaged
- Sequence Master has been “Disabled”
- Ethernet cable connecting boiler RJ45 connections has been disconnected

If communication can not be re-established, cycle power to clear the alarm condition.

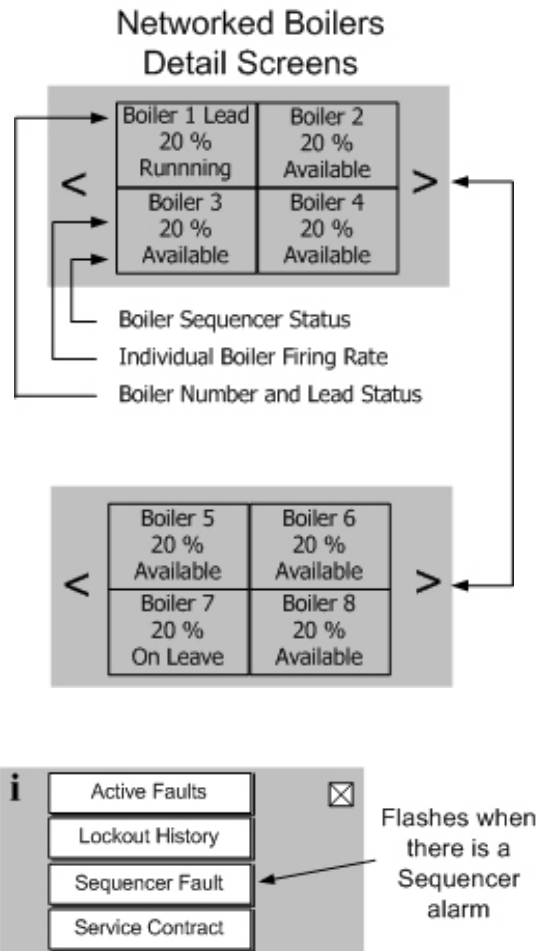


Figure 47: Sequencer Alarm and Detail Screens

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

3. Required Equipment and Setup

a. Header Sensor (p/n 103104-01)

A header sensor must be installed and wired to the Master Sequencer “enabled” Sage2.1 Controller. The header sensor is installed on the common system piping and provides blended temperature information to the Sequence Master. Refer to piping diagram Figures 41A and 42A for installation location and Figure 48 or 49 for installation detail.

b. RJ45 Splitters (P/N 103092-01)

RJ45 Splitters are required for installing communications between three or more boilers. When two boilers are connected the splitter is not required.

c. Ethernet Cables

Ethernet cables are used to connect the boiler network together. These are standard “straight through” cables that can be purchased at electrical distributors.

Alternately, the network can be wired together by simply wiring terminal J3, Modbus 2, terminals A, B and V- between each boiler. Refer to Figures 35 and 36 terminal J3 for wiring location.

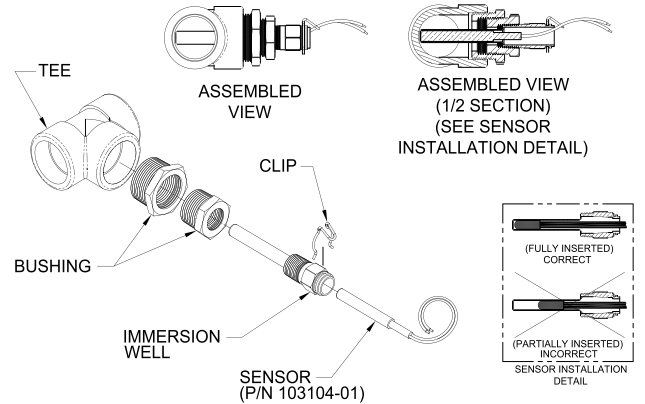


Figure 48: Recommended “Immersion” type Header Sensor Installation Detail

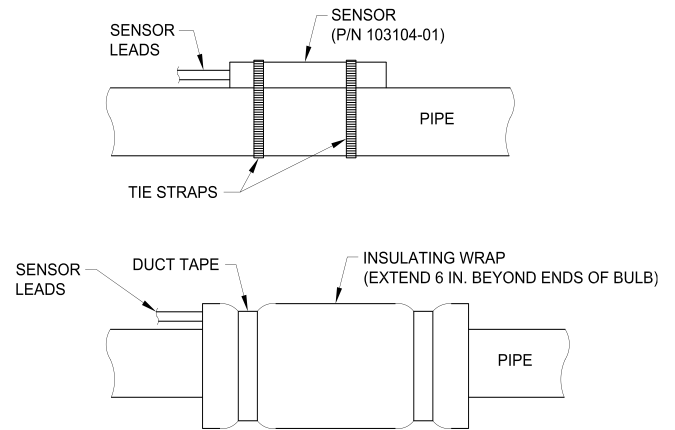
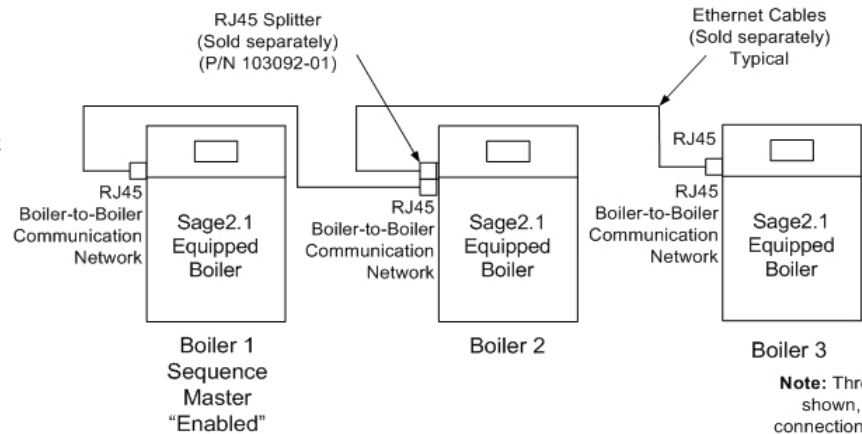


Figure 49: Alternate “Strap-on” type Header Sensor Installation Detail

Multiple Boiler Communication Network



Note: Three boilers shown, typical connections for up to eight boilers

TWO Boiler Communication Network

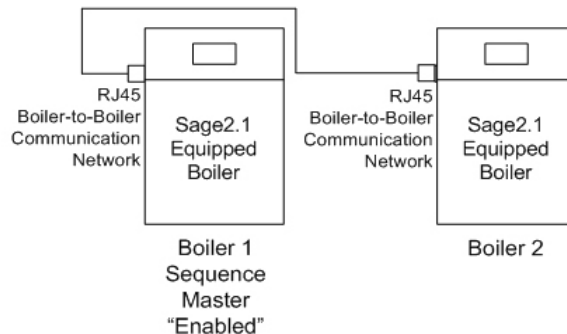


Figure 50: RJ45 Splitter Installation Detail

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

3. Required Equipment and Setup

d. Modular Boiler Setup

Step	Description	Comments
1	Install and wire the Header Sensor	Wire the header sensor to low voltage terminal strip terminals "Header sensor". NOTE This step can not be skipped. The Sequence Master can not be "enabled" unless a Header Sensor is installed.
2	Install Ethernet Cables between boilers	Standard Ethernet type cables with RJ45 connectors are "plugged in" to the Boiler-to-Boiler Communication Network connection located on the side of the boiler. When more than two boilers are connected an RJ45 splitter may be used to connect the boilers. Refer to Figure 50.
3	Apply Power to All Boilers	
4	Set Unique Boiler Addresses	Assign all boilers a <u>unique</u> Boiler Address using any number from 1 through 8. WARNING When two boiler's addresses are the same undesirable simultaneous operation occurs.
5	Enable 1 Boiler Master	Enable <u>only one</u> Sage2 Control's Sequencer Master. WARNING When more than one Sequencer Master is enable erratic behavior will result.
6	Power Down All Boilers	
7	Power Up Master Sequencer "Enabled" Boiler First	
8	Power Up Other Boilers	
9	Confirm Communication	From the Home Screen of the Sage2 Control with the Master Sequencer "enabled", select the Status button. The Sequencer display shows the boiler address of the communicating boilers. Additionally, from the "Home" screen select the "Detail" button and then the "Networked Boilers" buttons to view boiler communication status. If a boiler is not shown, check Ethernet cable connections and confirm all boilers have unique addresses.

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

4. Adjusting Parameters

From the “Home” screen select the Adjust button to access the adjust mode screens links (if required refer to “Entering Adjustment Mode”, Section XII, Paragraph D, 4 for login in instructions).

“Press” button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Disable	Enable, Disable	Master Enable/Disable The Sequencer Master Enable/Disable is used to “turn on” the Multiple Boiler Controller. Warning! enable ONLY one Sequence Master.
Boiler Piped	Boiler Piped, Primary Piped	Indirect Water Heater (IWH) Boiler Piped Sequencer to respond to an Isolated DHW demand that is piped to a single boiler. The individual boiler goes on “Leave” from the Sequencer Master and goes to DHW Service. Primary Piped The Sequence Master responds to the DHW Call For Heat. This allows one or more boilers to provide heat to the IWH.
Disabled	Enable, Disable	DHW Two Boiler Start The Sequencer to immediately start two boilers for a DHW call for heat. Used when DHW is the largest demand. Only visible when primary piped IWH is selected.
195°F	Central Heat Setpoint, 195°F	Stop All Boilers Setpoint When this temperature is reached all boilers are stopped. This setpoint allows the Sequencer to respond to rapid load changes.

“Press” button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
None	1-8	Boiler Address Each boiler must be given a unique address. When “Normal” slave selection order is used, the boiler address is used by the Master Sequencer as the boiler start order. The boiler address is also the Modbus Address when a building automation system is connected.
Normal	Use Boiler First, Normal, Use Boiler Last	Slave Selection Order “Use Boiler First”; places the Slave in the lead. “Normal”; firing order follows boiler number (1,2,3,..) order. “Use Boiler Last”; places the slave last in the firing order.
3	1-5	Response Speed This parameter adjusts the Sequence Master temperature controller Proportion Integral Derivative (PID) values. A larger Response Speed value results in tighter, more active, PID control. This speed is used whenever the Sequencer is released to modulate.

X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

4. Adjusting Parameters (continued)

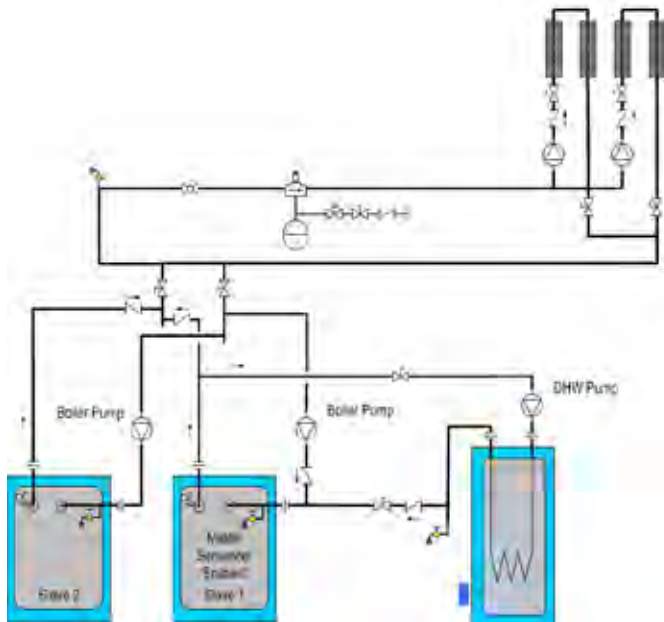
“Press” Pump Setup button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Any Demand	Never, Any Demand, Central Heat, Central heat, No Priority,	System Pump run pump for: Activates the system pump output according to selected function. Never: Pump is disabled and not shown on status screen Any Demand: Pump Runs during any call for heat. Central Heat, No Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and continues to run during Domestic Hot Water Priority. Central heat, Optional Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and will be forced off if there is a DHW call for heat and Domestic Hot Water Priority is active.
Any Demand	Any Demand, Central heat, off DHW demand	Boiler Pump run pump for: Activates the boiler pump output according to selected function. Any Demand: Pump Runs during any call for heat. Central heat, off DHW demand: Pump Runs during central heat and frost protection call for heat. Pump does not start for a DHW call for heat and will be forced off if there is a DHW call for heat and Domestic Hot Water Priority is active.
Primary Loop Pipe IWH	Never, Primary Loop Piped IWH, Boiler Piped IWH	Domestic Pump run pump for: Activates the Domestic pump output according to selected function Never: Pump is disabled and not shown on status screen. Primary Loop Piped IWH: Pump Runs during domestic hot water call for heat. Domestic Hot Water Priority enable/disable does not affect pump operation. Boiler Piped IWH: Pump Runs during domestic hot water call for heat. Pump is forced off during a central heat call for heat when Domestic Hot Water Priority “disabled” is selected and when Domestic Hot Water Priority “enable” has been selected and the DWH call for heat has remained on for longer than 1 hour (priority protection time).

Refer to following “Example Pump Parameter selections” for additional pump setup information.

Example Pump Parameter selections

- a. Multiple Boilers with Boiler Piped IWH, System and DHW Wired to Master



	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	“Boiler Piped”	
Pump Parameter Selections:		
System Pump =	Central Heat, No Priority	Never
Boiler Pump =	Central Heat, Off DHW Priority	Any demand
DHW Pump =	Boiler Piped IWH	Never

Explanation:

This piping arrangement does not allow both the Slave 1’s boiler and domestic hot water pump to run at the same time. When call for Domestic Hot Water is received the DHW pump is turned on and the boiler pump is turned off. However, the system pumps may run to satisfy a central heat demand that is being satisfied by a different slave. The central heat demand is ignored by Slave 1 until the domestic hot water demand is ended. If domestic hot water priority is enabled and priority protection time is exceeded the domestic hot water pump turns off to allow the boiler pump to run.

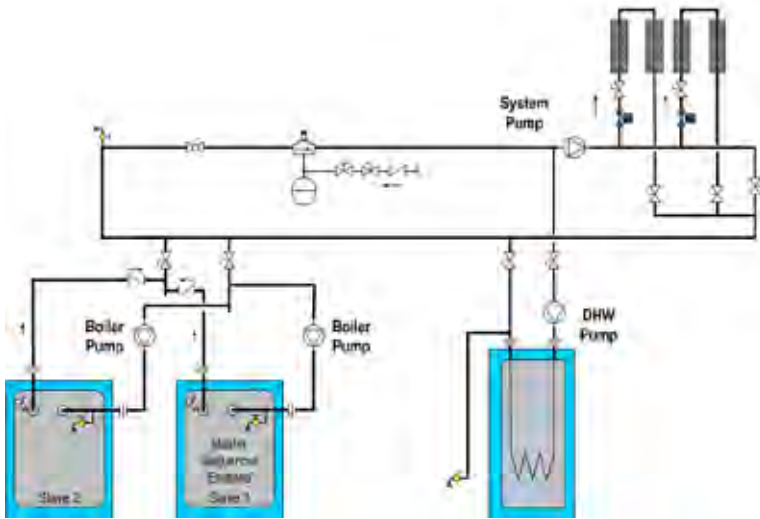
X. Modular Installation (continued)

G. Modular Boiler Operating Information (continued)

4. Adjusting Parameters (continued)

Example Pump Parameter selections (continued):

b. Multiple boilers IWH Piped to Primary, Optional Domestic Hot Water Priority

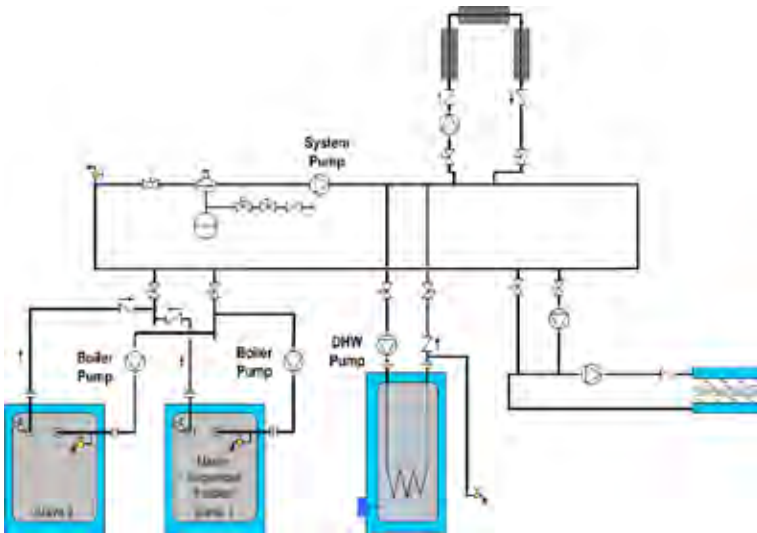


	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	"Primary Piped"	
Pump Parameter Selections:		
System Pump =	Central Heat, Optional Priority	Never
Boiler Pump =	Any demand	Any demand
DHW Pump =	Primary Loop Piped IWH	Never

Explanation:

This piping arrangement permits the system pump to run or not run when there is a domestic hot water call for heat. Domestic hot water priority is optional. It is permissible for the domestic and system pumps to run at the same time. The boiler pump must run for every call for heat.

c. Multiple Boilers, IWH piped to primary, system pump required to run for any call for heat



	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	"Primary Piped"	
Pump Parameter Selections:		
System Pump =	Any demand	Never
Boiler Pump =	Any demand	Any demand
DHW Pump =	Primary Loop Piped IWH	Never

Explanation:

This piping arrangement requires the system pump to be running for any calls for heat. Also the boiler pump must run for any call for heat.

XI. System Start-up

- A. Verify that the venting, water piping, gas piping and electrical system are installed properly. Refer to installation instructions contained in this manual.
- B. Confirm all electrical, water and gas supplies are turned off at the source and that vent is clear of obstructions.
- C. Confirm that all manual shut-off gas valves between the boiler and gas source are closed.

WARNING

Completely read, understand and follow all instructions in this manual before attempting start up.

- D. If not already done, flush the system to remove sediment, flux and traces of boiler additives. **This must be done with the boiler isolated from the system.** Fill entire heating system with water meeting the following requirements:

NOTICE

pH between 8.2 and 9.5.
If system contains aluminum components, pH must be less than 8.5
Total Dissolved Solids - less than 2500 PPM
Hardness - 3 to 9 grains/gallon.

Pressurize the system to at least 12 PSI. Purge air from the system.

WARNING

The maximum operating pressure of this boiler is 30 psig, 50 psig, 80 psig or 100 psig depending on the model and relief valve option selected. Never exceed these pressures. Do not plug or change pressure relief valve.

- E. Confirm that the boiler and system have no water leaks.
- F. Prepare to check operation.
 - 1. Obtain gas heating value (in Btu per cubic foot) from gas supplier.

- 2. Alpine gas valves have inlet and outlet pressure taps with built-in shut off screw. Turn each screw from fully closed position three to four turns counterclockwise to open taps. Connect manometers to pressure taps on gas valve.

NOTICE

If it is required to perform a long term pressure test of the hydronic system, the boiler should first be isolated to avoid a pressure loss due to the escape of air trapped in the boiler.

To perform a long term pressure test including the boiler, ALL trapped air must first be removed from the boiler.

A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.

- 3. Temporarily turn off all other gas-fired appliances.
- 4. Turn on gas supply to the boiler gas piping.
- 5. Open the field installed manual gas shut-off valve located upstream of the gas valve on the boiler.
- 6. Confirm that the supply pressure to the gas valve is 14 in. w.c. or less. Refer to Table 17 for minimum supply pressure.
- 7. Using soap solution, or similar non-combustible solution, electronic leak detector or other approved method. Check that boiler gas piping valves, and all other components are leak free. Eliminate any leaks.

DANGER

Do not use matches, candles, open flames or other ignition source to check for leaks.

- 8. Purge gas line of air.

G. Operating Instructions

Start the boiler using the lighting instructions, see Figure 51. After the boiler is powered up, it should go through the following sequence. Refer to Section XII, "Operation" to locate and view sequence status.

XI. System Start-up (continued)

Status	Control Action
Initiate	Power-up
Standby Delay	This state is entered when a delay is needed before allowing the burner control to be available and for sensor errors.
Standby	Boiler is not firing. There is no call for heat or there is a call for heat and the temperature is greater than setpoint.
Safe Startup	Test flame circuit then checks for flame signal.
Drive Purge	Driving blower to purge rate setting and waiting for the proper fan feedback.
Prepurge	Purge the combustion chamber for the 10 second purge time.
Drive Light-off	Driving blower to light-off rate setting and wait for the proper fan feedback.
Pre-ignition Test	Test the safety relay and verify that downstream contacts are off.
Pre-ignition	Energize the igniter and check for flame.
Direct Ignition	Open main fuel valve and attempt to ignite the main fuel directly from the ignition source.
Running	Normal boiler operation. Modulation rate depending on temperature and setpoint selections and modulating control action.
Postpurge	Purge the combustion chamber for the 30 second purge time.
Lockout	Prevent system from running due to a detected problem and record fault in Lockout History.

H. Purge Air From Gas Train

Upon initial start-up, the gas train will be filled with air. Even if the gas line has been completely purged of air, it may take several tries for ignition before a flame is established. If more than 5 tries for ignition are needed, it will be necessary to press the reset button to restart the boiler. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.

I. Check Burner Flame

Inspect the flame visible through the window. On high fire the flame should be stable and mostly blue (Figure 52). No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal.

J. Check Gas Inlet Pressure

Check the inlet pressure and adjust if necessary. Verify that the inlet pressure is between the upper and lower limits shown on the rating plate with all gas appliances on and off.

WARNING

The outlet pressure for the gas valve has been factory set and requires no field adjustment. This setting is satisfactory for both natural gas and propane. Attempting to adjust the outlet pressure may result in damage to the gas valve and cause property damage, personal injury or loss of life.

K. Perform Combustion Test

Boilers are equipped with Flue Temperature Sensor installed into:

- Flue sensor port of boiler CPVC/PVC two-pipe vent system connector (floor standing build) - See Figures 5 and 13.
- Flue sensor port of vent elbow, located inside air box behind access panel (wall hung build) - see Figure 6B.
- Flue sensor port of boiler concentric vent collar (floor standing build) - see Figure 14.

Remove Flue Temperature Sensor and insert the analyzer probe through Flue Temperature Sensor silicon cap opening, or if required, remove also the Flue Temperature Sensor silicon cap and insert the analyzer probe directly into flue sensor port. Reinstall the sensor and the cap upon combustion testing completion.

Check CO₂ (or O₂) and CO at both high and low fire. The boiler may be locked into high or low fire as follows:

1. To lock the boiler in high fire enter the Manual control screen by first entering the Adjust screen. To access the Adjust screen, touch the Adjust button, then Login using the contractor password "076". Press Save and then select the adjust button. Enter the Manual Control button and select "High". Allow the boiler to operate for approximately 5 minutes before taking combustion readings.
2. To lock the boiler in low fire select "Low" from the Manual Control screen. Allow the boiler to operate for approximately 5 minutes before taking combustion readings.
3. Normal modulation of the boiler will only occur after the "Auto" button is selected in the Manual Control screen.

Typical CO₂ readings are shown in Table 23.

WARNING

Each Alpine Series boiler is tested at the factory and adjustments to the air fuel mixture are normally not necessary. Improper gas valve or mixture adjustments could result in property damage, personal injury, or loss of life.

XI. System Start-up (continued)

Alpine™ Series Lighting and Operating Instructions

FOR YOUR SAFETY READ BEFORE OPERATING/POUR VOTRE SECURITE LISEZ AVANT DE METTRE EN MARCHE

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

AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans la présente notice risque de déclencher un incendie ou une explosion entraînant des dommages, des blessures ou la mort.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do **not** try to light the burner by hand.
- 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 any 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. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. 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 which has been under water.

- A. Cet appareil ne comporte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

- B. AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

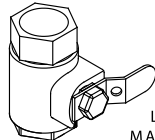
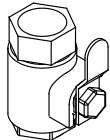
- Ne pas tenter d'allumer d'appareil.
 - Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
 - Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
 - Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.
- C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main ; ne jamais utiliser d'outil. Si la manette reste coincée, ne pas tenter de la réparer ; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.
- D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

OPERATING INSTRUCTIONS / INSTRUCTIONS DE FONCTIONNEMENT

1. STOP! Read safety information above (to the left) on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do **not** try to light the burner by hand.
5. Turn the external boiler manual gas valve handle clockwise ↻ to close the gas supply.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above (to the left) on this label. If you don't smell gas, go to the next step.
7. Turn the external boiler manual gas valve handle counterclockwise ↺ to open the gas supply.
8. Turn on all electric power to the appliance.
9. Set the thermostat to the desired setting.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

OPEN/OUVERT

CLOSED/FERMÉ



EXTERNAL BOILER
MANUAL GAS VALVE
LA CHAUDIÈRE EXTERNE
MANUELLE DE CLAPET À GAZ

1. ARRÊTEZ ! Lisez les instructions de sécurité sur la portion supérieure (à gauche) cette étiquette.
2. Réglez le thermostat à la température la plus basse.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est équipé de l' dispositif d'allumage qui automobile allume maticallyle brûleur. Ne pas essayer d'allumer le brûleur près main.
5. Tourner la chaudière externe manuelle poignée ↻ en clapet à gaz dans le sens des aiguilles d'une montre pour fermer l'offre de gaz.
6. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz, ARRÊTEZ ! Passez à l'étape B des instructions de sécurité sur la portion supérieure (à gauche) cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
7. Tourner la chaudière externe manuelle compteur de poignée ↺ en clapet à gaz ouvrir dans le sens des aiguilles d'une montre le gaz approvisionnement.
8. Allumer toute l'énergie électrique au appareil.
9. Réglez le thermostat à la température désirée.
10. Si l'appareil ne se met pas en marche, suivez les instructions intitulées « Comment couper l'admission de gaz de l'appareil » et appelez un technicien qualifié ou le fournisseur de gaz.

TO TURN OFF GAS TO APPLIANCE / COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Turn the external boiler manual gas valve handle clockwise ↻ to close gas supply.

1. Réglez le thermostat à la température la plus basse.
2. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
3. Tourner la chaudière externe manuelle poignée ↻ en clapet à gaz dans le sens des aiguilles d'une montre pour fermer l'offre de gaz.

Figure 51: Lighting Instructions

XI. System Start-up (continued)

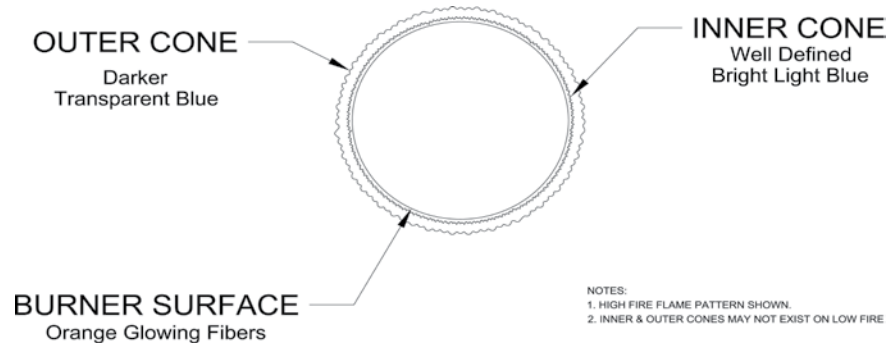


Figure 52: Burner Flame

Table 23: Recommended Combustion Settings, Natural Gas

Boiler Model	Altitude Range		
	0 - 7000 Ft.		
	% CO ₂	% O ₂ Range	CO, PPM
ALP080	8.7 - 7.3 (High Fire)	5.6 - 8-.0 (High fire)	Less than 100 PPM
ALP105			
ALP150			
ALP210	10.1 - 6.6 (Low Fire)	3.2 - 9.2 (Low Fire)	
ALP285			
ALP399			
ALP500			

L. Test External Limits

Test any external limits or other controls in accordance with the manufacturer's instructions.

M. Check Thermostat Operation

Verify that the boiler starts and stops in response to calls for heat from the heating thermostat and indirect water heater thermostat. Make sure that the appropriate circulators also start and stop in response to the thermostats.

N. Adjust Supply Water Temperature

As shipped, the heating and indirect water heater set point supply temperatures are both set to 180°F. If necessary, adjust these to the appropriate settings for the type of system to which this boiler is connected. See Section XII "Operation" of this manual for information on how to do this.

O. Adjust Thermostats

Adjust the heating and indirect water heater thermostats to their final set points.

P. Field Conversion From Natural Gas to LP Gas

Alpine Series boilers are factory shipped as Natural Gas builds. Follow steps below for field conversion from Natural Gas to LP Gas.

WARNING

This conversion should be performed 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 proper conversion of these boilers. The conversion is not proper and complete until the operation of the converted appliance is checked as specified in this manual.

WARNING

These instructions include a procedure for adjusting the air-fuel mixture on this boiler. This procedure requires a combustion analyzer to measure the CO₂ (or Oxygen) and Carbon Monoxide (CO) levels in flue gas. Adjusting the air-fuel mixture without a proper combustion analyzer could result in unreliable boiler operation, personal injury, or death due to carbon monoxide poisoning.

1. All Alpine boiler models can be converted from Natural Gas to LP Gas.
2. Conversion of Alpine Series boilers from one fuel to another is accomplished using the throttle screw on the gas valve. Figure 53 shows the location of the throttle screw on the Dungs valve. Locate the throttle on the boiler being converted.
3. If conversion is being made on a new installation, install the boiler in accordance with the installation instructions supplied with the boiler. If an installed boiler is being converted, connect the new gas supply to the boiler, check for gas leaks, and purge the gas line up to the boiler in accordance with the National Fuel Gas Code (ANSI Z223.1) or the requirements of the authority having jurisdiction.

XI. System Start-up (continued)

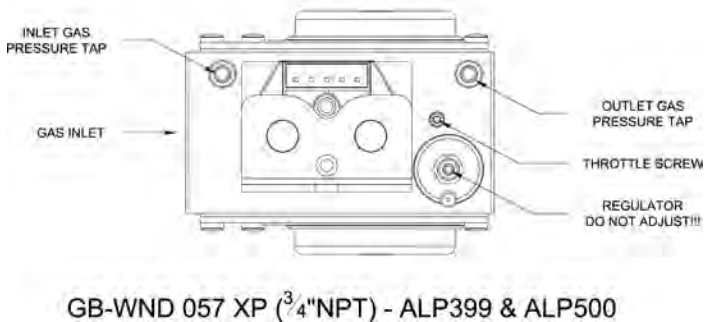
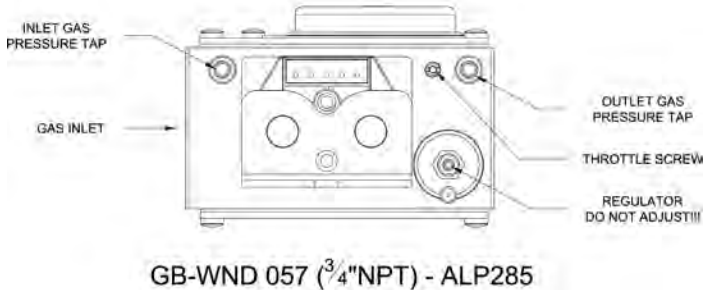
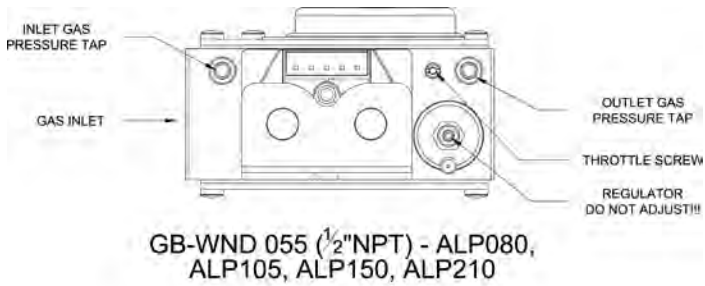


Figure 53: Dungs Gas Valve Detail

4. Before attempting to start the boiler, make the number of turns to the throttle screw called for in Table 24.
5. Attempt to start the boiler using the lighting instructions located inside the lower front cover of the boiler. If the boiler does not light on the first try for ignition, allow the boiler to make at least four more attempts to light. If boiler still does not light, turn the throttle counter clockwise in $\frac{1}{4}$ turn increments, allowing the boiler to make at least three tries for ignition at each setting, until the boiler lights.
6. After the burner lights, force the burner to high fire. Allow the boiler to operate for approximately 5 minutes before taking combustion readings.

Table 24: Number of Clockwise Throttle Screw Turns for LP Conversion

Boiler Model	Gas Valve	Throttle Screw Turns at Altitude Range
		0 - 7000 Ft.
ALP080	Dungs GB-055 ($\frac{1}{2}$ " NPT)	$2\frac{3}{4}$
ALP105		4
ALP150		$3\frac{3}{4}$
ALP210		4
ALP285	Dungs GB-057 ($\frac{3}{4}$ " NPT)	$4\frac{1}{2}$
ALP399	Dungs GB-057 HO ($\frac{3}{4}$ " NPT)	$1\frac{3}{4}$
ALP500		1

WARNING

The throttle adjustments shown in Table 24 are approximate. The final throttle setting must be found using a combustion analyzer. Leaving the boiler in operation with a CO level in excess of the value shown in Table 25 could result in injury or death from carbon monoxide poisoning.

XI. System Start-up (continued)

7. Perform a combustion test. Refer to Paragraph K above for details.
8. While the burner is at high fire adjust the throttle as needed to obtain the CO₂ (or O₂) settings shown in the Table 25:
 - To reduce the CO₂ (increase the O₂) turn the throttle clockwise

Table 25: Recommended Combustion Settings, LP Gas

Boiler Model	Altitude Range		
	0 - 7000 Ft.		
	% CO ₂	% O ₂ Range	CO, PPM
ALP080	10.1 - 8.5 (High Fire)	5.6 - 8.0 (High Fire)	Less than 100 PPM
ALP105			
ALP150	11.6 - 7.7 (Low Fire)	3.2 - 9.2 (Low Fire)	
ALP210			
ALP285			
ALP399			
ALP500			

- To increase the CO₂ (reduce the O₂) turn the throttle counter-clockwise
- Make adjustments in increments of 1/8 to 1/4 turn and allow the boiler at least a minute to respond to each adjustment before making another. In general, the CO level will be at its lowest somewhere in the CO₂ range shown in this table.
9. Verify that the gas inlet pressure is between the upper and lower limits shown in Table 17 with all gas appliances (including the converted boiler) both on and off.
 10. A label sheet is provided with the boiler for conversions from natural to LP gas. Once conversion is completed, apply labels as follows:
 - Apply the “Rating Plate Label” adjacent to the rating plate.
 - Apply the “Gas Valve Label” to a conspicuous area on the gas valve.
 - Apply the “Boiler Conversion Label” to a conspicuous surface on, or adjacent to, the outer boiler jacket. Fill in the date of the conversion and the name and address of the company making the conversion with a permanent marker.

NOTICE

If the throttle is very far out of adjustment on the “rich” (counter-clockwise) side, the boiler burner may be running at 0% Excess Air or even with air deficiency.

At 0% Excess Air the CO₂ readings will be either 11.9% CO₂ for Natural Gas or 13.8% CO₂ for LP Gas (O₂ will be 0%) and CO level will be extremely high (well over 1000 PPM).

If the burner operates with air deficiency, the following phenomena may be observed:

% CO₂ will actually drop (% O₂ will increase) as the throttle is turned counterclockwise

% CO₂ will actually increase (% O₂ will drop) as the throttle is turned clockwise

If the boiler appears to operate with air deficiency, turn the throttle clockwise to increase the amount of Excess Air to the burner.

As the throttle is turned clockwise, the CO₂ level will rise, eventually peaking @ 11.8% or 13.8%, depending of the type of gas being used, before falling (conversely, O₂ level will drop to 0% before rising). After this happens, continue turning the throttle clockwise, until CO₂ level drops (or O₂ level increases) to the values shown in Table 23 or Table 25.

WARNING

The pressure regulator has been factory set using precision instruments and must never be adjusted in the field. The gas valve outlet pressure is the same for both natural gas and propane. Make sure that all adjustments are made with the throttle, not the pressure regulator. Attempting to adjust the pressure regulator will result in damage to the gas valve and may cause property damage, personal injury or loss of life.

XII. Operation

A. Major Features

1. General

The Sage2.1™ Control provides safety interlocks and water temperature control. The Sage2.1 simply controls boiler modulation and pump outputs based on the boiler water outlet temperature and a contractor adjusted setpoint. However, using parameter menu selections, the control system may also respond to header water temperature and outside air temperatures with Domestic Hot Water Priority (DHWP), Frost Protection and Warm Weather Shut Down (WWSD), multiple boiler sequencer control or Building Automation System (BAS) firing rate demand, remote setpoint and remote start/stop commands.

2. Advanced Modulating & Safety Control

The Sage2.1 modulates the boiler input by varying the fan speed. As the fan speed increases, so does the amount of fuel gas drawn into the blower. As a result, a fairly constant air-fuel ratio is maintained across all inputs. The Sage2.1 determines the input needed by looking at both current and recent differences between the measured temperature and the setpoint temperature. As the measured temperature approaches the setpoint temperature, the fan will slow down and the input will drop. The Sage2.1 also monitors boiler return and flue temperatures. In addition, all other safety controls, including the optional field installed low water cut-off and auxiliary safety limits, are connected to external limits of the Sage2.1. The Sage2.1 uses input from all of these controls to either shut down the boiler when an unsafe condition exists or, in some cases, to correct the problem.

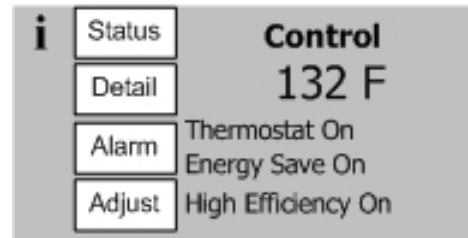
3. Circulator Control

The Sage2.1 control may be used to sequence the domestic hot water, boiler and system circulators. Service rated relay outputs are wired to a line voltage terminal block for easy field connection. Simple parameter selections allow all three pumps to respond properly to various system piping arrangements including either a boiler or primary piped indirect water heater.

4. Circulator Exercising

Circulators are automatically run for a 20 second exercise period after not being used for longer than 7 days. Exercise helps prevent pump rotor seizing.

5. Advanced Touch Screen Display



Sage2.1 LCD Touch Screen Display

a. Boiler Display

Boiler status and setup selections are available from an easy to use, dual color, LCD Touch Screen Display. Over one hundred helpful information screens are provided to explain status information and setup functions. In the event of a fault condition the user is guided by “blinking” touch buttons to Help screens that explain the problem cause and corrective action. The Sage2.1 uses a combination of Information and Help screens to guide the user to proper setup & troubleshooting.

b. Contractor Contact Information Screens

The contractor can insert name, address and phone information into the Sage2.1 Display. Users are directed to this contact information in the event of an alarm or when attempting to adjust parameters.

c. Data Logging

Supply and return temperature, fan speed and flame current Real Time Graphic Trends allow users to observe process changes over time providing valuable diagnostic information. Trends screens record data for 15 minutes with ten 1.5 minute divisions. Trends have start & stop buttons to retain displayed data. Also, Hard Lockout history records, boiler run time hours and cycle counts for the boiler and individual circulators are provided.

6. Communication

A boiler-to-boiler communications network allows connected Sage2.1 Controllers to exchange signals as required to provide sequencer control.

XII. Operation (continued)

7. Priority Demand

The Sage2.1 accepts a call for heat (demand) from multiple places and responds to each demand according to its relative importance. When more than one demand is present at one time the more important demand is selected as the “priority” demand and is used to operate the boiler and pumps. The selected priority demand is displayed on the boiler “Status” screen (see Figure 55). For example, when Domestic Hot Water (DHW) demand has priority the firing rate setpoint is set equal to the DHW Setpoint, the DHW, Boiler and System pumps respond to a DHW demand. Table 26 lists available priority demands in order of highest priority to lowest priority:

Table 26: Order of Priority

Priority Order	Status Screen Display “Priority”	Boiler Responding to:
1 st	Sequencer Control	The boiler is connected to the Sage2.1 modular boiler network. The boiler accepts demand from the Sequencer Master.
2 nd	Domestic HW	DHW demand has been received and selected as the priority demand. DHW is always higher priority than Central Heat and when DHW priority is enabled is higher priority than the Sequencer Control.
3 rd	Central Heat	Central Heat call for heat is on and has been selected as priority.
4 th	Frost Protection	Frost Protection is active and there is no other call for heat. Frost protection will be a higher priority than Sequencer Control if the Sequence Master has no active call for heat.
5 th	Warm Weather	Warm Weather Shutdown (WWSD) is active and the boiler will not respond to central heat demands. DHW demand is not blocked by WWSD.
Last	Standby	There is no demand or there is demand and the boiler is not firing because the sensed temperature is greater than setpoint.

The Sage2.1 accepts a demand from the following inputs:

a. Sequence Control

A Sequencer Control demand is received when the boiler is connected to a Sequence Master using an Ethernet cable to connect the “Boiler - to - Boiler Communication Network” RJ45 connection. Sequence Control is the priority when the boiler is connected to a Sage2.1 with the Sequence Master “enabled” (refer to Modular Installation, Section X, G, 4 for additional information). Networked boilers display “Sequence Control” as the priority even if there is no current Call For Heat. The boilers are “slaves” waiting to fire based on the Sequence Master’s demand inputs.

b. Domestic Hot Water

A domestic hot water demand is received by wiring a demand contact to the low voltage terminal strip “DHW Temp Switch” terminals. The boiler responds to a domestic hot water demand with a domestic hot water setpoint and pump settings. Domestic HW demand has priority over Central Heat demand and has priority over Sequencer Control when DHW Priority is enabled. Refer to Adjusting Parameters, Paragraph E for additional information.

c. Central Heat

The Sage2 accepts a Central Heat demand from the below listed sources. When a Central Heat demand has priority the boiler responds to central heat setpoint and pump settings. Outdoor reset and Setback Setpoint settings are available during a Central Heat priority:

i. Conventional Thermostat

A heating request is received by simply wiring a thermostat to the low voltage terminal strip “Heating T-Stat” terminals.

ii. EnviraCOM Enabled Thermostat

A heat demand and setpoint “setback” request is received by wiring an EnviraCOM enabled thermostat to controller terminals “D, R & C”. For example, when a VisionPro EnviraCOM thermostat is connected a call for heat and “sleep” and “away” information is received. Additionally, the home owner is alerted to a boiler problem by a thermostat red LED and error message.

iii. External Modular Boiler Controller or Building Automation System (BAS)

A heating request is received from an external control by wiring a heat demand to the low voltage terminal strip “Heating T-Stat” terminals and a firing rate to the Remote Firing Rate terminals. Additionally, parameter selections are required. Refer to Adjusting Parameters, Paragraph E for additional information.

d. Frost Protection Call For Heat

Frost Protection demand is generated by system protection logic (refer to Operation, Paragraph A, 9 h for more information). Frost protection will be a higher priority than Sequencer Control if the Sequence Master has no active call for heat.

e. Warm Weather Shutdown (WWSD) Setpoint

When enabled, the boiler will not be allowed to start if the outside temperature is greater than the WWSD setpoint. WWSD is the priority demand when active and there is no DHW demand.

XII. Operation (continued)

A. Major Features (continued)

8. Boiler Temperature Regulation

a. Overview

Based on the call for heat type, the Sage2.1 selects a firing rate target temperature setpoint. Sensed temperature is compared to this Setpoint to both adjust firing rate output and along with the corresponding “Diff Above” and “Diff Below” settings cycle the boiler.

b. Central Heat Setpoint

The Central Heat Setpoint is fixed at the contractor selected value unless Outdoor Air Reset is enabled or a “Setback” thermostat is connected. The value of this setpoint is set up based on the type and quantity of radiation installed.

c. Domestic Hot Water (DHW) Setpoint

The DHW setpoint is fixed at the user selected value unless a “setback” thermostat is connected. The value of this setpoint is established based on the requirements of the indirect water heater.

i. Domestic Hot Water Priority (DHWP)

When domestic hot water priority is selected and there is a DHW call for heat, the system pump will be turned off (when system pump run pump for parameter is set for “Central Heat Optional Priority”) and the DHW pump will be turned on. Additionally, if outdoor reset is active, the active setpoint is adjusted to be at least greater than a DHW Setpoint. Priority protection is provided to ensure central heat supply in the case of excessive or failed DHW call for heat.

d. Outdoor Air Reset

If an outdoor temperature sensor is connected to the boiler and Outdoor Reset is enabled, the Central Heat setpoint will automatically adjust downwards as the outdoor temperature

increases. When the water temperature is properly matched to home heating needs there is minimal chance of room air temperature overshoot. Excessive heat is not sent to the room heating elements by “overheated” (supply water temperature maintained at High Limit setting) water. Reset control saves energy by reducing room over heating, reducing boiler temperature & increasing combustion efficiency and reducing standby losses as a boiler and system piping cool down to ambient following room over heating.

i. Boost Time

When the Central Heat Setpoint is decreased by Outdoor Air Reset settings the Boost function can be enabled to increase the setpoint after the central heat demand is not satisfied for longer than the Boost Time minutes the operating temperature setpoint is increased by 10F. This process will continue until either heat demand is satisfied (indoor air is at desired temperature) or a maximum setpoint is reached. Once the heat demand is satisfied, the operating setpoint reverts to the value determined by the Outdoor Air Reset settings. If Boost Time is zero, then the boost function is not used.

ii. “Setback” Setpoints

User adjustable setback setpoints are provided for both Central Heat and DHW demands. The Setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes. When setback is “on” the thermostat setback setpoint shifts the reset curve to save energy while the home is in reduced room temperature mode. The Honeywell VisionPro IAQ (part number TH9421C1004) is a “setback” EnviraCOM enabled thermostat.

XII. Operation (continued)

A. Major Features (continued)

9. Boiler Protection Features

a. Supply Water Temperature High Limit

The boiler is equipped with independent automatic reset and a manual reset High Limit devices. The automatic reset high limit is provided by a supply manifold mounted Limit Device. The automatic high limit is set to 200°F. The Sage2.1 monitors a supply water temperature sensor that is also mounted in the supply water manifold and supplies an internal, manual reset high limit. The manual reset high limit Hard Lockout is set at 210°F. Additionally, if the supply temperature rises faster than the degrees Fahrenheit per second limit a soft lockout is activated.

b. High Differential Temperature Limit

The Sage2.1 monitors the temperature difference between the return and supply sensors. If this difference exceeds 90°F the control begins to reduce the maximum fan speed. If the temperature difference exceeds 100°F the control will shut the unit down. The unit will restart automatically once the temperature difference has decreased and the minimum off time has expired.

LWCO NOTE

i. The Sage2.1 shuts down the boiler when either the supply water temperature is too high or supply to return temperature differential temperature is too high. This ensures the boiler is shutdown in the event of a low water level or low water flow condition.

ii. Some codes and jurisdiction may accept these integral features instead of requiring a low water cutoff. **ADHERE TO ALL LOCAL CODE REQUIREMENTS.** Contact your local code inspector prior to installation. If required, a LWCO four-position wire harness connection is provided for an external LWCO kit (p/n 102097-01) to be added. If the LWCO opens, the boiler will shut down and an open limit indication and error code is provided. If the limit installed is a manual reset type, it will need to be reset before the boiler will operate.

c. Return Temperature Higher Than Supply Temperature (Inversion Limit)

The Sage2.1 monitors the supply and return temperature sensors. If the return water temperature exceeds the supply water temperature for longer than a limit time delay the Sage2.1 shuts down the boiler and delays restart. If the inverted temperature is detected more than five times the boiler manual

reset Hard Lockout is set. This condition is the result of incorrectly attaching the supply and return piping.

d. External Limit

An external limit control can be installed between terminals 11 and 12 on the low voltage terminal strip. Be sure to remove the jumper when adding an external limit control to the system. If the external limit opens, the boiler will shut down and an open limit indication and error code is provided. If the limit installed is a manual reset type, it will need to be reset before the boiler will operate.

e. Boiler Mounted Limit Devices

The Sage2.1 monitors individual limit devices: pressure switch, high limit device, condensate level switch, low water cutoff (optional), fuel gas pressure switches (optional) and external limit (optional). If any of these limits opens, the boiler will shut down and an individual open limit indication is provided.

f. Stack High Limit

The Sage2.1 monitors the flue temperature sensor located in the vent connector. If the flue temperature exceeds 194°F the control begins to reduce the maximum fan speed. If the flue temperature exceeds 204°F the control activates a manual reset Hard Lockout.

g. Ignition Failure

The Sage2.1 Control monitors ignition using a burner mounted flame sensor. In the event of a failed ignition the control continuously retries with a 5 minute time delay after 5 consecutive retries.

h. Central Heating System Frost Protection

When enabled, Frost Protection starts the boiler and system pump and fires the boiler when low outside air temperatures are sensed. The Sage2.1 control provides the following control action when frost protection is enabled:

Table 27: Frost Protection

Device	Start Temperatures	Stop Temperatures
Boiler & System Pump	Outside Air < 0°F Supply Water < 45°F	Outside Air > 4°F Supply Water > 50°F
Boiler	Supply Water < 38°F	Supply Water > 50°F

NOTE

The Sage2.1 primarily provides freeze protection for the boiler. Since the Sage2.1 only controls the system and boiler circulators individual zones are not protected. It is recommended that the boiler be installed in a location that is not exposed to freezing temperatures.

XII. Operation (continued)

B. Operating Mode

1. Home Screen

Under normal conditions, the boiler display shows the “Home” screen and the display looks like that shown in Figure 54. The temperature value shown is the boiler’s supply temperature. Boiler status is shown below the supply water temperature. The “Home” screen provides the following “Buttons” and information:

a. Status Button

Displays boiler’s current status including measured temperatures, setpoint, firing rate, current boiler demands, pump status and helpful real time trends.

b. Detail Button

Displays additional boiler status information. Detail screens provide in depth operating parameter status such as active differentials, sensor and setpoint sources.

c. Help Button

Describes active faults, lockout history and provides service contact information.

d. Adjust Button

This control mode allows the user to view and change Sage2.1 control parameters. Password protection is provided to discourage unauthorized or accidental changes to settings.

e. Efficiency information

“Energy Save On” – appears when the outdoor reset or setback has lowered the central heat setpoint based on outside measured air temperature or time of day.

“Max Efficiency On”- appears when the boiler return temperature is low enough to cause flue gas condensation.

f. Boiler Status

When there is no call for heat this line shows “standby”. Table 28 shows each possible status and the control action taken during the condition.

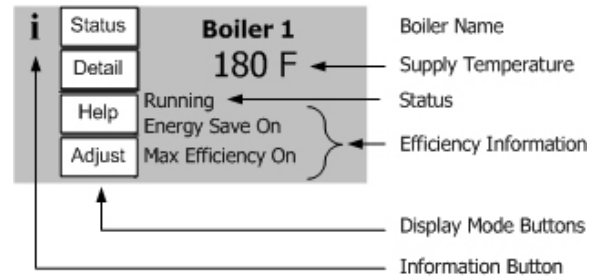


Figure 54: Home Screen

Table 28: Boiler Status

Status	Control Action
Initiate	Power-up
Standby Delay	This state is entered when a delay is needed before allowing the burner control to be available and for sensor errors.
Standby	Boiler is not firing. There is no call for heat or there is a call for heat and the temperature is greater than setpoint.
Safe Startup	Tests flame circuit then checks for flame signal.
Drive purge	Driving blower to purge rate setting and waiting for the proper fan feedback.
Prepurge	Purge the combustion chamber for the 10 second purge time.
Drive light-off	Driving blower to light-off rate setting and waiting for the proper fan feedback.
Pre-ignition test	Test the safety relay and verify that downstream contacts are off.
Pre-ignition	Energize the igniter and check for flame.
Direct ignition	Open main fuel valve and attempt to ignite the main fuel directly from the ignition source.
Running	Normal boiler operation. Modulation rate depending on temperature and setpoint selections and modulating control action.
Post-purge	Purge the combustion chamber for the 30 second purge time
Lockout	Prevent system from running due to a detected problem and record fault in Lockout History.

XII. Operation (continued)

B. Operating Mode (continued)

2. Boiler Status Screen

The “Status” screen, shown in Figure 55, provides an overview of boiler operation. The following information is provided on this screen:

a. Boiler Status

Boiler status can be found on the “Home” screen and at the bottom of the first “Status” screen. Table 28 shows each status and the action the control takes during the condition.

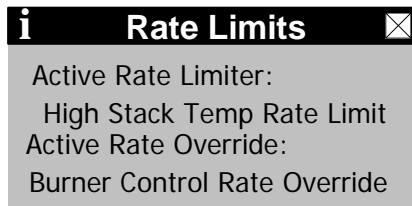
b. Fault Indication & Screen Link

A soft or hard lockout, sensor fault or open limit will cause the active fault indication to appear. When visible the text becomes a screen link to the “Help mode” screen and blinking screen links guide the user to the cause of the fault. The text and link disappear when the fault is cleared.

c. Rate Limit Indication & Screen Link

The “▼” symbol appears to the right of the Rate % when firing rate is limited or overridden in any way. During the start-up and shutdown sequence it is normal for the rate to be overridden by the purge and light-off requirements.

When a rate limit is the result of boiler protection logic the “▼” symbol blinks. The symbol is a screen link, when selected displays the cause of the rate limit:



Typical Rate Limits Screen

Rate Limits:

- * High Supply Temperature Limit
- * High Differential Temperature Limit
- * High Stack Temperature Limit
- * Minimum Modulate (normal start/stop sequence)
- * Forced Modulation (normal start/stop sequence)
- * Burner Fault Rate (Lockout, etc.,)
- * Burner Control Rate (normal start/stop sequence)
- * Manual Firing Rate (User selection)

Select “Status” button on home screen to view:

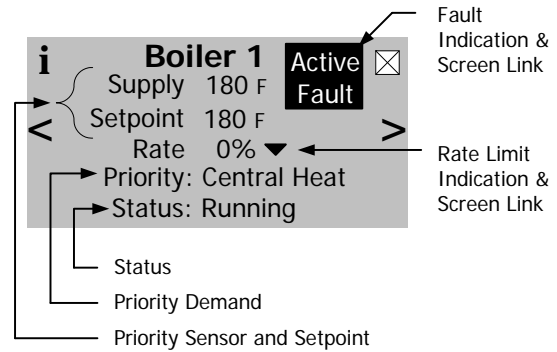


Figure 55: Status Screen

Table 29: Boiler Priority Definitions

Priority	Boiler Responding to:
Standby	Boiler is not firing. There is no call for heat or there is a call for heat and the temperature is greater than setpoint.
Central Heat	Central Heat call for heat
Domestic HW	Domestic Hot Water call for heat
Sequencer Control	Multiple Boiler Controller control
Frost Protection	Frost Protection call for heat
Warm Weather	Warm Weather Shutdown boiler off

d. Rate

The rate % value is equal to the actual fan speed divided by the maximum fan speed.

e. Priority Demand

The selected Priority demand is displayed on the first “Status” screen. A call for heat (demand) is responded to according to its priority. A list of boiler priorities is provided in Table 29.

XII. Operation (continued)

C. Controls Startup Check List

The Sage2.1 Control is factory programmed with default parameters. Before operating the boiler, these parameters must be checked and adjusted as necessary to conform to the site requirements. Follow the steps below, making selections and adjustments as necessary to ensure optimal boiler operation.

No.	Title	Terminal	Description
1	Check Wiring	1 & 2	Is the heating thermostat connected? Insure this is "dry", non-powered input.
		2 & 3	Is an IWH providing a boiler heat demand?
		5 & 6	Is an Outdoor Air sensor used? If yes, refer to step 2 and 9 to activate outdoor air reset.
		7 & 8	Is a header sensor used? If yes, refer to step 11 below to activate this feature.
		9 & 10	Is a Remote 4-20mA required for a building management system or external multiple boiler control? If used see step 10 below to activate this input.
		11 & 12	Is an External Limit used? Remember to remove factory-installed jumper.
		LWCO Plug	Is a LWCO required? Check installation of the LWCO.

From the Home Screen press the Adjust button and login to access the adjust mode screens (if required, refer to "Entering Adjustment Mode" Paragraph D, 4 for login instructions). The following parameters should be reviewed:

No.	Menu	Parameter	Description
2	System Setup	Outdoor Air Sensor	If an outdoor air temperature sensor is installed, press "Installed" otherwise leave as "Not Installed".
		Frost Protection	Selecting "Enable" will cause the boiler and boiler connected pumps to run for low temperature events.
		Warm Weather Shutdown	Selecting "Enable" will restrict boiler start during warm weather (only if an outdoor air temperature sensor is installed).
		Warm Weather Shutdown Setpoint	Use this setting to adjust the temperature that the WWSD function will prevent a boiler start.
3	Modulation Setup	Boiler Type	WARNING Confirm that the correct boiler model is shown. Stop installation and contact factory if the wrong boiler model is shown.
4	Pump Setup	System Pump	Ensure that the pump parameter selections are correct for your heating system. Refer to Section E. Adjusting Parameters, Pump Setup Menu for additional information.
		Boiler Pump	
		Domestic Pump	
5	Contractor Setup	Contractor Name	Enter your contact information , name, address, and phone number on this screen. In the event of a fault or the need to adjust a setting the display will direct the homeowner to you.
		Address	
		Phone	
6	Manual Control	Manual Speed Control	Use the "High and "Low" options to force the boiler to high fire and low fire for combustion testing.
7	Central Heat	Setpoint	Ensure Setpoint, (firing rate target temperature) is correct for you type of radiation.
		Setback Setpoint	Check the setting for the central heat setpoint when the T-Stat "Sleep" or "Away" Setback mode is entered (if EnviraCOM Setback thermostat is used).
8	DHW	Setpoint	Ensure Setpoint, (firing rate target temperature) is suitable for the IWH requirements.
		Setback Setpoint	Check the setting for the DHW setpoint when the T-Stat "Sleep" or "Away" Setback mode is entered (if EnviraCOM Setback thermostat is used).
		Priority	Select "Enable" to give domestic hot water demand priority over central heat demand.
9	Outdoor Reset	Outdoor Reset Enable/Disable	Ensure the Outdoor Air Reset settings are correct for this site.
10	Remote 4-20mA	Modulation Source	Set to 4-20mA when an external multiple boiler controller is connected to the system.
		Setpoint Source	Set to 4-20mA when a Energy Management system is sending a "remote" setpoint.
11	Sequencer	Master Slave	Refer to Sequencer Master Setup Section X, G if multiple boilers are installed at this site.

XII. Operation (continued)

D. User Interface

1. Using The Display

The Sage2.1 uses a state-of-the-art touch screen display. The following is a display arrangement overview:

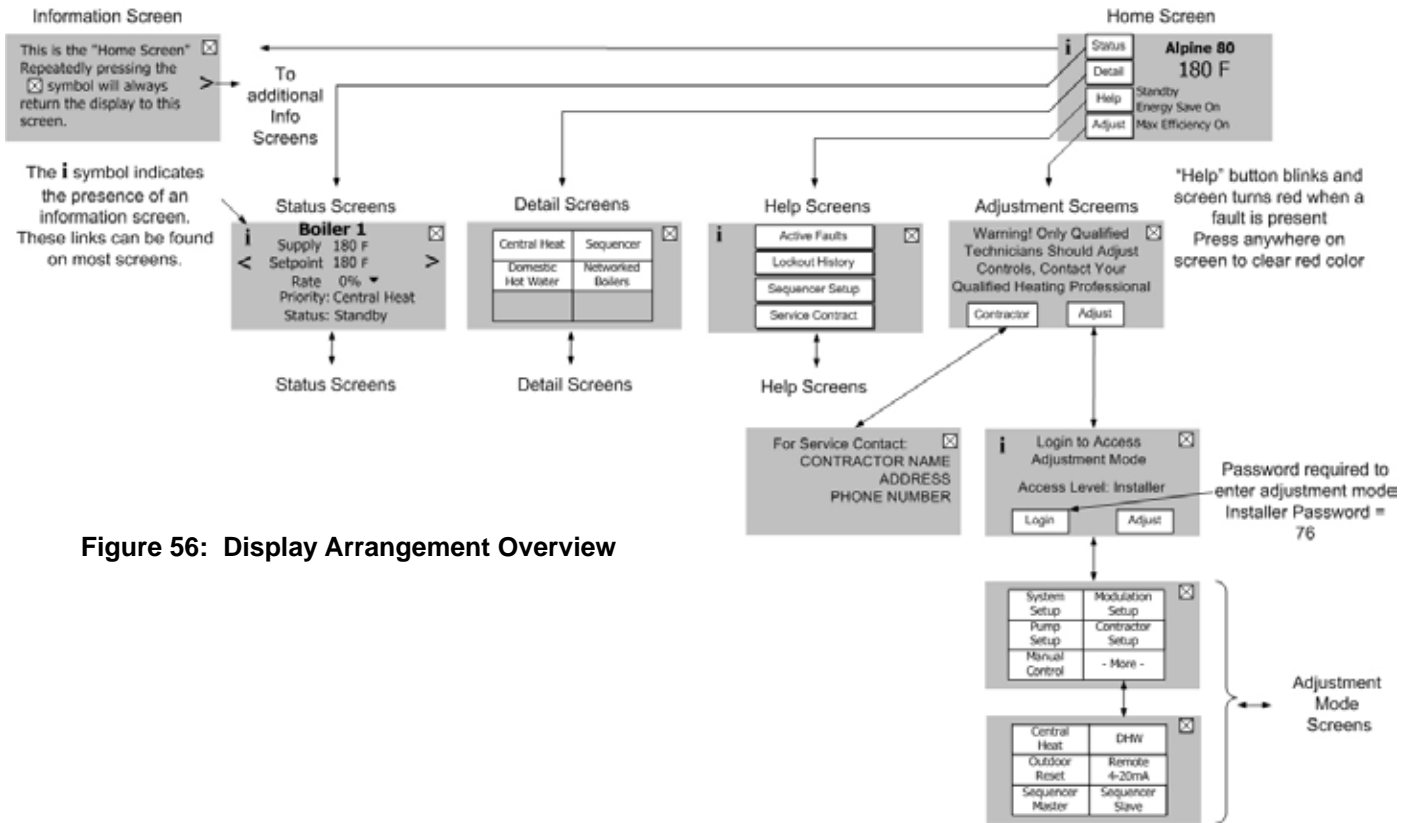


Figure 56: Display Arrangement Overview

Note: The “Home Screen” is the default screen. Any screen left untouched for more than four minutes will revert to the home screen.

2. Selecting View Mode options

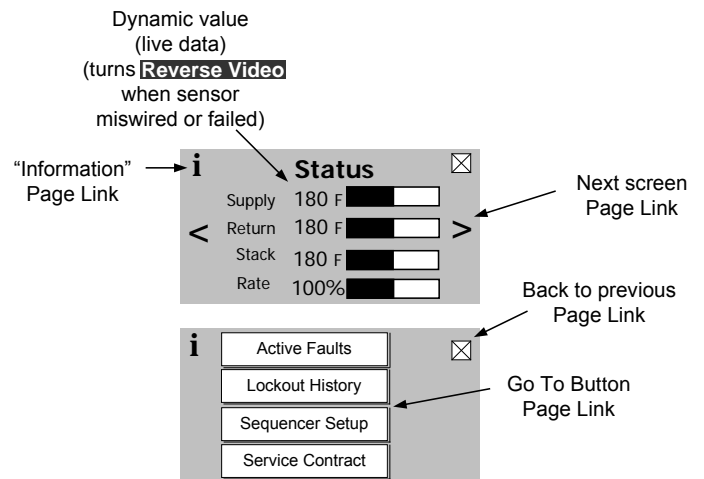
Dynamic Value (live data): Measured temperatures are shown throughout the user interface. If the sensor has failed or is miswired the value will be shown as a Reverse Video (background black and value white) to indicate that there is a problem with the sensor.

Screen Links:

“Information”: The “i” screen link symbol indicates the presence of an Information screen. These screens explain screen content and provide other helpful information.

Next screen: The “<” or “>” screen link symbol indicates the presence of additional screens.

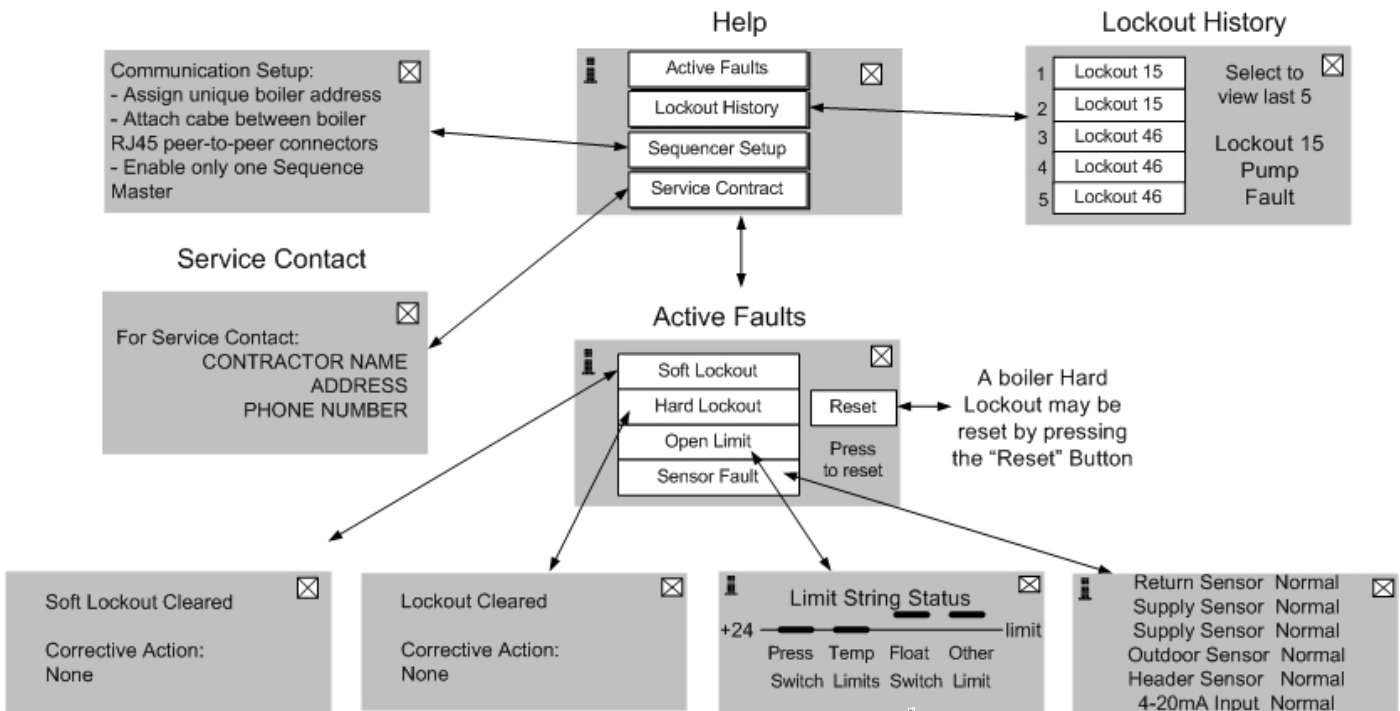
Back to Previous: This button selects the previous screen or allows the user to leave this display level and return to the previous level. Repeatedly pressing button will return you to the “Home” screen.



XII. Operation (continued)

D. User Interface (continued)

3. Help Screens



The "Help" screen provides access to active faults, lockout history, the service contact and the boiler reset button. The "Help" screen is accessed from the "Home" screen.

Limit String Status Display

This display is provided to identify the cause of an Interlock input "open" contact (refer to Figure 36 Ladder Diagram, Interlock input terminal J5-1). For example, this illustration depicts the "Float Switch" contact as "open." This indicates that boiler's condensate float switch has detected high water level and it's contact is "open" causing the boiler to stop. Note, Interlock input limit items are wired in series. Items down stream of the open limit will also appear as "open" (measure zero volts). When the first item in the string is resolved (repaired, or fixed) the down stream items will also be fixed.

XII. Operation (continued)

D. User Interface (continued)

4. Entering Adjust Mode



The “Adjust mode” screen is accessed from the “Home” screen. The “Adjust Mode” provides contractors access to view and adjust additional information.


a. Entering Adjustment Mode


The Sage2.1 is factory programmed to include basic modulating boiler functionality. These settings are password protected to discourage unauthorized or accidental changes to settings. User login is required to view or adjust these settings:

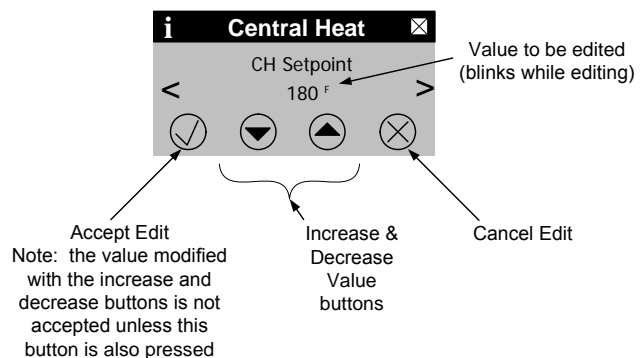
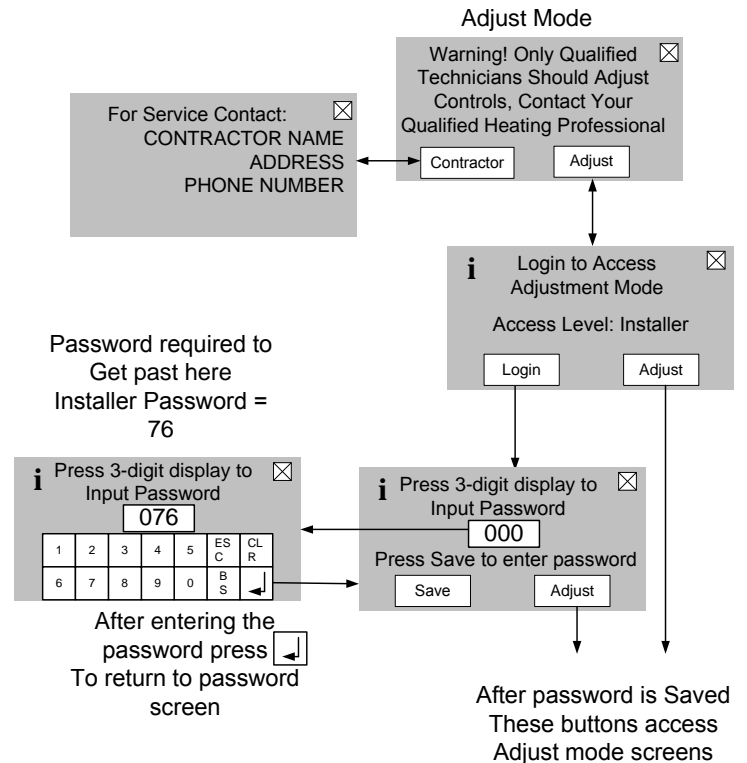
- i. Press the “Adjust” button on the Home screen.
- ii. Press the “Adjust” button on the Adjust Mode screen or Press Contractor for service provider contact information.
- iii. Press “Login” button to access password screen.
- iv. Press 3-digit display to open a keypad. Enter the password (**Installer Password is 76**) and press the return arrow to close the keypad. Press the “Save” button.
- v. Press the “Adjust” button to enter Adjustment mode.

b. Editing Parameters is accomplished as follows:

Value to be edited: Use the   buttons to edit a value. While editing a value **it will blink until it has been accepted** or cancelled as described below. A value is also cancelled by leaving the screen without accepting the value.

Accept Edit: Press the  button to confirm newly edited value.

Cancel Edit: Press the  button to cancel newly edited value and go back to the original value.

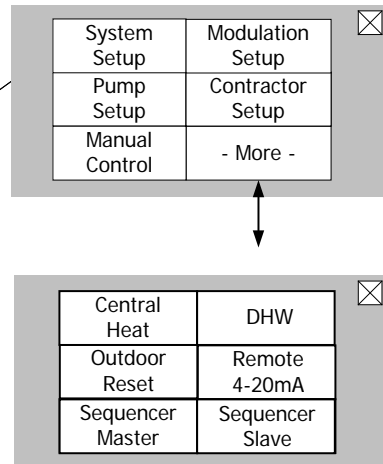


XII. Operation (continued)

E. Adjusting Parameters

From the “Home” screen select the Adjust button to access the adjustment mode screens show below (if required, refer to the previous page to review how to enter Adjustment mode):

The following pages describe Sage2.1’s adjustable parameters. Parameters are presented in the order they appear on the Sage2.1 Display, from top to bottom and, left to right




“Press” System Setup button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description												
Fahrenheit	Fahrenheit, Celsius	Temperature Units The Temperature Units parameter determines whether temperature is represented in units of Fahrenheit or Celsius degrees.												
30%	0-100%	Display Brightness Display brightness is adjustable from 0 to 100%.												
30%	0-100%	Display Contrast Display contrast is adjustable from 0 to 100%.												
Installed	Not Installed, Installed	Outdoor Sensor Source Not Installed Outdoor Sensor is not connected to the boiler, the sensor is not monitored for faults. Installed Outdoor Sensor is installed and monitored for faults. Note: Enabling Frost Protection, Warm weather shutdown or Outdoor Air Reset functions will automatically install the outdoor sensor. If you choose to disable these features and not use the outdoor sensor, press the “Not Installed” selection to remove the outdoor sensor from fault monitoring screens.												
Disabled	Enable/Disable	Frost Protection Disable Frost Protection is not used. Enable Boiler and system circulators start and boiler fires when low outside air, supply and return temperatures are sensed as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Device</th> <th>Start Temperatures</th> <th>Stop Temperatures</th> </tr> </thead> <tbody> <tr> <td>Boiler & System</td> <td>Outside Air < 0°F</td> <td>Outside Air > 4°F</td> </tr> <tr> <td>Pump</td> <td>Supply Water < 45°F</td> <td>Supply Water > 50°F</td> </tr> <tr> <td>Boiler</td> <td>Supply Water < 38°F</td> <td>Supply Water > 50°F</td> </tr> </tbody> </table>	Device	Start Temperatures	Stop Temperatures	Boiler & System	Outside Air < 0°F	Outside Air > 4°F	Pump	Supply Water < 45°F	Supply Water > 50°F	Boiler	Supply Water < 38°F	Supply Water > 50°F
Device	Start Temperatures	Stop Temperatures												
Boiler & System	Outside Air < 0°F	Outside Air > 4°F												
Pump	Supply Water < 45°F	Supply Water > 50°F												
Boiler	Supply Water < 38°F	Supply Water > 50°F												
Disabled	Enable/Disable	Warm weather shutdown enable Disable Warm Weather Shutdown (WWSD) is not used. Enable The boiler will not be allowed to start in response to a central heat call for heat if the outside temperature is greater than the WWSD setpoint. The boiler will still start in response to a Domestic Hot Water call for heat.												
70°F	0-100°F	Warm weather shutdown setpoint The Warm Weather Shutdown (WWSD) Setpoint used to shutdown the boiler when enabled by the “WWSD Enable” parameter.												

XII. Operation (continued)

E. Adjusting Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
See Table 30	See Table 30	Boiler Type The Boiler Type parameter changes the parameters listed in Table 30. Factory level password is required. This parameter is intended to allow a user to set the parameters in a spare part Sage2.1 to a particular boiler type. Table 31 shows the spare part numbers for the different boiler types.
See Table 30	Absolute Max to Minimum Modulation	Central Heat Maximum Modulation This parameter defines the highest modulation rate the Sage2.1 control will go to during a central heat call for heat. If the rated input of the installed home radiation is less than the maximum output of the boiler, change the Central Heat Maximum Modulation (fan speed) setting to limit the boiler output accordingly.
See Table 30	Absolute Max to Minimum Modulation	Domestic Hot Water (DHW) Max Modulation This parameter defines the highest modulation rate the Sage2.1 control will go to during a central heat Domestic Hot Water call for heat. If the rated input of the indirect water heater is less than the maximum output of the boiler, change the DHW Maximum Modulation (fan speed) setting to limit the boiler output accordingly.
See Table 30	Absolute Max to Absolute Minimum	Minimum Modulation This parameter is the lowest modulation rate the Sage2.1 control will go to during any call for heat.

Table 30: Parameters Changed Using the Boiler Type Parameter Selections:

Boiler Type Selections:	ALP080 -02	ALP080 -27	ALP105 -02	ALP105 -27	ALP150 -02	ALP150 -27	ALP150 -70	ALP210 -02	ALP210 -27	ALP210 -70	ALP285 -07	ALP285 -70	ALP399 -07	ALP500 -07
CH maximum modulation rate	4450	4450	4850	4850	5500	5500	6200	6200	6200	7000	6300	7000	8500	6400
DHW maximum modulation rate	4450	4450	4850	4850	5500	5500	6200	6200	6200	7000	6300	7000	8500	6400
Minimum modulation rate	1125	1700	1250	1800	1300	2000	2000	1375	2400	1800	1450	2400	2100	1400
Absolute maximum fan speed*	4500	4500	4900	4900	5500	5500	6200	6200	6200	7000	6300	7000	8550	6400
Absolute minimum fan speed*	1100	1700	1200	1800	1300	2000	2000	1300	2400	1800	1400	2400	2050	1400

*The absolute minimum and maximum fan speeds are only set by selecting the boiler type. This parameter selection requires a factory level password.

NOTE: It is important to purchase the correct REPLACEMENT CONTROLLERS, See table below for correct controller part numbers based on boiler model number:

Table 31: Sage2.1 Control Spare Part Numbers

	Controller Part Number													
	103141-01											103141-02		103141-03
Boiler Type Selections:	ALP080 -02	ALP808 -27	ALP105 -02	ALP105 -27	ALP150 -02	ALP150 -27	ALP150 -70	ALP210 -02	ALP210 -27	ALP210 -70	ALP500 -07	ALP285 -07	ALP285 -70	ALP399 -07
Light-off Rate	3000											2500		3800
Fan PWM Frequency	3000											2000		2000

XII. Operation (continued)

E. Adjusting Parameters (continued)

“Press” button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Any Demand	Never, Any Demand, Central heat, No Priority, Central Heat, Optional Priority	<p>System Pump run pump for: Activates the system pump output according to selected function.</p> <p>Never: Pump is disabled and not shown on status screen.</p> <p>Any Demand: Pump Runs during any call for heat.</p> <p>Central Heat, No Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and continues to run during Domestic Hot Water Priority.</p> <p>Central heat, Optional Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and will be forced off if there is a DHW call for heat and Domestic Hot Water Priority is active.</p>
Any Demand	Any Demand, Central heat, off DHW demand	<p>Boiler Pump run pump for: Activates the boiler pump output according to selected function.</p> <p>Any Demand: Pump Runs during any call for heat.</p> <p>Central heat, off DHW demand: Pump Runs during central heat and frost protection call for heat. Pump does not start for a DHW call for heat and will be forced off if there is a DHW call for heat and Domestic Hot Water Priority is active.</p>
Primary Loop Pipe IWH	Never, Primary Loop Piped IWH, Boiler Piped IWH	<p>Domestic Pump run pump for: Activates the Domestic pump output according to selected function</p> <p>Never: Pump is disabled and not shown on status screen.</p> <p>Primary Loop Piped IWH: Pump Runs during domestic hot water call for heat. Domestic Hot Water Priority enable/disable does not affect pump operation.</p> <p>Boiler Piped IWH: Pump Runs during domestic hot water call for heat. Pump is forced off during a central heat call for heat when Domestic Hot Water Priority “disabled” is selected and when Domestic Hot Water Priority “enable” has been selected and the DWH call for heat has remained on for longer than 1 hour (priority protection time).</p>

Refer to “Example Pump Parameter selections:” on the next pages for additional pump setup information.

“Press” button to access the following parameters:

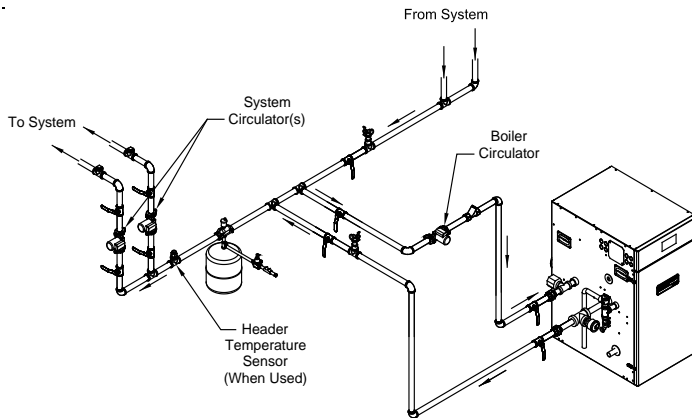
Factory Setting	Range / Choices	Parameter and Description
Contractor Name	User defined	Contractor Name
Address	User defined	Contractor Address
Phone	User defined	Contractor Phone

XII. Operation (continued)

E. Adjusting Parameters (continued)

Example Pump Parameter selections:

- a. Single boiler with no Indirect Water Heater



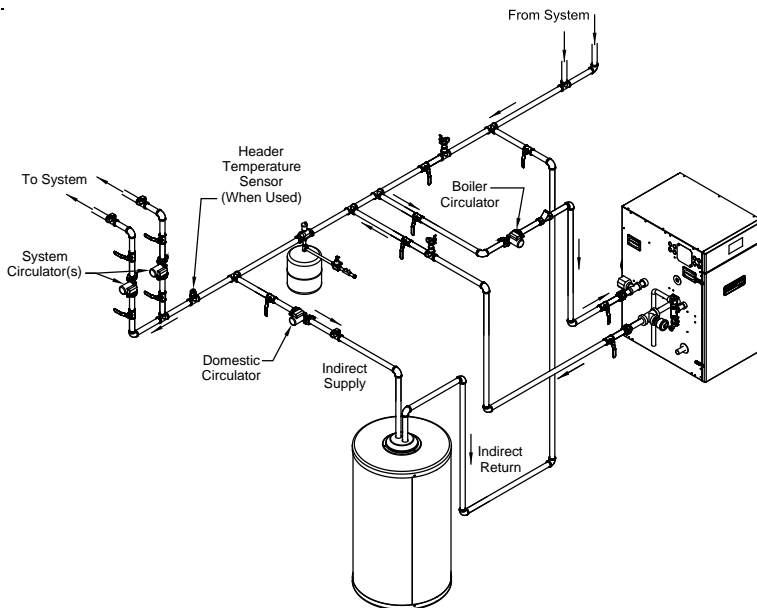
Parameter Selections:

System Pump = "any demand"
Boiler Pump = "any demand"
DHW Pump = "never"

Explanation:

This piping arrangement only services central heat. When there is any demand both boiler and system pumps turn on.

- b. Single boiler Indirect Water Heater Piped to Primary, Optional Domestic Hot Water Priority.



Parameter Selections:

System Pump = "Central Heat , Optional Priority"
Boiler Pump = "any demand"
DHW Pump = "Primary Loop Piped IWH"
DHW Priority Enable is optional

Explanation:

This piping arrangement permits the system pump to run or not run when there is a domestic hot water call for heat. Domestic hot water priority is optional. It is permissible for the domestic and system pumps to run at the same time. The boiler pump must run for every call for heat.

XII. Operation (continued)

E. Adjusting Parameters (continued)

“Press” Central Heat button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
180°F	80°F to 190°F	Central Heat Setpoint Target temperature for the central heat priority. Value also used by the outdoor air reset function.
170°F	80°F to 190°F	Central Heat Thermostat “Sleep” or “Away” Setback Setpoint Thermostat setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes and sensed at E-COM terminals D, R, and C. When setback is “on” the thermostat setback setpoint shifts the reset curve to save energy while home is in a reduced room temperature mode. The reset curve is shifted by the difference between the High Boiler Water Temperature and the Thermostat Setback Setpoint. Honeywell VisionPro IAQ part number TH9421c1004 is a “setback” EnviraCOM enabled thermostat. When connected, it allows boiler water setback cost savings.
2°F	2°F to 10°F	Central Heat Diff Above The boiler stops when the water temperature rises ‘Diff Above’ degrees above the setpoint.
10°F	2°F to 30°F	Central Heat Diff Below The boiler starts when the water temperature drops ‘Diff Below’ degrees below the setpoint.

“Press” DHW button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
180°F	80°F to 190°F	Domestic Hot Water Setpoint The Domestic Hot Water (DHW) Setpoint parameter is used to create a minimum boiler water temperature setpoint that is used when DHW heat demand is “on”. When the DHW heat demand is not “on” (the contact is open or <u>not wired</u>) this setpoint is ignored.
170°F	80°F to 190°F	Domestic Hot Water Thermostat “Sleep” or “Away” Setback Setpoint Thermostat setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes and sensed at E-COM terminals D, R, and C. When setback is “on” the thermostat setback setpoint shifts the DHW setpoint to lower the IWH temperature and to save energy while home is in a reduced room temperature mode.
2°F	2°F to 10°F	Domestic Hot Water Diff Above The boiler stops when the water temperature drops ‘Diff Above’ degrees above the setpoint.
10°F	2°F to 30°F	Domestic Hot Water Diff Below The boiler starts when the water temperature drops ‘Diff Below’ degrees below the setpoint.
Enable	Enable Disable	Domestic Hot Water Priority (DHWP) When Domestic Hot Water Priority is Enabled and Domestic Hot Water (DHW) heat demand is “on” the DHW demand will take “Priority” over home heating demand. When the System and Boiler pumps are configured as “Central Heat (off DHW priority)” or “Central Heat, Optional Priority” then they will be forced “off” during DHW Priority. Priority protection time of one hour is provided to end DHWP in the event of a failed or excessive DHW demand.

XII. Operation (continued)

E. Adjusting Parameters (continued)

“Press” Outdoor Reset button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Enabled	Enable Disable	<p>Outdoor Reset Enable If an outdoor sensor is installed and Outdoor Reset is Enabled, the boiler will automatically adjust the heating zone set point temperature based on the outdoor reset curve in Figure 57. The maximum set point is defined by the Central Heat Setpoint (factory set to 180°F) when the outdoor temperature is 0°F or below. The minimum set point temperature shown is 130°F (adjustable as low as 80 F) when the outdoor temperature is 50°F or above. As the outdoor temperature falls the supply water target temperature increases. For example, if the outdoor air temperature is 30°F, the set point temperature for the supply water is 150°F.</p> <p>Disable <u>Do Not</u> Calculate setpoint based on outdoor temperature Enable Calculate the temperature setpoint based on outdoor temperature using a reset curve defined by Low Outdoor Temp, High Outdoor Temp, Low Boiler Water Temp, Min Boiler Temp and Central Heat Setpoint and Boost Time parameters.</p>
0°F	-40°F to 100°F	<p>Low Outdoor Temperature The Low Outdoor Temperature parameter is also called “Outdoor Design Temperature”. This parameter is the outdoor temperature used in the heat loss calculation. It is typically set to the coldest outdoor temperature.</p>
70°F	32°F to 100°F	<p>High Outdoor Temperature The High Outdoor Temperature parameter is the outdoor temperature at which the Low Boiler Water Temperature is supplied. This parameter is typically set to the desired building temperature.</p>
110°F	70°F to 190°F	<p>Low Boiler Water Temperature The Low Boiler Water Temperature parameter is the operating setpoint when the High Outdoor Temperature is measured. If the home feels cool during warm outdoor conditions, the Low Boiler Water Temperature parameter should be increased.</p>
130°F	80°F to 190°F	<p>Minimum Boiler Temperature The Minimum Boiler Temperature parameter sets a low limit for the Reset setpoint. Set this parameter to the lowest supply water temperature that will provide enough heat for the type radiation used to function properly. Always consider the type of radiation when adjusting this parameter.</p>
1200 Seconds (20 Minutes)	0-1800 Seconds (0-30 Minutes)	<p>Boost Time When the Central Heat Setpoint is decreased by Outdoor Reset settings, the Boost Time parameter is used to increase the operating setpoint when the home heat demand is not satisfied after the Boost Time setting is exceeded. When heat demand has been “on” continuously for longer than the Boost Time parameter the operating setpoint is increased by 10°F. The highest operating setpoint from Boost Time is 192°F minus the Central Heat “Diff Above” setting. A setting of 0 seconds disables this feature.</p>

XII. Operation (continued)

E. Adjusting Parameters (continued)

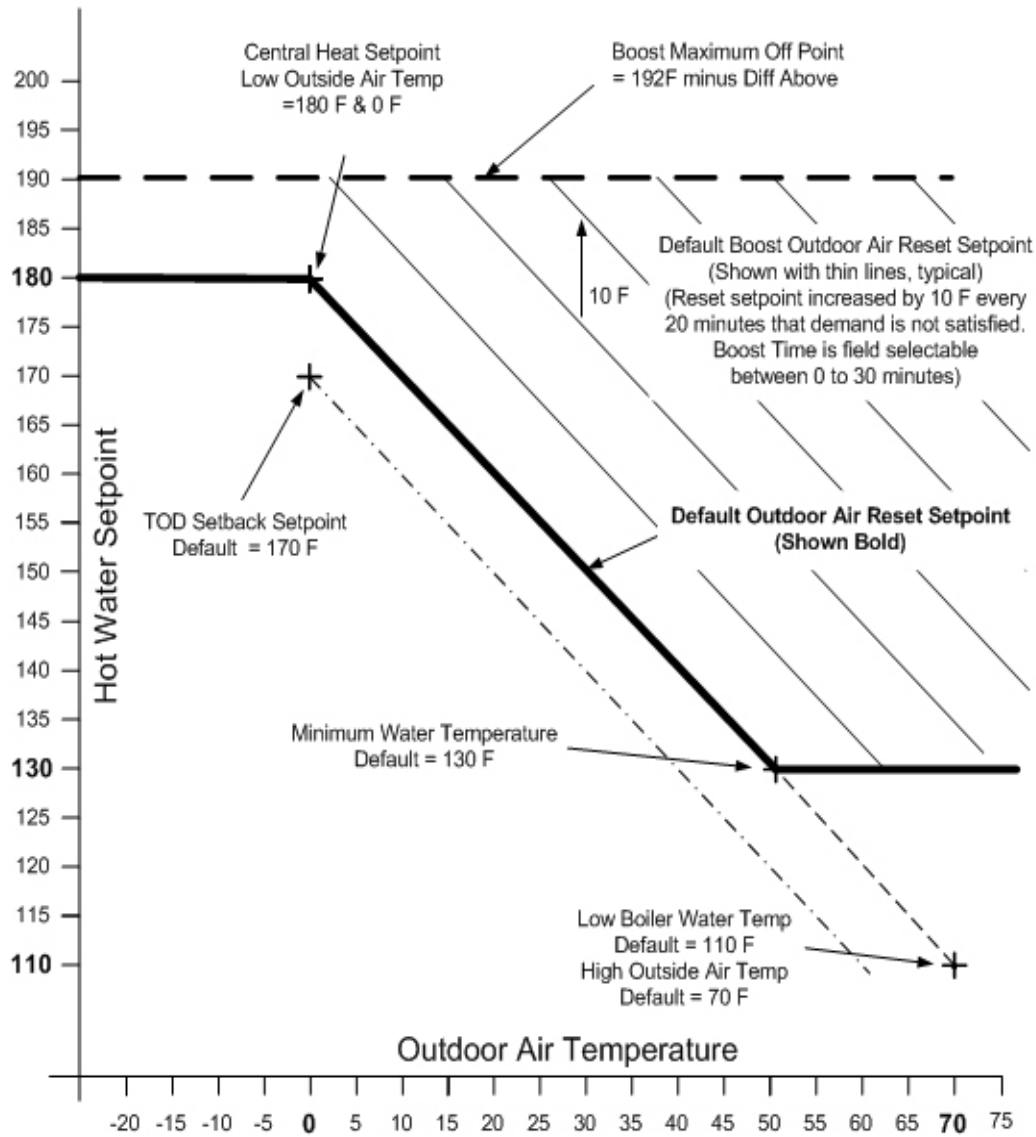



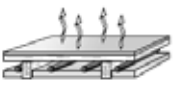


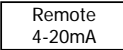


Figure 57: Outdoor Reset Curve

Central Heat Setpoint	Heating Element Type		Central Heat Setpoint	Heating Element Type	
180 to 190°F	Fan Coil		100 to 140°F	In Slab Radiant High Mass Radiant	
160 to 190°F	Convection Baseboard Fin Tube Convective		130 to 160°F	Staple-up Radiant Low Mass Radiant	
130 to 160°F	Radiant Baseboard		140 to 160°F	Radiators	

XII. Operation (continued)

E. Adjusting Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Local	Local, 4-20mA	Central Heat Modulation Source This parameter enables the 4-20mA input to control firing rate and the thermostat input to control boiler on/off demand directly without using internal setpoint. The 4-20mA selection is used to enable a remote multiple boiler controller to control the Sage2.1 Control: Local: 4-20mA Input on Terminal 9 & 10 is ignored. 4-20mA 4-20mA Input on Terminal 9 & 10 is used to control firing Rate % directly.
Local	Local, 4-20mA	Central Heat Setpoint Source Sets the remote (Energy Management System) control mode as follows: Local: Local setpoint and modulation rate is used. 4-20mA input on Terminal 9 & 10 is ignored. 4-20mA 4-20mA Input on Terminal 9 & 10 is used as the temperature setpoint. The following two parameters may be used to adjust the signal range.
130°F	80°F - Central Heat Setpoint	Central Heat 4-20mAdc Setup, 4 mA Water Temperature* Sets the Central Heat Temperature Setpoint corresponding to 4mA for signal input on terminal 9 & 10. Voltage below 4mA is considered invalid, (failed or incorrect wired input).
130°F	80°F - Central Heat Setpoint	Central Heat 4-20mAdc Setup, 20 mA Water Temperature* Sets the Central Heat Temperature Setpoint corresponding to 20mA for signal input on terminal 9 & 10. Voltage above 20mA is considered invalid, (failed or incorrect wired input).

* Only visible when Central Heat Setpoint Source is set to 4-20mA.

For Sequence Master and Sequence Slave menu explanation refer to Section XII “Modular Installation”, Paragraph G, 4.

XIII. Service and Maintenance

DANGER

This boiler uses flammable gas, high voltage electricity, moving parts, and very hot water under high pressure. Assure that all gas and electric power supplies are off and that the water temperature is cool before attempting any disassembly or service.

Do not attempt any service work if gas is present in the air in the vicinity of the boiler. Never modify, remove or tamper with any control device.

WARNING

This boiler must only be serviced and repaired by skilled and experienced service technicians.

If any controls are replaced, they must be replaced with identical models.

Read, understand and follow all the instructions and warnings contained in all the sections of this manual.

If any electrical wires are disconnected during service, clearly label the wires and assure that the wires are reconnected properly.

Never jump out or bypass any safety or operating control or component of this boiler.

Read, understand and follow all the instructions and warnings contained in ALL of the component instruction manuals.

Assure that all safety and operating controls and components are operating properly before placing the boiler back in service.

NOTICE

Warranty does not cover boiler damage or malfunction if the following steps are not performed at the intervals specified.

A. Continuously:

1. Keep the area around the boiler free from combustible materials, gasoline and other flammable vapors and liquids.
2. Keep the area around the combustion air inlet terminal free from contaminants .
3. Keep the boiler room ventilation openings open and unobstructed.

B. Monthly Inspections:

1. Inspect the vent piping and outside air intake piping to verify they are open, unobstructed and free from leakage or deterioration. Call the service technician to make repairs if needed.
2. Inspect the condensate drain system to verify it is leak tight, open and unobstructed. Call the service technician if the condensate drain system requires maintenance.

3. Inspect the water and gas lines to verify they are free from leaks. Call the service technician to make repairs if required.

CAUTION

Water leaks can cause severe corrosion damage to the boiler or other system components. Immediately repair any leaks found.

C. Annual Inspections and Service:

In addition to the inspections listed above the following should be performed by a service technician once every year.

1. If equipped, test the low water cutoff by pressing the "Test" button located at its end. The yellow light should come on and "Limit Open" will flash in the Active Faults screen on the display. Push the reset button to restore normal operation. If yellow light does not come on, determine why the low water cutoff is not working properly.
2. Follow the procedure for turning the boiler off per Figure 51 "Lighting Instructions".
3. Inspect the wiring to verify the conductors are in good condition and attached securely.

XIII. Service and Maintenance (continued)

CAUTION

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

4. Remove the ignition electrode and inspect it for oxides. Clean the oxides from the electrode with steel wool. Do not use sandpaper for the cleaning. Inspect the ceramic insulator for cracks and replace the ignitor assembly if necessary. Check the ignitor electrode spacing gap. Refer to Figure 58 “Ignitor Electrode Gap” for details.

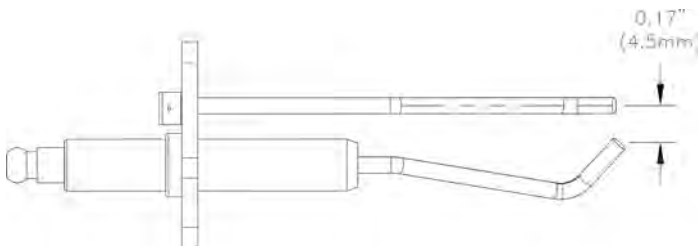


Figure 58: Ignitor Electrode Gap

5. Remove the fan/gas valve assembly from the burner hood. Inspect for lint and dust. If significant lint and dust are found, disassemble the fan/gas valve assembly to expose the swirlplate and fan inlet (see the exploded diagram in the parts list at the back of this manual). Vacuum these parts as required, being careful not to damage the vanes on the swirlplate.
6. Remove the burner hood to access the burner and the combustion chamber.
7. Remove the burner and vacuum any dust or lint from the burner. If the burner shows signs of deterioration or corrosion, replace it immediately. Inspect the burner gasket and replace, if necessary.
8. Inspect the heat exchanger, clean and vacuum any debris found on the surfaces. A soft nylon brush must be used for cleaning. Remove insulation disc and clean the surfaces by flushing with clean water. Drain and flush the inside of the heat exchanger and condensate collector. Do not use any cleaning agents or solvents. Re-install insulation disc.
9. Inspect the condensate trap to verify it is open and free from debris. Inspect condensate line integrity between boiler and condensate neutralizer (if used) and condensate neutralizer and the drain. Clean/repair if needed.
If the condensate neutralizer is used, check pH before and after the neutralizer to determine neutralizing effectiveness. Replace limestone chips and clean out the neutralizer if needed.

10. Reinstall the burner, burner hood and fan/gas valve assembly.
11. Reconnect any wiring which has been disconnected.
12. Inspect the heating system and correct any other deficiencies prior to restarting the boiler.
13. Follow Section XI “System Start-up” before leaving installation.
14. Perform the combustion test outlined in Section XI “System Start-up”.
15. Verify that the system PH is between 8.2 and 9.5.
16. Check for vent terminal obstructions and clean as necessary.

D. Recommended Heating System Water Treatment Products:

1. System Cleaning and Conditioning:
 - a. The following heating system water treatment products are recommended for an initial existing heating system sludge removal, initial boiler cleaning from copper dust, flux residue and any boiler debris and for preventive treatment as corrosion/scale inhibitors:
 - i. Fernox™ Restorer (universal cleaner, sludge remover, scale remover, flux residue/debris remover, corrosion inhibitor)
 - ii. Fernox™ Protector (Alphi 11, CH#, Copal) (sludge remover, corrosion inhibitor)
Follow manufacturer application procedure for proper heating system/boiler cleaning and preventive treatment.
Above referenced products are available from Cookson Electronics Company, 4100 Sixth Avenue, Altoona, PA 16602, Tel: (814) 946-1611 and/or selected HVAC distributors. Contact U.S. Boiler for specific details.
 - iii. Equivalent system water treatment products may be used in lieu of products referenced above.
2. System Freeze Protection:
 - a. The following heating system freeze protection products are recommended for Alpine boilers:
 - i. Fernox™ Protector Alphi 11 (combined antifreeze and inhibitor).
Follow manufacturer application procedure to insure proper antifreeze concentration and inhibitor level.
Above referenced product is available from Cookson Electronics Company, 4100 Sixth Avenue, Altoona, PA 16602, Tel: (814) 946-1611 and/or selected HVAC distributors. Contact U.S. Boiler for specific details.

XIII. Service and Maintenance (continued)

- b. Equivalent system freeze protection products may be used in lieu of product referenced above. In general, freeze protection for new or existing systems must use specially formulated glycol, which contains inhibitors, preventing the glycol from attacking the metallic system components. Insure that system fluid contains proper glycol concentration and inhibitor level. The system should be tested at least once a year and as recommended by the manufacturer of the glycol solution. Allowance should be made for expansion of the glycol solution.

CAUTION

Use only inhibited propylene glycol solutions specifically formulated for hydronic systems. Do not use ethylene glycol, which is toxic and can attack gaskets and seals used in hydronic systems.

E. Condensate Overflow Switch and Condensate Trap Removal and Replacement:

For removal or replacement of the condensate overflow switch and/or condensate trap follow the steps below. For parts identification, refer to Section XV "Repair Parts".

1. Condensate Overflow Switch Removal and Replacement:
 - a. Disconnect power supply to boiler.
 - b. Remove two (2) wire nuts and disconnect overflow switch wire pigtails from boiler wiring.

- c. Using pliers, release spring clip securing the overflow switch to condensate trap body and remove the switch. Note that the switch has factory applied silicon adhesive seal, which may have to be carefully cut all around to facilitate the switch removal.
- d. Insure the trap overflow switch port is not obstructed with silicon seal debris, clean as needed.
- e. **Apply silicon seal to the replacement switch threads and install the switch into the trap body making sure it is properly oriented - the arrow molded into the switch hex end side must face down for proper switch operation. See Figure 59 "Condensate Overflow Switch Orientation" for details.**
- f. Reconnect the switch wire pigtails to the boiler wiring and secure with wire nuts.
- g. Restore power supply to boiler. Fill up the trap (see Section V "Condensate Disposal") and verify the switch operation.

2. Condensate Trap Removal and Reinstallation:

- a. Disconnect power supply to boiler.
- b. Remove two (2) wire nuts and disconnect overflow switch wire pigtails from boiler wiring.
- c. Disconnect pressure switch hose from condensate trap.
- d. Disconnect outside condensate compression fitting from condensate trap stab.

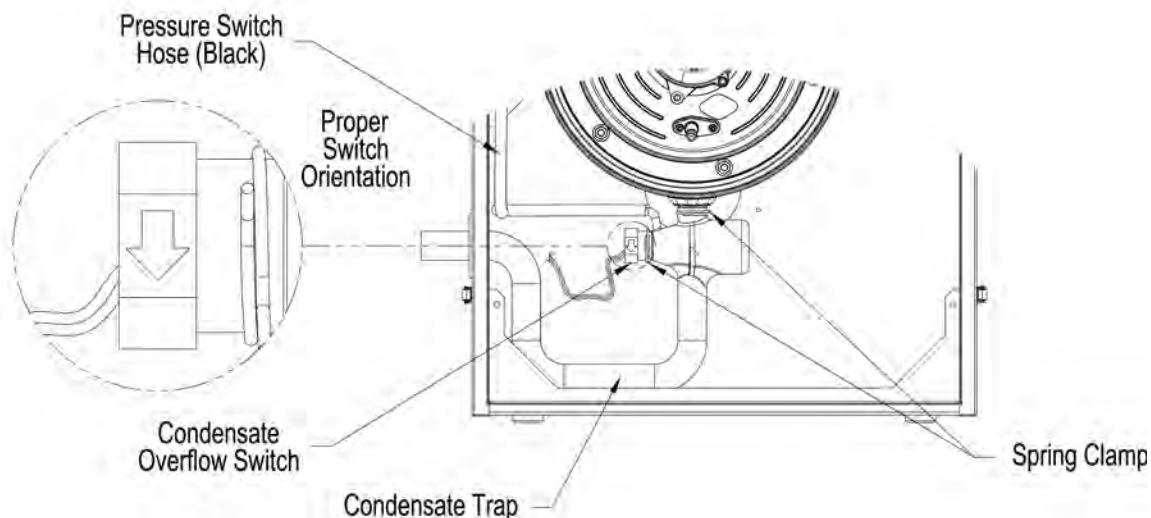


Figure 59: Condensate Overflow Switch Orientation

XIII. Service and Maintenance (continued)

- e. Using pliers, release spring clip securing the overflow switch to condensate trap body and remove the switch. Note that the switch has factory applied silicon adhesive seal, which may have to be carefully cut all around to facilitate the switch removal.
- f. Using pliers, release spring clip securing condensate trap body to the heat exchanger bottom drain stab.
- g. Firstly, pull the trap downwards to release from the heat exchanger bottom drain stab; secondly, pull the trap end from left side jacket panel sealing grommet and remove the trap from boiler.
- h. To reinstall the trap, reverse above steps.
- i. If the original condensate overflow switch is to be re-used, follow the appropriate switch removal steps from Condensate Overflow Switch Removal and Replacement procedure above.
- j. **Insure that fresh silicon sealant is applied to the overflow switch threads, and the switch is properly oriented relative to the trap body - the arrow molded into the switch hex side end must face down for proper switch operation. See Figure 59 “Condensate Overflow Switch**

Orientation” for details. Insure that pressure switch hose is reconnected to the trap.

- k. Restore power supply to boiler. Fill up the trap (see Section V “Condensate Disposal”) and verify the switch operation.

Header Temperature Sensor Temperature versus Resistance (P/N 103104-01)

(10kOhm NTC Sensor), Beta of 3950

Temperature		Ohms of Resistance
°F	°C	
32	0	32648
50	10	19898
68	20	12492
77	25	10000
86	30	8057
104	40	5327
122	50	3602
140	60	2488
158	70	1752
176	80	1256
194	90	916
212	100	697
248	120	386

Outdoor Air Temperature Sensor Temperature versus Resistance (P/N 102946-01)

(10kOhm NTC Sensor)

Outdoor Temperature		Ohms of Resistance
°F	°C	
-20	-28.9	106926
-10	-23.3	80485
0	-17.8	61246
10	-12.2	47092
20	-6.7	36519
30	-1.1	28558
40	4.4	22537
50	10.0	17926
60	15.6	14356
70	21.1	11578
76	24.4	10210
78	25.6	9795
80	26.7	9398
90	32.2	7672
100	37.8	6301
110	43.3	5203
120	48.9	4317

Supply, Return and Stack Temperature Sensor Temperature versus Resistance

(12kOhm NTC Sensor), Beta of 3750

Temperature		Ohms of Resistance
°F	°C	
32	0	36100
50	10	22790
68	20	14770
77	25	12000
86	30	9810
104	40	6653
122	50	4610
140	60	3250
158	70	2340
176	80	1710
194	90	1270
212	100	950
230	110	730
248	120	560

XIV. Troubleshooting

WARNING

Turn off power to boiler before working on wiring.

A. Troubleshooting problems where no error code is displayed.

Condition	Possible Cause
Display Blank, Fan off, LWCO lights off, no green power light on Sage2.1 Controller	No 120VAC Power at boiler. Check breaker and wiring between breaker panel and boiler.
Display Panel Blank, Fan running	<ul style="list-style-type: none"> Loose 120VAC connection wiring between boiler J-Box and transformer Loose 24 Vac connection wiring between transformer and Sage2.1 Loose 5 Vdc connection wiring between display and Sage2.1
Boiler fires, but display panel is blank	<ul style="list-style-type: none"> Loose 5 Vdc connection wiring between display and Sage2.1 Defective display
Boiler not responding to call for heat, Status screen reads "Central Heat T-Stat Off"	Boiler is not seeing call for heat. Check thermostat or zone wiring for loose connection, miswiring, or defective thermostat/zone control.
Boiler not responding to a call for heat, "Standby" status is showing.	Boiler is not firing. There is no call for heat or there is a call for heat and the temperature is greater than setpoint.
Boiler not responding to Domestic Hot Water Heat Request	Boiler is not sensing Domestic Hot Water Heat Request. Check wiring for loose connection, miswiring, or defective indirect water heater aquastat.
Boiler Running but System or Boiler Circulator is not running	<ul style="list-style-type: none"> Check wiring for loose connection, miswiring When there is a Domestic Hot Water Heat Request the System or Boiler pumps will be forced "off" when there "Run Pump for" parameter is set to "Central heat, off DHW demand" or "Central Heat, Optional Priority". This has been set to allow all of the heat to be provided for fast indirect water heater recovery. After one hour of "priority protection" or the end of the Domestic Hot Water Heat Request the system and boiler pumps will be free to run.
Home is cold during mild weather days	<ul style="list-style-type: none"> Increase Low Boiler Water Temperature parameter 5°F per day.
Home is cold during cold weather days	<ul style="list-style-type: none"> Increase High Boiler Water Temperature parameter 5°F per day

XIV. Troubleshooting (continued)

B. Troubleshooting problems where a Soft Lockout Code is displayed. When a soft lockout occurs, the boiler will shut down, the display will turn red and

the “Help” button will “blink”. Select the “blinking” “Help” button to determine the cause of the soft lockout. The boiler will automatically restart once the condition that caused the lockout is corrected.

Soft Lockout Codes Displayed

Lockout Number	Condition	Possible Cause
1 Anti Short Cycle	Minimum time between starts has not been reached. Normal delay used to avoid excessive cycles.	
2 Boiler Safety Limit Open	Boiler Safety Limit wired to terminals J6-1, 2 or 3 OPEN: <ul style="list-style-type: none"> Condensate Trap Float Switch contacts open. Air Pressure Switch contacts open. Auto Reset High Limit contact open. 	<ul style="list-style-type: none"> Loose wiring to limit device. Auto Reset Supply high limit sensor detected temperatures in excess of 200°F. Defective Auto Reset Supply High Limit Switch. Plugged Condensate Trap - also check to ensure boiler is level. Air Pressure Switch contacts open - check for blocked vent. See possible causes for “Hard Lockout 4”. <p style="text-align: center;">NOTE Block Vent Special Note</p> <p>Before a call for heat the air pressure switch is closed. When there is a call for heat with a blocked vent the air pressure switch will open (due to excessive pressure of the fan against a blocked flue pipe) after the fan starts. The control stops the start sequence and stops the fan. After the fan stops the pressure switch re-closes and the cycle continues. The displays shows the cause of trip for only the time the pressure switch is open.</p>
3 Boiler Safety Limit Open, (ILK Off)	Boiler Safety Limit, or External Limit wired to terminals J5-1 OPEN: <ul style="list-style-type: none"> Jumper for External Limit wired to terminals 11 and 12 or device connected to it open. Jumper for Low Water Cutoff (LWCO) Switch or device connected to it open. Jumper for Low Gas Pressure Switch or device connected to it open. 	<ul style="list-style-type: none"> See possible causes for “Hard Lockout 4”. Loose wiring to limit device. External Limit defective or jumper not installed. Low Gas Pressure Switch contacts open (if installed). LWCO switch not installed and jumper missing. If yellow light on LWCO is on, system is low on water. If neither yellow or green light is on, check LWCO harness.
7 Return sensor fault	Shorted or open return temperature sensor.	<ul style="list-style-type: none"> Shorted or mis-wired return sensor wiring. Defective return sensor.
8 Supply sensor fault	Shorted or open supply temperature sensor.	<ul style="list-style-type: none"> Shorted or mis-wired supply sensor wiring. Defective supply sensor.
9 DHW sensor fault	Shorted or open Domestic Hot Water (DHW) temperature sensor.	<ul style="list-style-type: none"> Shorted or mis-wired DHW sensor wiring. Defective DHW sensor.
10 Stack sensor fault	Shorted or open flue gas (stack) temperature sensor.	<ul style="list-style-type: none"> Shorted or mis-wired stack sensor wiring. Defective stack sensor.
11 Ignition failure	Flame failure after 5 tries to restart.	<ul style="list-style-type: none"> No gas pressure. Gas pressure under minimum value shown on rating plate. Gas line not completely purged of air. Defective Electrode. Loose burner ground connection. Defective Ignition Cable. Defective gas valve (check for 24 Vac at harness during trial for ignition before replacing valve). Air-fuel mixture out of adjustment - consult factory.
13 Flame rod shorted to ground	Flame rod shorted to ground	<ul style="list-style-type: none"> Shorted or mis-wired flame rod wiring. Defective flame rod.
14 Delta T inlet/outlet high	Temperature rise between supply and return is too high.	<ul style="list-style-type: none"> Inadequate boiler water flow. Verify that pump is operating and that pump and piping are sized per Section VI of this manual.
15 Return temp higher than supply	Sage2.1 is reading a return sensor temperature higher than the supply sensor temperature. Condition must be present for at least 75 seconds for this error code to appear.	<ul style="list-style-type: none"> Flow through boiler reversed. Verify correct piping and pump orientation. No boiler water flow. Verify that system is purged of air and that appropriate valves are open. Sensor wiring reversed. Supply or return sensor defective.
16 Supply temp has risen too quickly	Supply water temperature has risen too quickly.	<ul style="list-style-type: none"> See possible causes for “Hard Lockout 4”. Inadequate boiler water flow. Verify that pump is operating and that pump and piping are sized per Section VI of this manual.
17 Fan speed not proved	Normal waiting for fan speed to match purge and light-off setpoint.	

XIV. Troubleshooting (continued)

C. Troubleshooting problems where a Hard Lockout Code is displayed. When a hard lockout occurs, the boiler will shut down, the display will turn red and the “Help” button will “blink”. Select the “blinking”

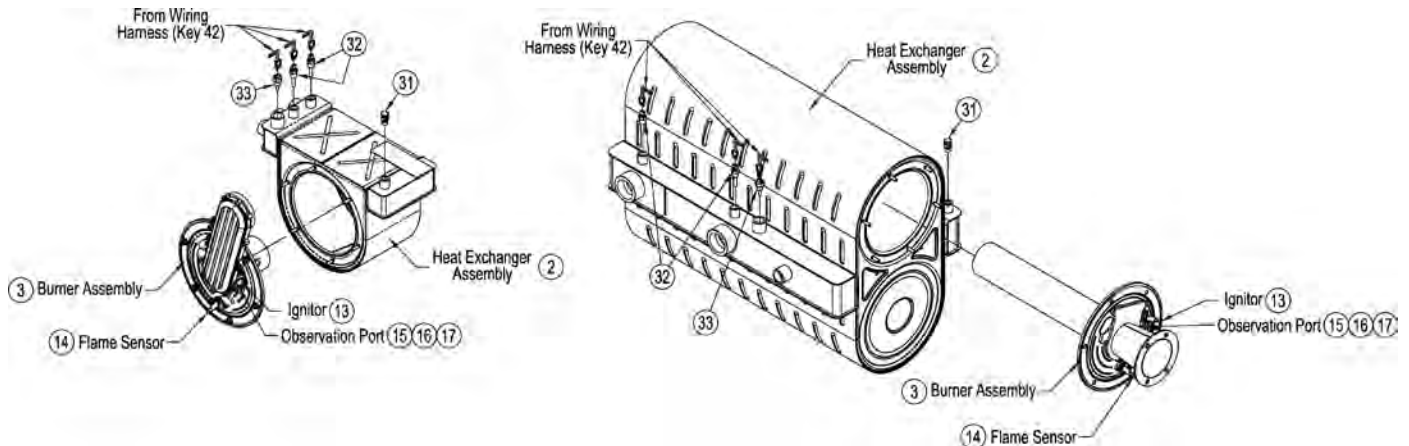
“Help” button to determine the cause of the Hard Lockout. Once the condition that caused the lockout is corrected, the boiler will need to be manually reset using the Reset button on the “Active Fault” display or located on the Sage2.1 Control.

Hard Lockout Codes Displayed

Lockout Number	Condition	Possible Cause
4 Supply high limit	Sage2.1 supply sensor detected temperatures in excess of 210°F.	<ul style="list-style-type: none"> • Heating load at time of error was far below the minimum firing rate of the boiler. • Defective system pump or no flow in primary loop. • Defective boiler pump or no flow in boiler loop. • Control system miswired so that the boiler operation is permitted when no zones are calling.
5 DHW high limit	Sage2.1 DHW sensor detected temperatures in excess of Setpoint.	<ul style="list-style-type: none"> • DHW load at time of error was far below the minimum firing rate of the boiler. • Control system miswired so that boiler operation is permitted when no DHW are calling.
6 Stack High limit	Sage2.1 Flue gas (Stack) sensor detected temperatures in excess of 204°F.	<ul style="list-style-type: none"> • Heat exchanger needs to be cleaned. • Boiler over-fired. • Air-fuel mixture out of adjustment - consult factory.
12 Flame detected out of sequence	A flame signal was present when there should be no flame.	<ul style="list-style-type: none"> • Defective gas valve - make sure inlet pressure is below maximum on rating plate before replacing valve.
18 Light off rate proving failed	Blower is not running at Light-off rate when it should or fan speed signal not being detected by Sage2.1.	<ul style="list-style-type: none"> • Loose connection in 120 VAC fan wiring. • Loose or miswired fan speed harness. • Defective fan
19 Purge rate proving failed	Blower is not running at Purge rate when it should or fan speed signal not being detected by Sage2.1.	<ul style="list-style-type: none"> • Loose connection in 120 VAC fan wiring. • Loose or miswired fan speed harness. • Defective fan
20 Invalid Safety Parameters	Unacceptable Sage2.1 control Safety related parameter detected.	Safety Parameter verification required. Contact factory.
21 Invalid Modulation Parameter	Unacceptable Sage2.1 control Modulation related parameter detected.	Reset the control.
22 Safety data verification needed	Safety related parameter change has been detected and a verification has not been completed.	Safety related Sage2.1 control parameter has been changed and verification has not been performed.
23 24VAC voltage low/high	Sage2.1 control 24Vac control power is high or low.	<ul style="list-style-type: none"> • Loose connection in 24Vac VAC power wiring. • Loose or miswired 24Vac harness. • Miswired wiring harness causing power supply short to ground. • Defective transformer. • Transformer frequency, voltage and VA do not meet specifications.
24 Fuel Valve Error	Power detected at fuel valve output when fuel valve should be off.	<ul style="list-style-type: none"> • Loose or defective gas valve harness. Check electrical connections. • Defective gas valve (check for 24 Vac at harness during trial for ignition before replacing valve).
25 Hardware Fault	Internal control failure.	<ul style="list-style-type: none"> • Reset the control. If problem reoccurs, replace the Sage.
26 Internal Fault	Internal control failure.	<ul style="list-style-type: none"> • Reset the control. If problem reoccurs, replace the Sage.
27 Unknown Fault	Unknown Fault	<ul style="list-style-type: none"> • Reset the control. If problem reoccurs, replace the Sage.

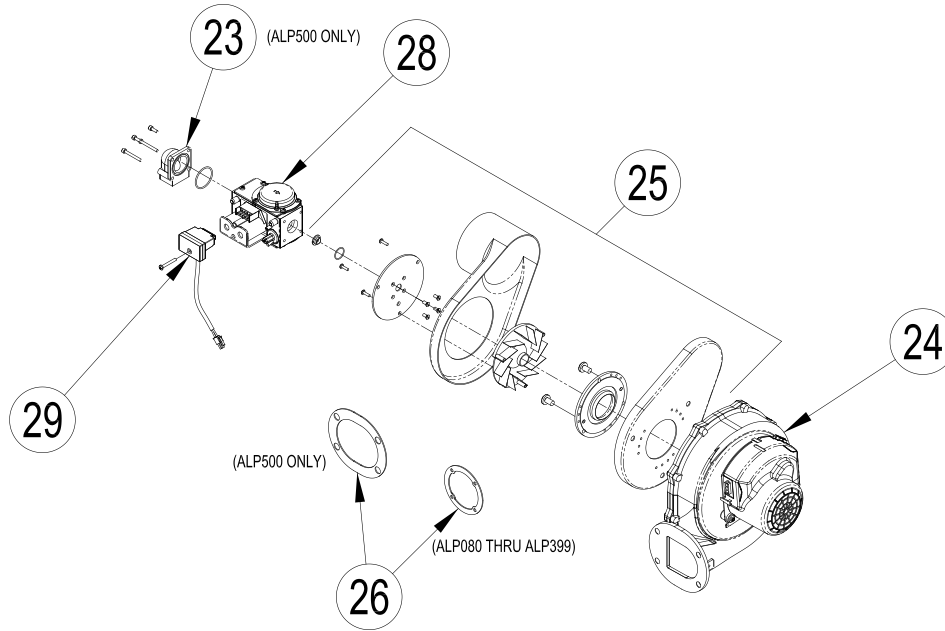
XV. Repair Parts

All Alpine™ Series Repair Parts may be obtained through your local U.S. Boiler Wholesale distributor. Should you require assistance in locating a U.S. Boiler distributor in your area, or have questions regarding the availability of U.S. Boiler products or repair parts, please contact U.S. Boiler Customer Service at (717) 481-8400 or Fax (717) 481-8408.

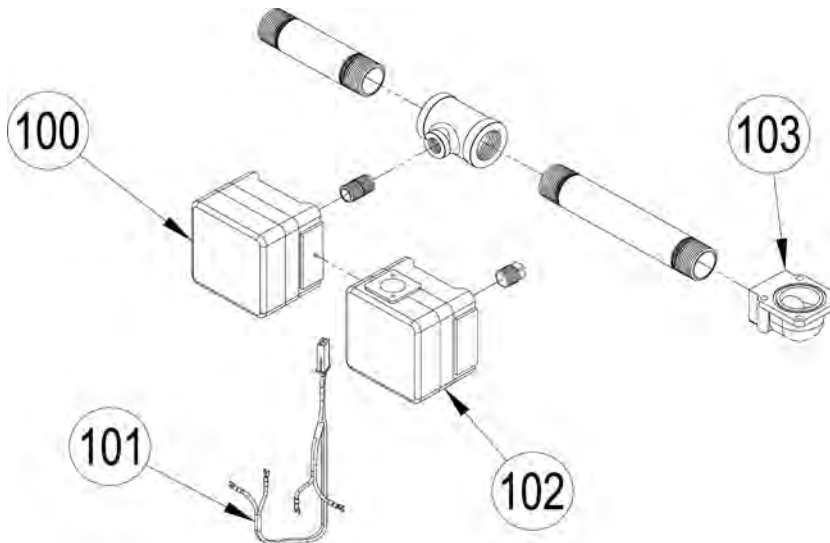


Key No.	Description	(Quantity) Part Number						
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500
1	Heat Exchanger, Burner, Etc. (Key No's 2 thru 23)	101520-01	101521-01	101522-01	101523-01	101524-01	101525-01	N/A
2	Heat Exchanger Assembly	101710-01	101711-01	101712-01	101713-01	101714-01	101715-01	102513-07
3	Burner Assembly	101717-01	101718-01	101719-01	101720-01	101721-01	101722-01	101933-07
13	Ignitor and Gasket Kit	103005-01						
14	Flame Sensor	101734-01						
15	Observation Glass Retaining Plate	101735-01						
16	Observation Glass	101736-01						
17	Observation Glass Gasket	101737-01						
31	Air Vent Valve	101586-01						
32	Water Temp Sensor	(2) 101685-01						
33	High Limit	101653-01						
	M6x1 Hex Flange Nut (Not Shown)	(6) 101724-01						
	Gas/Air Intake Duct Assembly (Not Shown)	101725-01			101725-02			N/A
	Gas/Air Intake Duct Weldment (Not Shown)	N/A						102615-01
	Burner Plate (Not Shown)	101727-01						
	Burner Plate Insulation (Warning: Contains RCF, Not Shown)	101728-01						
	Burner Plate Inner Seal (Not Shown)	101729-01						
	Burner Plate Outer Seal (Not Shown)	101730-01						
	Burner Head (Not Shown)	101731-01	101731-02	101731-03	101731-04	101731-05	101731-06	
	Burner Head Seal (Not Shown)	101732-01						
	M3x6 mm Socket Hd Thread Forming Screw, T10 Drive (Not Shown)	(2) 101738-01						
	Flame Sensor Gasket (Not Shown)	101741-01						
	M4x8 mm Socket Hd Cap Thread Forming Screw, X20 Drive (Not Shown)	(4) 101739-01						
	M5x14 mm Pan Hd Thread Forming Screw, T25 Drive (Not Shown)	(4) 101742-01						N/A
	M5x10mm Pan Hd Thread Forming Screw, Phillips Drive (Not Shown)	N/A						(5) 102671-01
	Insulation Disc (Warning: Contains RCF, Not Shown)	101996-01						

XV. Repair Parts (continued)

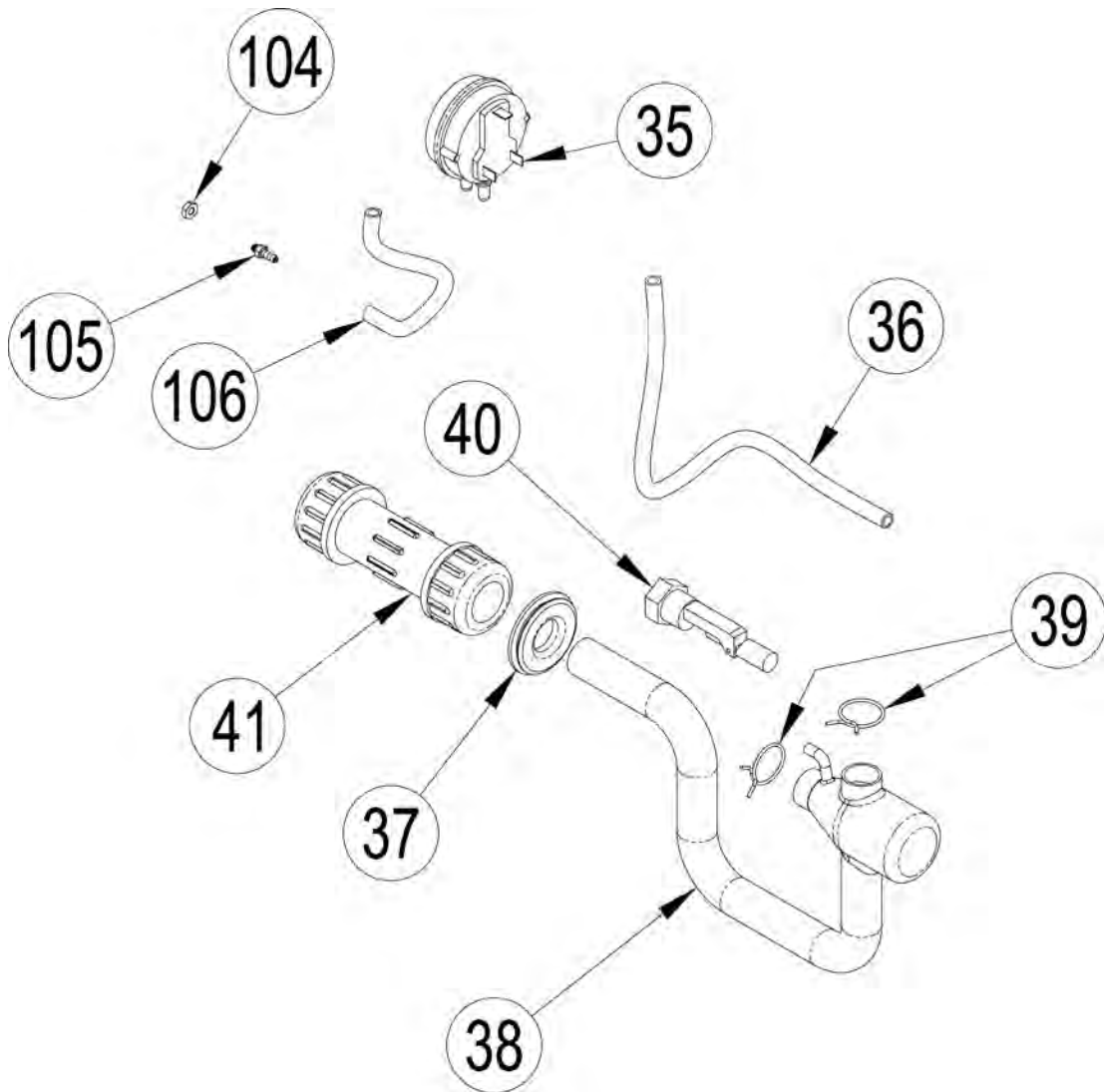


Key No.	Description	(Quantity) Part Number							
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500	
---	Gas Train Assembly (Key No's 23 thru 29)	MCBA Control	101585-01	101585-02	101585-03	101585-04	101585-05	101585-06	101585-07
		Sage2.1 Control	102852-01	102852-02	102852-03	102852-04	102852-05	102852-06	102852-07
23	Gas Valve Flange Kit		N/A						102972-03
24	Blower		101527-01	101528-01	101529-01	101530-01	101531-01		
25	Blower Inlet Shroud Assembly		101704-01	101704-02	101704-03	101704-04		101704-05	
26	Blower Outlet Gasket		101345-01						102614-01
27	Blower Mounting Plate		N/A						
28	Gas Valve		102975-01	102975-02	102975-04	102975-05	102975-06	102975-07	
29	Gas Valve Harness with Plug	MCBA Control	102971-02						
		Sage2.1 Control	102971-01						



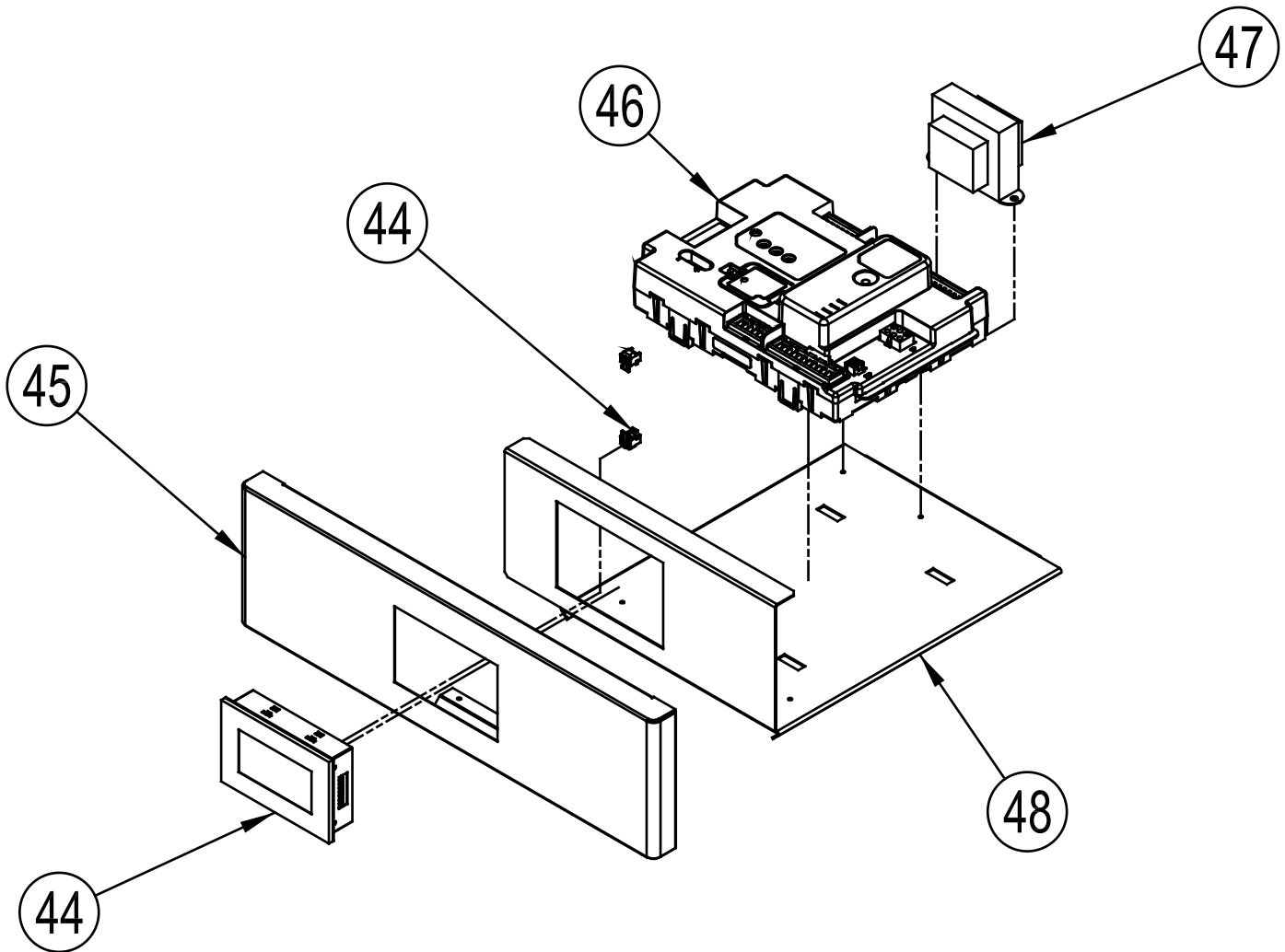
Key No.	Description	(Quantity) Part Number
		ALP500
100	Low Gas Pressure Switch	102702-01
101	Gas Pressure Switch Wire Harness	102704-01
102	High Gas Pressure Switch	102703-01
103	Dung's 90° Flange	102673-01

XV. Repair Parts (continued)



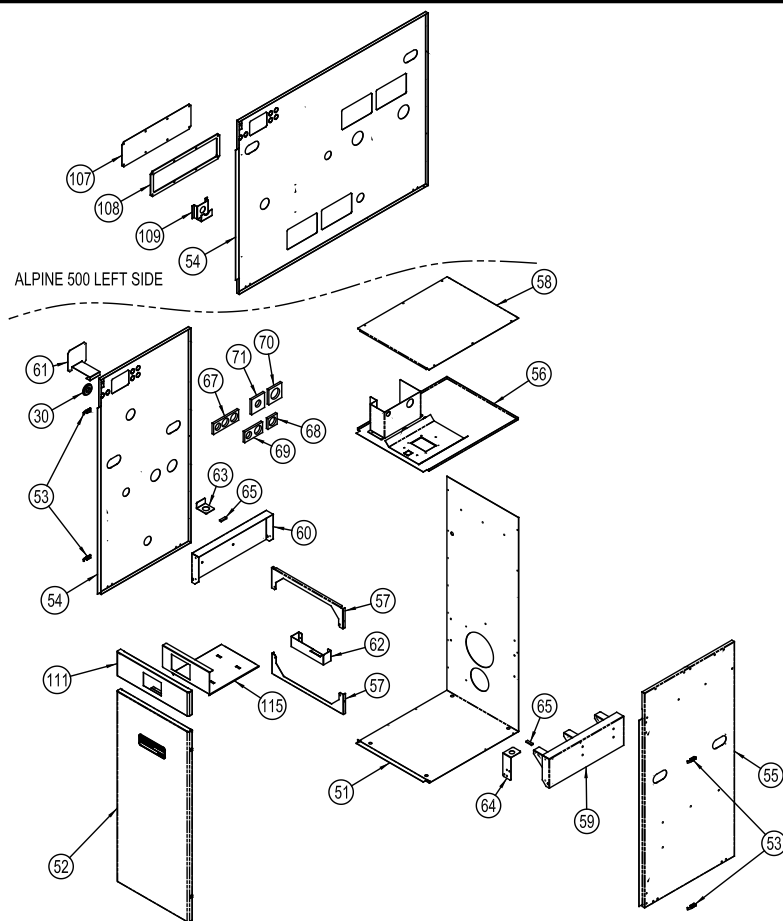
Key No.	Description	(Quantity) Part Number						
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500
35	Air Pressure Switch		80160762				101862-01	
36	Air Pressure Switch Hose		7016039				7016046	
37	Rubber Grommet, Condensate Trap				101595-01			
38	Condensate Trap, Blow Molded				101239-01			
39	Spring Clip, Condensate Trap				(2) 101632-01			
40	Blocked Condensate Drain Switch				101587-01			
41	Condensate Comp. Fitting				101546-01			
104	Hex Flange Nut, 10-32				101864-01			
105	Barbed Fitting, 1/8"				101863-01			
106	Silicone Tube, Gray, 7"				101865-01			

XV. Repair Parts (continued)



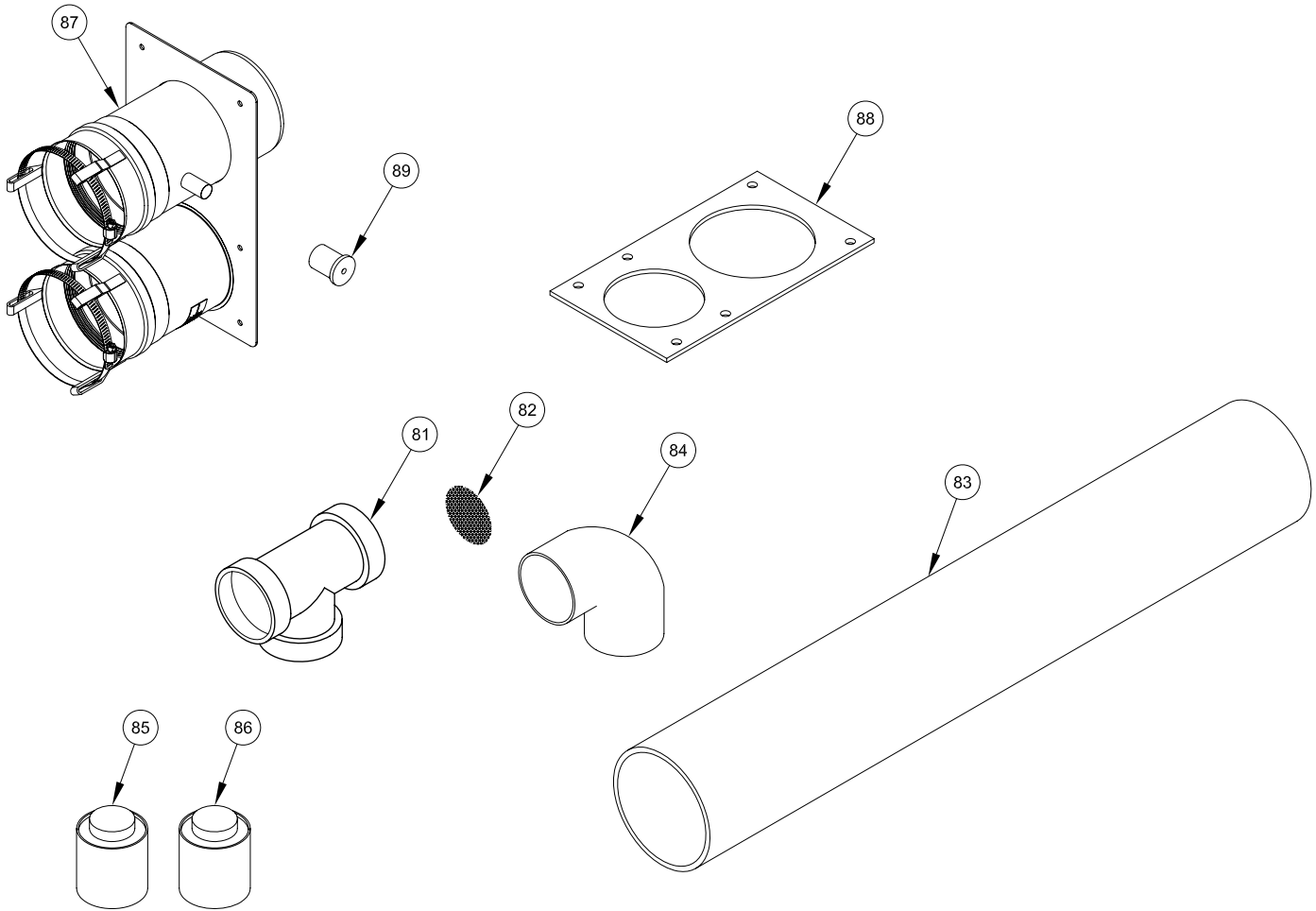
Key No.	Description	(Quantity) Part Number						
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500
42	Wiring Harness (Not Shown)	102701-01						
43A	Control Panel Assembly (Programmed - 0-2000' or 0-7000') (Includes all parts shown)	103142-01	103142-02	103142-03	103142-04	103142-05	103142-06	103142-07
43B	Control Panel Assembly (Programmed - 2000' or 7000') (Includes all parts shown)	103142-08	103142-09	103142-10	103142-11	N/A		
43C	Control Panel Assembly (Programmed - 7001' - 10,000') (includes all parts shown)	N/A		103067-03	103067-04	103067-05	N/A	
44	Programmed Display (with Mounting Hardware)	102726-02						
45	Jacket, Upper Front Panel	102778-01						
46	Sage2.1 (Programmed)	103141-01				103141-02	103141-03	103141-01
47	Sage2.1 Transformer	102516-01						
48	Control Panel, Sage2.1	102777-01						

XV. Repair Parts (continued)



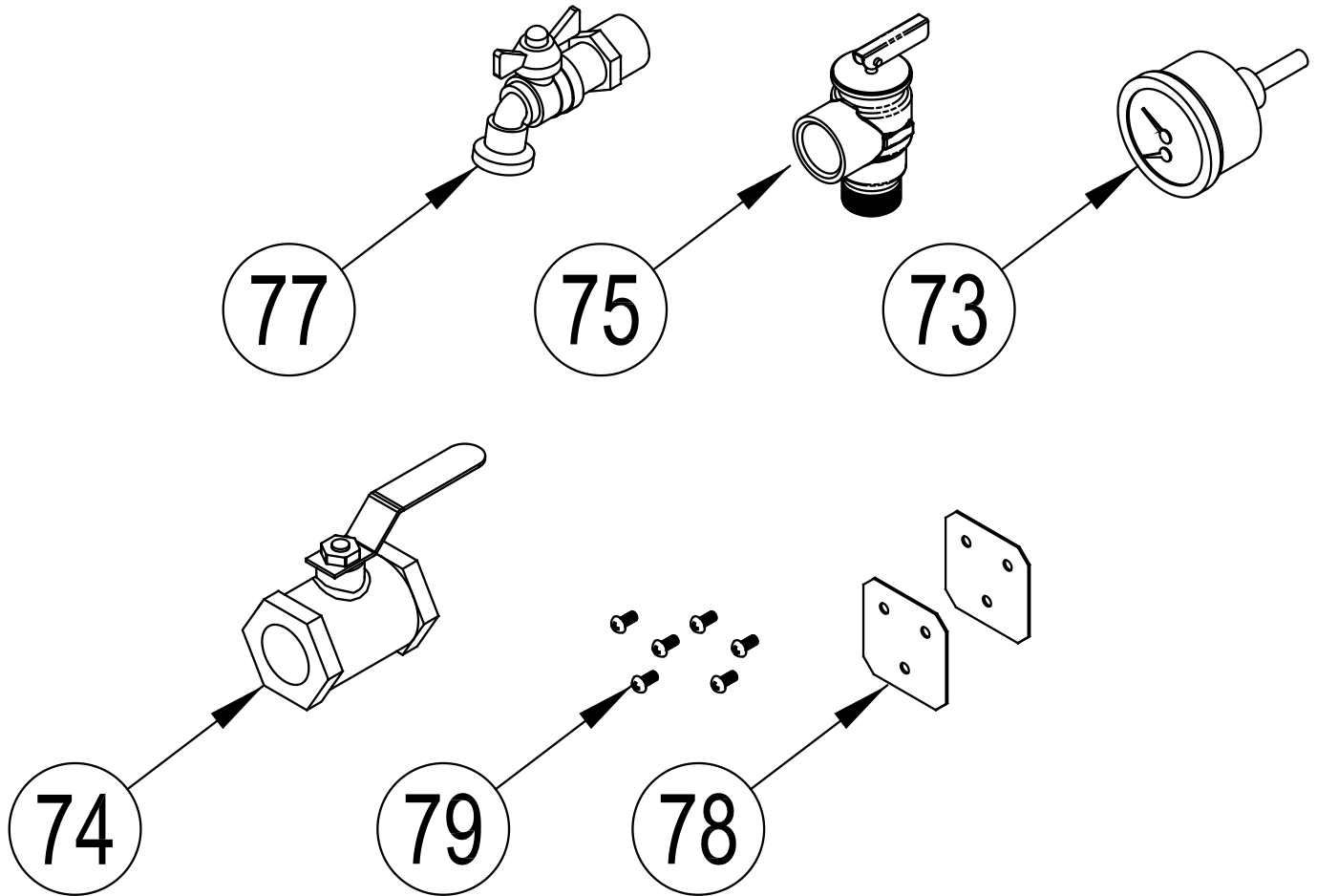
Key No.	Description	(Quantity) Part Number						
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500
30	Rubber Grommet, Gas Line	820SOL0001				101638-01		
51	Jacket, Rear/Bottom Panel	101217-01	101217-02	101217-03	101217-04	101764-01	101764-02	102608-01
52	Lower Front Door Assembly	101227-01				101227-02		101227-01
53	Draw Latch	101037-01						
54	Jacket, Left Side Panel	102776-01	102776-02	102776-03	102776-04	102776-05	102776-06	102776-07
55	Jacket, Right Side Panel	101216-01	101216-02	101216-03	101216-04	101766-01	101766-02	102610-01
56	Partition Shelf Assembly	102831-01	102831-02	102831-03	102831-04	102831-05	102831-06	102831-07
57	Jacket Support Bracket	(2) 101593-01						
58	Jacket, Top Panel	101218-01	101218-02	101218-03	101218-04	101218-05	101218-06	101218-07
59	Bracket Assembly, Right Side	101232-01	101232-02	101232-03	101232-04	101232-05	101232-06	101232-07
60	Side Bracket	101224-01	101224-02	101224-03	101224-04	101224-05	101224-06	101224-07
61	Bracket, High Voltage Terminal	102780-01						
62	Bracket, Rear HX Support	101381-01						
63	Bracket, Left Clip	101507-01				101507-02		
64	Bracket, Right Clip	101508-01						
65	Rubber Pad, Right Clip	101245-01						
66	Jacket, Upper Front Panel	101509-01						
67	Gasket, Header (All Three)	101240-01	N/A					
68	Gasket, Header, 1" NPT	N/A	101243-01			N/A		
69	Gasket, Header, 1" & 3/4" NPT	N/A	101252-01			N/A		
70	Gasket, Header, Duo Size	N/A				101372-02	101372-03	
71	Gasket, Header, Duo Size	N/A				101372-01		
107	Access Panel	N/A						
108	Gasket, Access Panel	N/A						
109	Bracket, Gas Train	N/A						

XV. Repair Parts (continued)



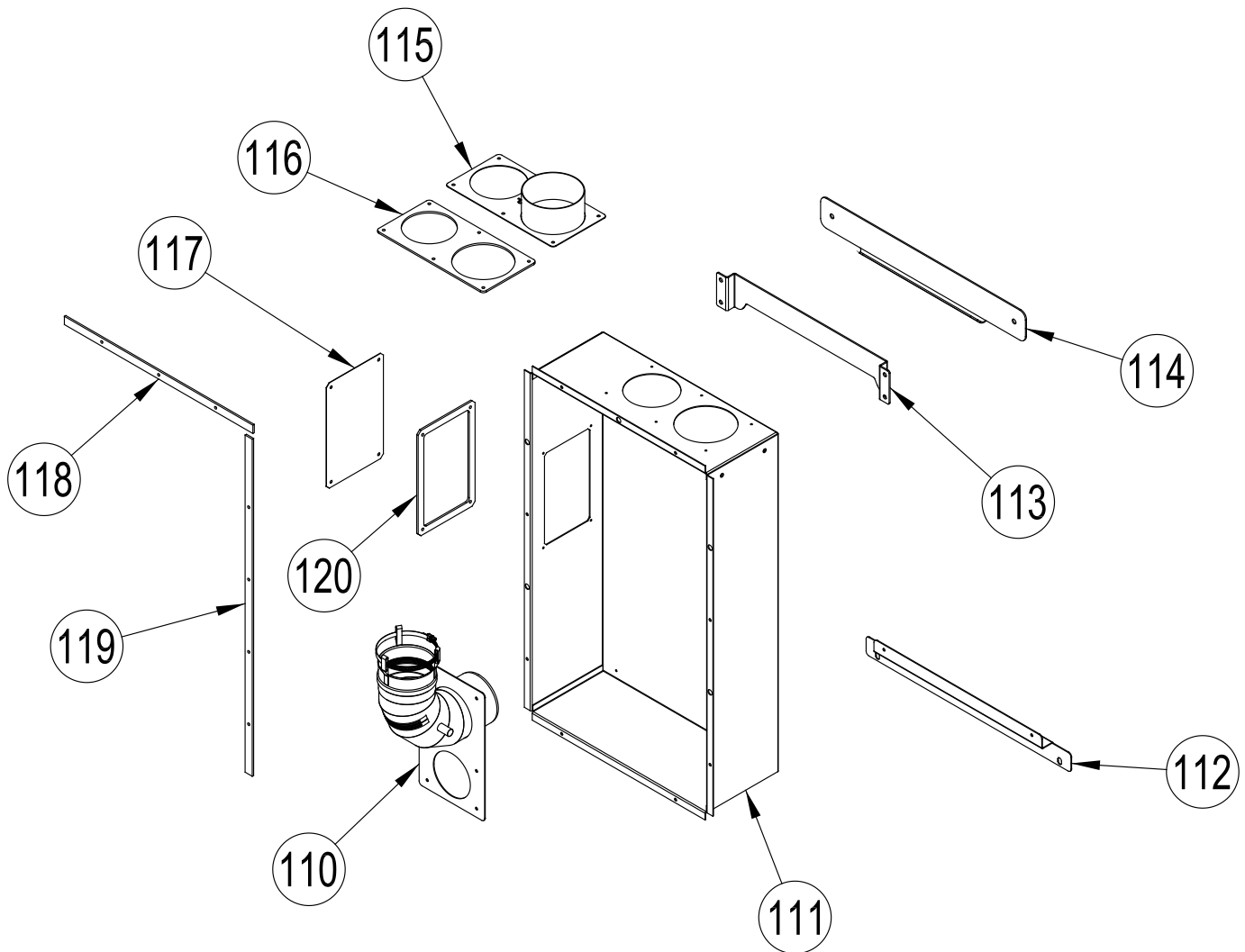
Key No.	Vent System Components	Part Number	Quantity		
			ALP080 & ALP105	ALP150 & ALP210	ALP285 thru ALP500
81	3" Schedule 40 PVC Tee Vent/Combustion Air Terminal	102190-01	2	1	---
	4" Schedule 40 PVC Tee Vent/Combustion Air Terminal	102190-02	---	1	2
82	3" Stainless Steel Rodent Screens	102191-01	2	1	---
	4" Stainless Steel Rodent Screens	102191-02	---	1	2
83	3" x 30" Schedule 40 CPVC Pipe	102193-01	1	1	---
	4" x 30" Schedule 40 CPVC Pipe	102193-02	---	---	1
84	3" Schedule 80 CPVC 90° Elbow	102192-01	1	1	---
	4" Schedule 80 CPVC 90° Elbow	102192-02	---	---	1
85	8 oz. Bottle of Transition Cement	102195-01	1	1	1
86	8 oz. Bottle of Primer	102194-01	1	1	1
87	3" x 3" CPVC/PVC Vent System Connector	102183-01	1	---	---
	3" x 4" CPVC/PVC Vent System Connector	102183-02	---	1	---
	4" x 4" CPVC/PVC Vent System Connector	102183-03	---	---	1
88	3" x 4" CPVC/PVC Vent System Connector Gasket	102185-01	1	1	---
	4" x 4" CPVC/PVC Vent System Connector Gasket	102185-02	---	---	1
89	Flue Temperature Sensor Cap	102153-01	1	1	1

XV. Repair Parts (continued)



Key No.	Description	(Quantity) Part Number					
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399
MISCELLANEOUS PARTS CARTON		102942-01			102942-02	102942-03	
73	Temperature/Pressure Gauge	100282-01					
74	External Gas Shut Off Valve	806SOL0005			101615-01		
75	Relief Valve	81660363				81660302	
77	Boiler Drain Valve	806603061					
78	Boiler Stacking Brackets	(2) 101679-01					
79	Boiler Stacking Bracket Screws	(8) 80860743					
80	Outdoor Temperature Sensor (Not Shown)	(1) 102946-01					

XV. Repair Parts (continued)



Key No.	Description	(Quantity) Part Number						
		ALP080	ALP105	ALP150	ALP210	ALP285	ALP399	ALP500
110	Vent Elbow w/Flue Sensor Port		102878-01				N/A	
111	Rear Air Box		102867-01				N/A	
112	Bottom Securing Bracket		102870-01				N/A	
113	Hanging Bracket, Boiler		102868-01				N/A	
114	Hanging Bracket, Wall		102869-01				N/A	
115	Air Collar Plate Assembly		102871-01				N/A	
116	Air Collar Plate Gasket		102876-01				N/A	
117	Access Panel, Rear Air Box		102873-01				N/A	
118	Horizontal Strip Gasket		(2) 102875-01				N/A	
119	Vertical Strip Gasket		(2) 102874-01				N/A	
120	Access Panel Gasket		102877-01				N/A	
	1/4-20 x 5/8 Hex Head Cap Screw (Not Shown)		(4) 80861312				N/A	
	1/4-20 Hex Nut w/Lock (Not Shown)		(4) 80860456				N/A	
	Sheet Metal Screw, #8 x 1/2", Black Oxide (Not Shown)		(18) 80860061				N/A	
	3" Female x 4" Female Vent Pipe Reducer (Not Shown)	(1)	103008-01				N/A	

Important Product Safety Information **Refractory Ceramic Fiber Product**

Warning:

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures about 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
 - Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

First Aid Procedures:

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

Appendix A - Figures

Figure Number	Page Number	Description
Section I - Product Description, Specifications & Dimensional Data		
Figure 1A	7	Models ALP080 thru ALP210 (Floor Mounted)
Figure 1B	8	Models ALP080 thru ALP210 (Wall Mounted)
Figure 1C	9	Models ALP285 thru ALP399 (Floor Mounted Only)
Figure 1D	10	Model ALP500 (Floor Mounted Only)
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Figure 2A	15	Clearances To Combustible and Non-combustible Material, Floor Standing
Figure 2B	15	Clearances To Combustible and Non-combustible Material, Wall Mounted
Figure 2C	16	Wall Mounting Hole Location / Layout
Figure 2D	17	Bottom Mounting Bracket Installation / Boiler Wall Mounting
Figure 2E	17	Access Panel & Gasket Installation
Section IV - Venting		
Figure 3	19	Location of Vent Terminal Relative to Windows, Doors, Grades, Overhangs, Meters and Forced Air Inlets (Concentric Terminal Shown - Two-Pipe System Vent Terminal to be installed in same location Two-Pipe System Air Intake Terminal Not Shown)
Figure 4	23	Expansion Loop and Offset
Figure 5	23	Field Installation of CPVC/PVC Two-Pipe Vent System Connector - Floor Mounted Boiler Builds
Figure 6A	24	Near-Boiler Vent/Combustion Air Piping - Floor Mounted Boiler Builds
Figure 6B	25	Field Installation of CPVC Vent Pipe - Wall Mounted Boiler Builds
Figure 7	25	CPVC/PVC Vent Pipe Thru Combustible Wall Installation
Figure 8	26	Direct Vent - Sidewall
Figure 9	26	Rodent Screen Installation
Figure 10	27	Direct Vent - Optional Sidewall Snorkel Terminations
Figure 11	27	Direct Vent - Vertical Terminations
Figure 12	28	Direct Vent - Vertical Terminations w/ Sloped Roof
Figure 13	29	Field Installation of Two-Pipe Vent System Adapter for Stainless Steel
Figure 14	32	Field Installation of Boiler Concentric Vent Collar
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Limited Warranty

For Residential Grade Water and Steam Boilers

Using Cast Iron, Carbon Steel, Cast Aluminum,
or Stainless Steel Heat Exchangers
and Parts/Accessories

Subject to the terms and conditions set forth below, U.S. Boiler Company, Inc. Lancaster, Pennsylvania hereby extends the following limited warranties to the original owner of a residential grade water or steam boiler or U.S. Boiler Company, Inc. supplied parts and/or accessories manufactured and shipped on or after July 1, 2008:

ONE YEAR LIMITED WARRANTY ON RESIDENTIAL GRADE BOILERS AND PARTS / ACCESSORIES SUPPLIED BY U.S. BOILER COMPANY, INC.

U.S. Boiler Company, Inc. warrants to the original owner that its residential grade water and steam boilers and parts/accessories comply at the time of manufacture with recognized hydronic industry standards and requirements then in effect and will be free of defects in material and workmanship under normal usage for a period of one year from the date of original installation. If any part of a residential grade boiler or any part or accessory provided by U.S. Boiler Company, Inc. is found to be defective in material or workmanship during this one year period, U.S. Boiler Company, Inc. will, at its option, repair or replace the defective part.

HEAT EXCHANGER WARRANTIES

U.S. Boiler Company, Inc. warrants to the original owner that the heat exchanger of its residential grade boilers will remain free from defects in material and workmanship under normal usage for time period specified in the chart below of the original owner at the original place of installation. If a claim is made under this warranty during the "No Charge" period from the date of original installation, U.S. Boiler Company, Inc. will, at its option, repair or replace the heat exchanger. If a claim is made under this warranty after the expiration of the "No Charge" period from the date of original installation, U.S. Boiler Company, Inc. will, at its option and upon payment of the pro-rated service charge set forth below, repair or replace the heat exchanger. The service charge applicable to a heat exchanger warranty claim is based upon the number of years the heat exchanger has been in service and will be determined as a percentage of the retail price of the heat exchanger model involved at the time the warranty claim is made as follows:

Years in Service	Service Charge as a % of Retail Price																													
	1-5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+									
Cast Iron Water	No Charge					5	10	15	20	25	30	35	40	45	50	55	60	65	70	75										
Cast Iron Steam*	No Charge					100																								
Carbon Steel	No Charge					5	10	15	20	25	30	35	40	45	50	55	60	65	70	75										
Cast Aluminum	No Charge					30	40	50	60	70	100																			
Stainless Steel	No Charge					30	40	50	60	70	100																			

NOTE: If the heat exchanger involved is no longer available due to product obsolescence or redesign, the value used to establish the retail price will be the published price as shown in the Burnham® Products Repair Parts Pricing where the heat exchanger last appeared or the current retail price of the then nearest equivalent heat exchanger.

***Burnham® MegaSteam™ Waterside Corrosion Warranty:** U.S. Boiler Company, Inc. warrants the cast iron sections of the Burnham® MegaSteam™ boiler to resist Temperature Induced Chloride Activated Graphitic Corrosion for a period of five years from the date of original installation. In the event that any cast iron section of a Burnham® MegaSteam™ boiler fails due to this corrosion mechanism during this period, U.S. Boiler Company, Inc. will repair or replace, at its option, the cast iron section assembly.

LIFETIME NIPPLE LEAKAGE WARRANTY

U.S. Boiler Company, Inc. warrants the cast iron and steel nipples that join the cast iron boiler sections to be free of defects in material and workmanship for the lifetime of the original owner at the original place of installation. In the event that such nipples are found to be defective in material and workmanship during this period, U.S. Boiler Company, Inc. will repair or replace at its option, the cast iron section assembly.

ADDITIONAL TERMS AND CONDITIONS

1. **Applicability:** The limited warranties set forth above are extended only to the original owner at the original place of installation within the United States and Canada. These warranties are applicable only to boilers, parts, or accessories designated as residential grade by U.S. Boiler Company, Inc. and installed in a single or two-family residence and do not apply to commercial grade products.
2. **Components Manufactured by Others:** Upon expiration of the one year limited warranty on residential grade boilers, all boiler components manufactured by others but furnished by U.S. Boiler Company, Inc. (such as oil burner, circulator and controls) will be subject only to the manufacturer's warranty, if any.
3. **Proper Installation:** The warranties extended by U.S. Boiler Company, Inc. are conditioned upon the installation of the residential grade boiler, parts, and accessories in strict compliance with U.S. Boiler Company, Inc. installation instructions. U.S. Boiler Company, Inc. specifically disclaims liability of any kind caused by or relating to improper installation.
4. **Proper Use and Maintenance:** The warranties extended by U.S. Boiler Company, Inc. are conditioned upon the use of the residential grade boiler, parts, and accessories for its intended purposes and its maintenance accordance with U.S. Boiler Company, Inc. recommendations and hydronics industry standards. For proper installation, use, and maintenance, see all applicable sections of the Installation and Operating, and Service Instructions Manual furnished with the unit.
5. This warranty does not cover the following:
 - a. Expenses for removal or reinstallation. The homeowner will be responsible for the cost of removing and reinstalling the alleged defective part or its replacement and all labor and material connected therewith, and transportation to and from U.S. Boiler Company, Inc.
 - b. Components that are part of the heating system but were not furnished by U.S. Boiler Company, Inc. as part of the residential boiler.
 - c. Improper burner adjustment, control settings, care or maintenance.

- d. This warranty cannot be considered as a guarantee of workmanship of an installer connected with the installation of the U.S. Boiler Company, Inc. boiler, or as imposing on U.S. Boiler Company, Inc. liability of any nature for unsatisfactory performance as a result of faulty workmanship in the installation, which liability is expressly disclaimed.
 - e. Boilers, parts, or accessories installed outside the 48 contiguous United States, the State of Alaska and Canada.
 - f. Damage to the boiler and/or property due to installation or operation of the boiler that is not in accordance with the boiler installation and operating instruction manual.
 - g. Any damage or failure of the boiler resulting from hard water or scale buildup in the heat exchanger.
 - h. Any damage caused by improper fuels, fuel additives or contaminated combustion air that may cause fireside corrosion and/or clogging of the burner or heat exchanger.
 - i. Any damage resulting from combustion air contaminated with particulate which cause clogging of the burner or combustion chamber including but not limited to sheetrock or plasterboard particles, dirt, and dust particulate.
 - j. Any damage, defects or malfunctions resulting from improper operation, maintenance, misuse, abuse, accident, negligence including but not limited to operation with insufficient water flow, improper water level, improper water chemistry, or damage from freezing.
 - k. Any damage caused by water side clogging due to dirty systems or corrosion products from the system.
 - l. Any damage resulting from natural disaster.
 - m. Damage or malfunction due to the lack of required maintenance outlined in the Installation and Operating Manual furnished with the unit.
6. **Exclusive Remedy:** U.S. Boiler Company, Inc. obligation for any breach of these warranties is limited to the repair or replacement of its parts in accordance with the terms and conditions of these warranties.
 7. **Limitation of Damages:** Under no circumstances shall U.S. Boiler Company, Inc. be liable for incidental, indirect, special or consequential damages of any kind whatsoever under these warranties, including, but not limited to, injury or damage to persons or property and damages for loss of use, inconvenience or loss of time. U.S. Boiler Company, Inc. liability under these warranties shall under no circumstances exceed the purchase price paid by the owner for the residential grade boiler involved. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.
 8. **Limitation of Warranties:** These warranties set forth the entire obligation of U.S. Boiler Company, Inc. with respect to any defect in a residential grade boiler, parts, or accessories and U.S. Boiler Company, Inc. shall have no express obligations, responsibilities or liabilities of any kind whatsoever other than those set forth herein. These warranties are given in lieu of all other express warranties.

ALL APPLICABLE IMPLIED WARRANTIES, IF ANY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED IN DURATION TO A PERIOD OF ONE YEAR EXCEPT THAT IMPLIED WARRANTIES, IF ANY, APPLICABLE TO THE HEAT EXCHANGER IN A RESIDENTIAL GRADE BOILER SHALL EXTEND TO THE ORIGINAL OWNER FOR THE TIME SPECIFIED IN THE HEAT EXCHANGER SECTION SHOWN ABOVE AT THE ORIGINAL PLACE OF INSTALLATION. SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PROCEDURE FOR OBTAINING WARRANTY SERVICE

In order to assure prompt warranty service, the owner is requested to complete and mail the Warranty Card provided with the product or register product online at www.usboiler.burnham.com within ten days after the installation of the boiler, although failure to comply with this request will not void the owner's rights under these warranties. Upon discovery of a condition believed to be related to a defect in material or workmanship covered by these warranties, the owner should notify the installer, who will in turn notify the distributor. If this action is not possible or does not produce a prompt response, the owner should write to U.S. Boiler Company, Inc., Attn: Customer Service, P.O. Box 3020, Lancaster, PA 17604, giving full particulars in support of the claim. The owner is required to make available for inspection by U.S. Boiler Company, Inc. or its representative the parts claimed to be defective and, if requested by U.S. Boiler Company, Inc. to ship these parts prepaid to U.S. Boiler Company, Inc. at the above address for inspection or repair. In addition, the owner agrees to make all reasonable efforts to settle any disagreement arising in connection with a claim before resorting to legal remedies in the courts.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.



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