



Installation & Operation Manual
Models: 400 - 801



WARNING

This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual and the Knight XL Service Manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.



Save this manual for future reference.

Contents

HAZARD DEFINITIONS	2	6. HYDRONIC PIPING	
PLEASE READ BEFORE PROCEEDING	3	System Water Piping Methods.....	36
THE KNIGHT XL -- HOW IT WORKS	4-6	Low Water Cutoff Device	36
RATINGS	7	Chilled Water System.....	36
1. DETERMINE BOILER LOCATION		Freeze Protection.....	36
Provide Air Openings to Room	10	General Piping Information	36
Flooring and Foundation	10	Flow Switch and Relief Valve Installation	37
Residential Garage Installation	10	Flow Switch Adjustment.....	38
Vent and Air Piping	10	Near Boiler Piping Components.....	38-39
Prevent Combustion Air Contamination.....	10	Circulator Sizing	39
Corrosive Contaminants and Sources	11	Near Boiler Piping Connections	39
Using an Existing Vent System to Install a New Boiler ...	11	7. GAS CONNECTIONS	
Removing a Boiler from Existing Common Vent.....	12	Connecting Gas Supply Piping	46
2. PREPARE BOILER		Natural Gas	47
Remove Boiler from Wood Pallet.....	13	Pipe Sizing for Natural Gas	47
Gas Conversions.....	13	Natural Gas Supply Pressure Requirements	47
Model 400	13	Propane Gas	47
Model 501	14	Pipe Sizing for Propane Gas	47
Models 601 - 801	14	Propane Supply Pressure Requirements	47
Leveling the Boiler.....	14	Check Inlet Gas Supply	48
3. GENERAL VENTING		Gas Pressure	49
Direct Venting Options	15	Gas Valve Replacement	49
Install Vent and Combustion Air Piping	16	8. FIELD WIRING	
Requirements for Installation in Canada.....	17	Line Voltage Connections	50
Sizing	17	Low Voltage Connections	50
Min./Max. Combustion Air & Vent Piping Lengths	17	Wiring of the Cascade.....	52
Materials.....	18	9. CONDENSATE DISPOSAL	
Optional Room Air.....	19	Condensate Drain	54
PVC/CPVC	19-20	10. STARTUP	55-60
Polypropylene.....	21	11. OPERATING INFORMATION	
Stainless Steel Vent.....	22	General.....	61
4. SIDEWALL DIRECT VENTING		Cascade	64
Vent/Air Termination - Sidewall.....	23-26	Sequence of Operation	65-66
Determine Location.....	23-25	Knight XL Control Module	67-68
Prepare Wall Penetrations.....	25-26	Status Display Screens.....	69-71
Multiple Vent/Air Terminations	26	12. MAINTENANCE	
Sidewall Termination - Optional Concentric Vent	27-29	Maintenance and Annual Startup.....	72-76
5. VERTICAL DIRECT VENTING		13. DIAGRAMS	
Vent/Air Termination - Vertical	30-31	Wiring Diagram.....	77
Determine Location.....	30	Ladder Diagram.....	78
Prepare Roof Penetrations	31	Revision Notes	Back Cover
Multiple Vent/Air Terminations	31		
Vertical Termination - Optional Concentric Vent.....	32-33		
Alternate Vertical Concentric Venting	34-35		

Hazard definitions

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

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠ WARNING

Installer – Read all instructions, including this manual and the Knight XL Service Manual, before installing. Perform steps in the order given.

User – This manual is for use only by a qualified heating installer/service technician. Refer to the User's Information Manual for your reference.

Have this boiler serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE

When calling or writing about the boiler – Please have the boiler model and serial number from the boiler rating plate.

Consider piping and installation when determining boiler location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING

Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

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

This appliance **MUST NOT** be installed in any location where gasoline or flammable vapors are likely to be present.

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 near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

When servicing boiler –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.

Boiler operation –

- Do not block flow of combustion or ventilation air to the boiler.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Boiler water –

- Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure. Addition of oxygen carried in by makeup water can cause internal corrosion in system components. Leaks in boiler or piping must be repaired at once to prevent makeup water.

⚠ CAUTION

Do not use petroleum-based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.

⚠ CAUTION

Do not use “homemade cures” or “boiler patent medicines”. Serious damage to the boiler, personnel, and/or property may result.

Freeze protection fluids –

- NEVER use automotive antifreeze. Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

The Knight XL - How it works...

1. **Stainless steel heat exchanger**

Allows system water to flow through specially designed coils for maximum heat transfer, while providing protection against flue gas corrosion. The coils are encased in a jacket that contains the combustion process.

2. **Combustion chamber access cover**

Allows access to the combustion side of the heat exchanger coils.

3. **Blower**

The blower pulls in air and gas through the venturi (item 5). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.

4. **Gas valve**

The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.

5. **Venturi**

The venturi controls air and gas flow into the burner.

6. **Flue gas sensor (limit rated)**

This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the boiler if the flue gas temperature gets too hot. This protects the flue pipe from overheating.

7. **Boiler outlet temperature sensor (housed with the high limit sensor)**

This sensor monitors boiler outlet water temperature (system supply). If selected as the controlling sensor, the control module adjusts boiler firing rate so the outlet temperature is correct.

8. **Boiler inlet temperature sensor**

This sensor monitors return water temperature (system return). If selected as the controlling sensor, the control module adjusts the boiler firing rate so the inlet temperature is correct.

9. **Temperature and pressure gauge (field installed, not shown)**

Monitors the outlet temperature of the boiler as well as the system water pressure.

10. **Electronic LCD display**

The electronic display consists of 4 buttons, a navigation dial and a multiple line liquid crystal display.

11. **Flue pipe adapter**

Allows for the connection of the PVC vent pipe system to the boiler.

12. **Burner (not shown)**

Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a wide range of firing rates.

13. **Water outlet (system supply)**

A 1-1/2" or 2" NPT (depending on the model) water connection that supplies hot water to the system.

14. **Water inlet (system return)**

A 1-1/2" or 2" NPT (depending on the model) water connection that returns water from the system to the heat exchanger.

15. **Gas connection pipe**

Threaded pipe connection of 1". This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the boiler.

16. **SMART SYSTEM Control Module**

The SMART SYSTEM Control responds to internal and external signals and controls the blower, gas valve, and pumps to meet the heating demand.

17. **Manual air vent**

Designed to remove trapped air from the heat exchanger coils.

18. **Air intake adapter**

Allows for the connection of the PVC air intake pipe to the boiler.

19. **High voltage junction box**

The junction box contains the connection points for the line voltage power and all pumps.

20. **Boiler drain port**

Location from which the heat exchanger can be drained.

21. **Low voltage connection board**

The connection board is used to connect external low voltage devices.

22. **Low voltage wiring connections (knockouts)**

Conduit connection points for the low voltage connection board.

23. **Condensate drain connection**

Connects the condensate drain line to a 1/2" PVC union.

24. **Access cover - front**

Provides access to the gas train and the heat exchanger.

25. **Ignition electrode**

Provides direct spark for igniting the burner.

26. **Flame inspection window**

The quartz glass window provides a view of the burner surface and flame.

27. **Gas shutoff valve (Models 501 - 801 only)**

Manual valve used to isolate the gas valve from the gas supply.

28. **Relief valve**

Protects the heat exchanger from an over pressure condition. The relief valve provided with the unit is set at 50 PSI.

29. **Flame sensor**

Used by the control module to detect the presence of burner flame.

30. **Line voltage wiring connections (knockouts)**

Conduit connection points for the high voltage junction box.

31. **Top panel**

Removable panel to gain access to the internal components.

32. **Power switch**

Turns 120 VAC ON/OFF to the boiler.

33. **Leveling legs**

Used to allow the heat exchanger to be leveled. This is needed for the proper draining of the condensate from the combustion chamber.

34. **Air shroud (Model 501 only)**

The air shroud controls air and gas flow into the burner.

35. **Air pressure switch**

The air pressure switch detects blocked flue/inlet conditions, break the control circuit, shutting the boiler down.

36. **Pump relay board**

The pump relay board is used to connect the boiler, system and DHW pumps.

37. **Transformer**

The transformer provides 24V power to the integrated control.

38. **High limit sensor (housed with the outlet temperature sensor)**

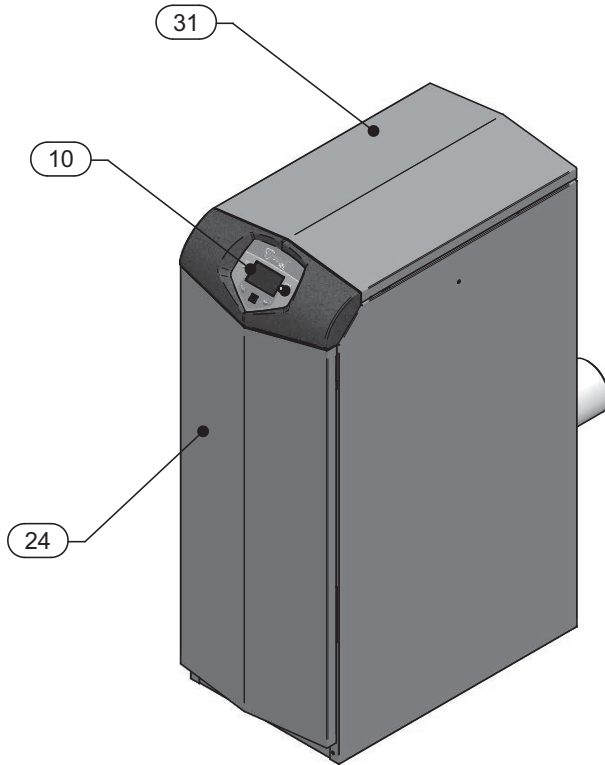
Device that monitors the outlet water temperature. If the temperature exceeds its setting, the integrated control will break the control circuit, shutting the boiler down.

39. **Over-temp switch (located underneath access cover)**

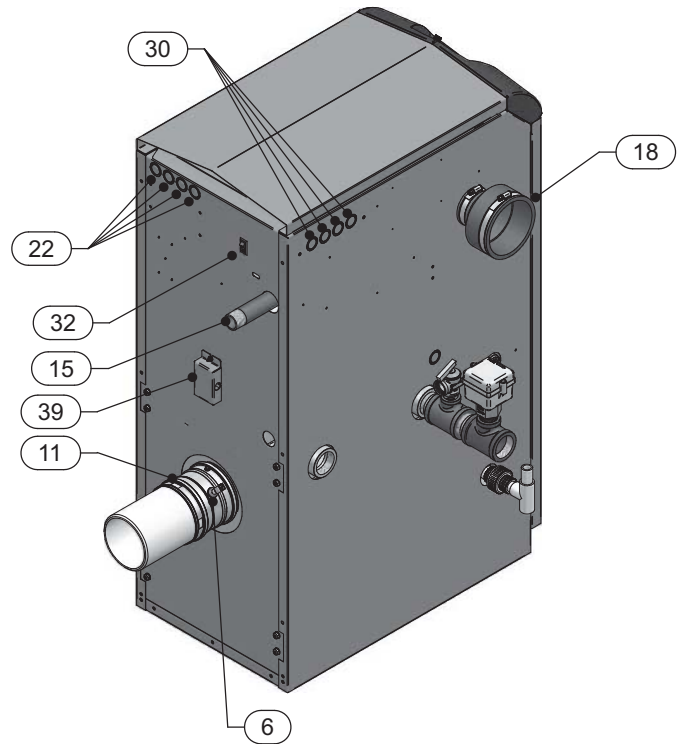
An electrical switch designed to shut down boiler operation in the event the outer back of the heat exchanger, directly above the flue connection exceeds 604°F (318°C). This is a one time switch and could warrant a heat exchanger replacement. Check the integrity of the rear refractory at the back of the upper coil if the switch opens.

The Knight XL - How it works... (continued)

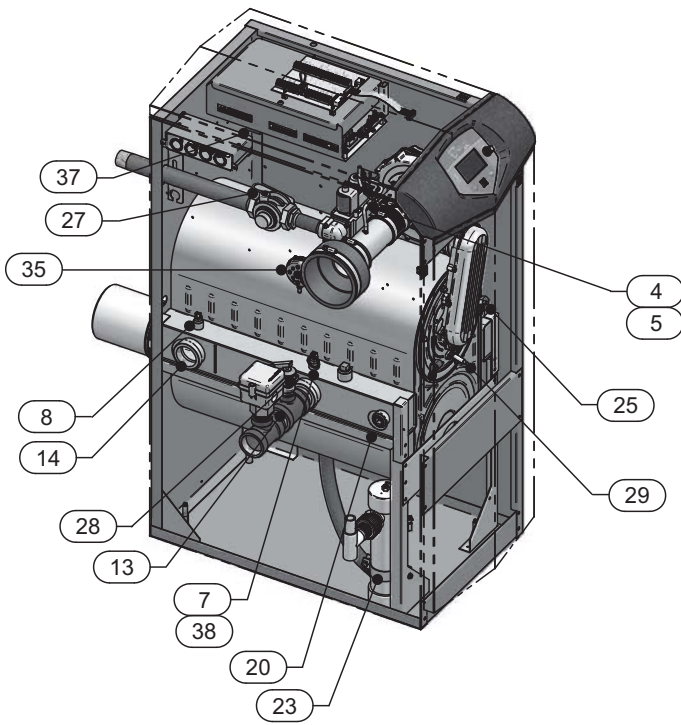
Model 400



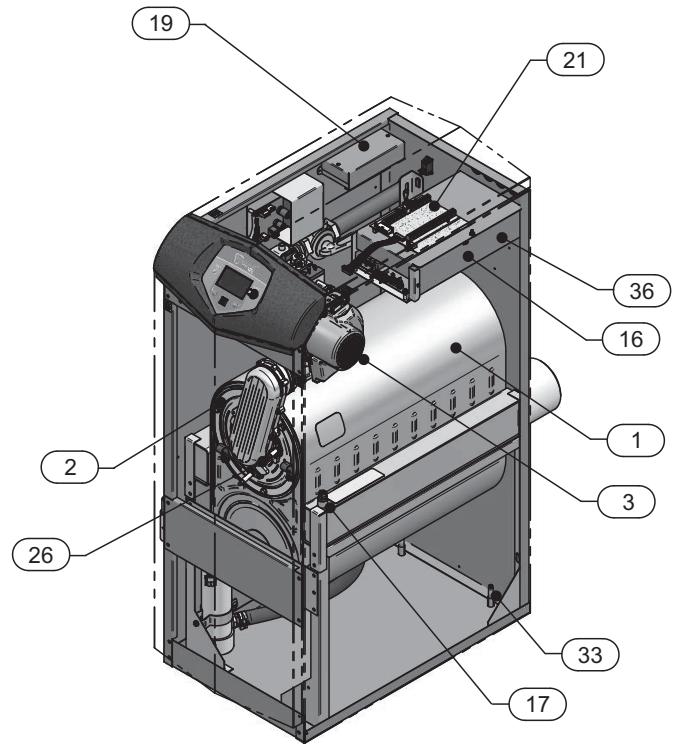
Front View - Model 400



Rear View - Model 400



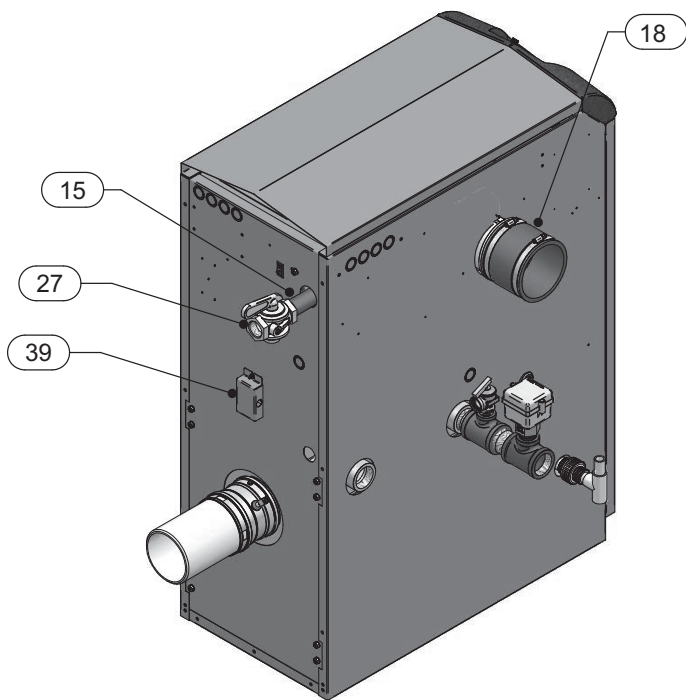
Left Side (inside unit) - Model 400



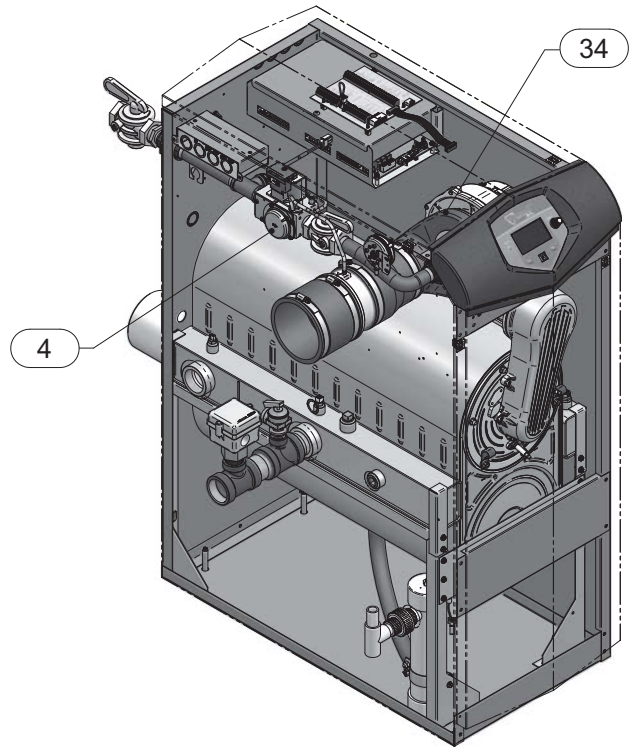
Right Side (inside unit) - Model 400

The Knight XL - How it works...

Model 501

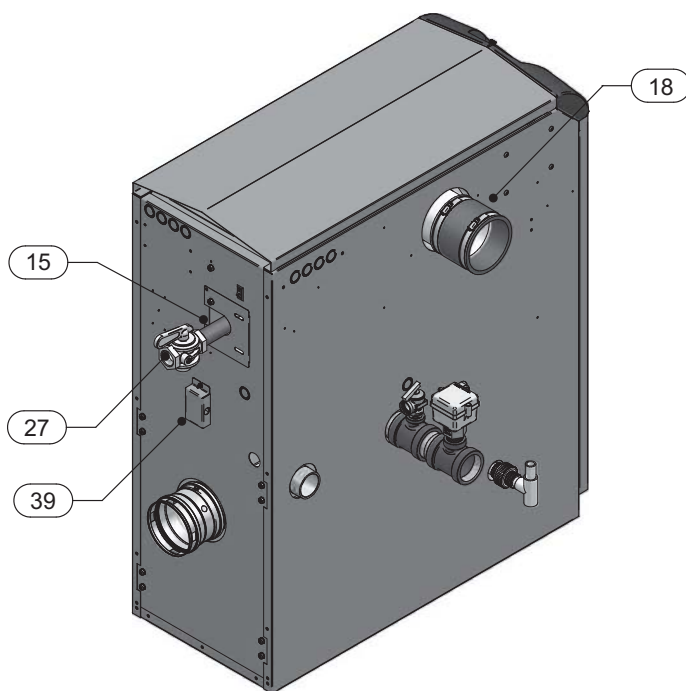


Rear View - Model 501

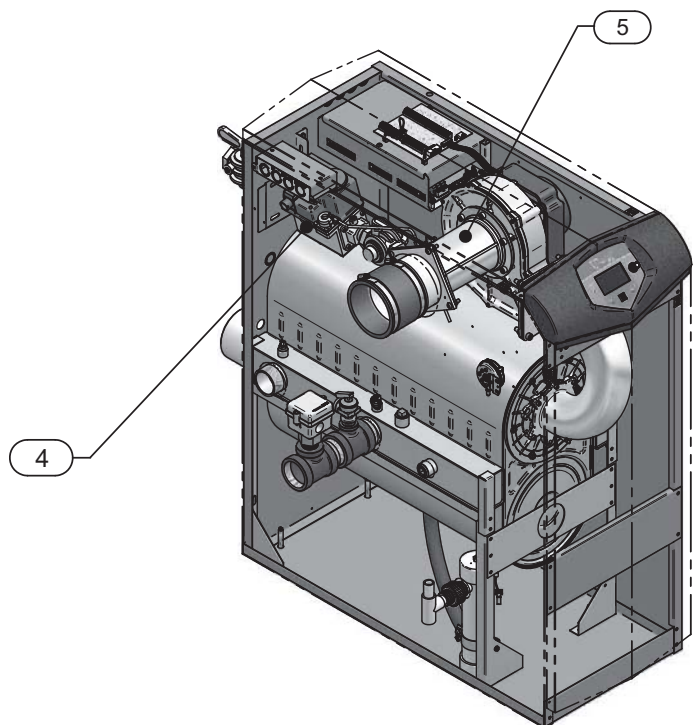


Left Side (inside unit) - Model 501

Models 601 - 801



Rear View - Models 601 - 801



Left Side (inside unit) - Models 601 - 801

Ratings


DOE

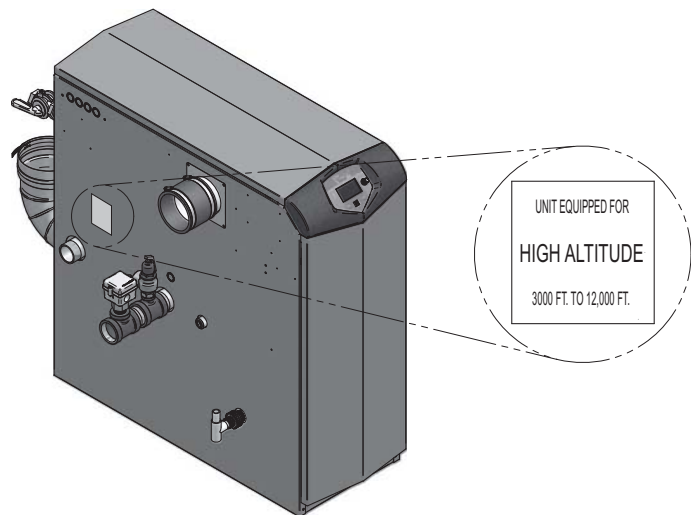
Knight XL Boiler AHRI Rating					Other Specifications				
Model Number Note: Change "N" to "L" for L.P. gas models.	Input MBH (Note 4)		Gross Output MBH (Note 1)	Net AHRI Ratings Water, MBH (Note 2)	Boiler Water Content Gallons	Water Connections	Gas Connections	Air Size	Vent Size (Note 3)
	Min	Max							
KBN400	80	399	373	324	3.4	1-1/2"	1"	4"	4"
KBN501	100	500	467	406	4.2	1-1/2"	1"	4"	4"
KBN601	120	600	567	493	4.2	2"	1"	4"	4"
KBN701	140	700	660	574	5.0	2"	1"	4"	6"
KBN801	160	800	752	654	5.7	2"	1"	4"	6"

NOTICE

Maximum allowed working pressure is located on the rating plate.

Notes:

- The ratings are based on standard test procedures prescribed by the United States Department of Energy.
- Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pickup. Ratings are based on a piping and pickup allowance of 1.15.
- Knight XL boilers require special gas venting. Use only the vent materials and methods specified in the Knight XL Installation and Operation Manual.
- Standard Knight XL boilers are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The boiler will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
- High altitude Knight XL boilers are equipped to operate from 3,000 to 12,000 feet **only** with no field adjustments. The boiler will de-rate by 2% for each 1,000 feet above 3,000 feet. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard boilers. A high altitude label (as shown in FIG. A) is also affixed to the unit.
- Ratings have been confirmed by the Hydronics Section of AHRI.
- Knight XL boilers comply with the requirements of CSD-1 Section CW-400 requirements as a temperature operation control. The manual reset high limit provided with the Knight XL is listed to UL353.


Figure A High Altitude Label Location

1 Determine boiler location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE

The Knight XL gas manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13 – latest edition.

Before locating the boiler, check:

1. Check for nearby connection to:
 - System water piping
 - Venting connections
 - Gas supply piping
 - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the boiler. Remove any combustible materials, gasoline and other flammable liquids.

WARNING

Failure to keep boiler area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Knight XL must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
5. If a new boiler will replace an existing boiler, check for and correct system problems, such as:
 - System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
 - Incorrectly-sized expansion tank.
 - Lack of freeze protection in boiler water causing system and boiler to freeze and leak.

WARNING

This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

WARNING

This appliance requires a special venting system. The vent connection to the appliance must be made with the starter CPVC/stainless steel pipe section provided with the appliance. The field provided PVC vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closest and alcove installations

A closet is any room the boiler is installed in which is less than 171 cubic feet for KBN400 models, 193 cubic feet for KBN501 models, 223 cubic feet for KBN601 models, 247 cubic feet for KBN701 models and 278 cubic feet for KBN801 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 5 feet long, 4 feet wide, and 8 foot ceiling = 5 x 4 x 8 = 160 cubic feet. This would be considered a closet for a Knight XL Boiler.

WARNING

For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC or stainless steel vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

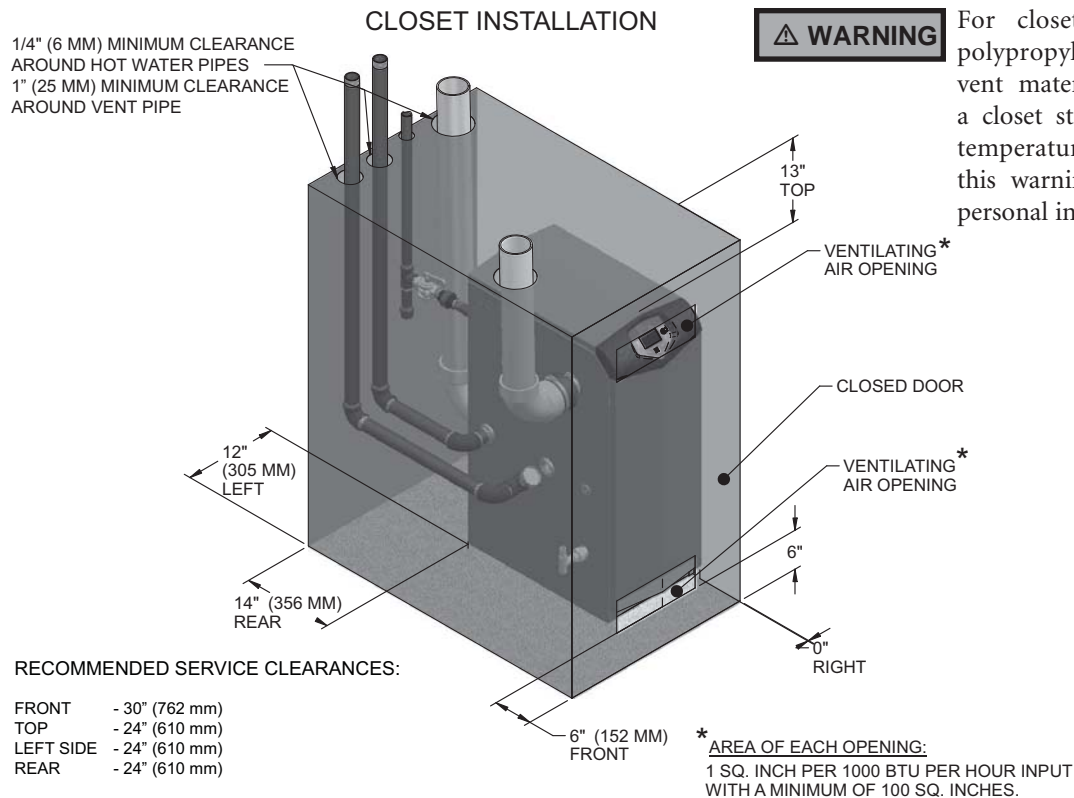
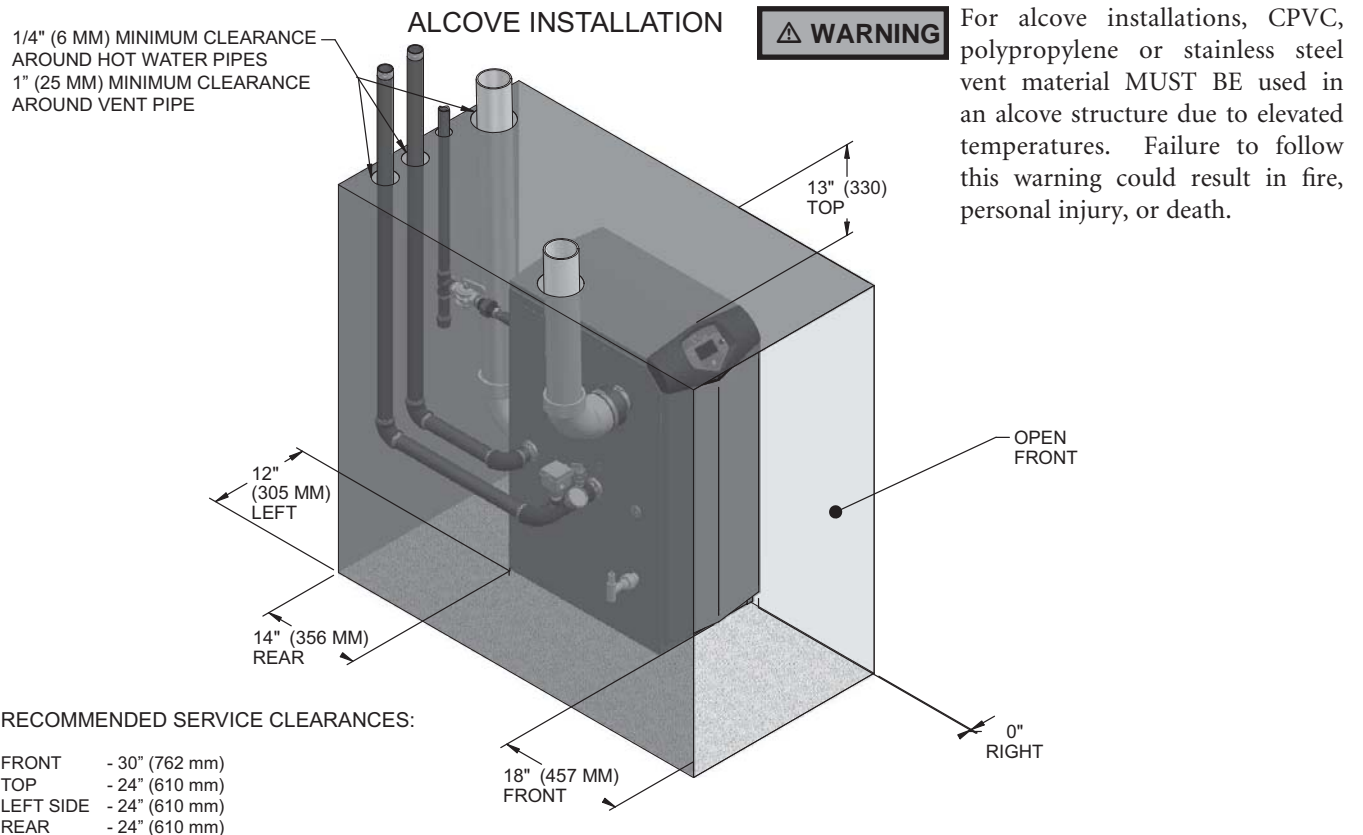
Clearances from combustible materials

1. Hot water pipes—at least 1/4" (6 mm) from combustible materials.
2. Vent pipe – at least 1" (25 mm) from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 9 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 9 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the boiler without removing it from the space.

1 Determine boiler location *(continued)*

Figure 1-1 Closet Installation - Minimum Required Clearances

Figure 1-2 Alcove Installation - Minimum Required Clearances


1 Determine boiler location

Provide air openings to room:

Knight XL alone in boiler room

1. No air ventilation openings into the boiler room are needed when clearances around the Knight XL are at least equal to the SERVICE clearances shown in FIG.'s 1-1 and 1-2. For spaces that do NOT supply this clearance, provide two openings as shown in FIG. 1-1. Each opening must provide one square inch free area per 1,000 Btu/hr of boiler input.

Knight XL in same space with other gas or oil-fired appliances

1. Follow the National Fuel Gas Code (U.S.) or CSA B149.1 (Canada) to size/verify size of the combustion/ventilation air openings into the space.

⚠ WARNING

The space must be provided with combustion/ventilation air openings correctly sized for all other appliances located in the same space as the Knight XL.

Do not install the boiler in an attic.

Failure to comply with the above warnings could result in severe personal injury, death, or substantial property damage.

2. Size openings only on the basis of the other appliances in the space. No additional air opening free area is needed for the Knight XL because it takes its combustion air from outside (direct vent installation).

Flooring and foundation

Flooring

The Knight XL is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠ WARNING

Do not install the boiler on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

If flooding is possible, elevate the boiler sufficiently to prevent water from reaching the boiler.

Residential garage installation

Precautions

Take the following precautions when installing the appliance in a residential garage. If the appliance is located in a residential garage, it should be installed in compliance with the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGA-B149 Installation Code.

- Appliances located in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling shall be installed so that all burners and burner ignition devices are located not less than 18 inches (46 cm) above the floor.
- The appliance shall be located or protected so that it is not subject to physical damage by a moving vehicle.

Vent and air piping

The Knight XL requires a special vent system, designed for pressurized venting.

The boiler is to be used for either direct vent installation or for installation using indoor combustion air. When room air is considered, see the General Venting Section. Note prevention of combustion air contamination below when considering vent/air termination.

Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Knight XL using any other means.

Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated. The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in this manual.

Prevent combustion air contamination

Install air inlet piping for the Knight XL as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, page 11 for products and areas which may cause contaminated combustion air.

⚠ WARNING

You must pipe combustion air to the boiler air intake. Ensure that the combustion air will not contain any of the contaminants in Table 1A, page 11. Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine boiler location *(continued)*

Table 1A Corrosive Contaminants and Sources

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

When using an existing vent system to install a new boiler:

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 3 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 3A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 3E and 3G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 3 through 5 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 3H for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Boiler Section on page 12.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on pages 19 and 20.

⚠ WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

1 Determine boiler location

When removing a boiler from existing common vent system:

⚠ DANGER

Do not install the Knight XL into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

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.

- a. Seal any unused openings in the common venting system.
- b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.
- c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
- f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.
- g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. 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 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

2 Prepare boiler

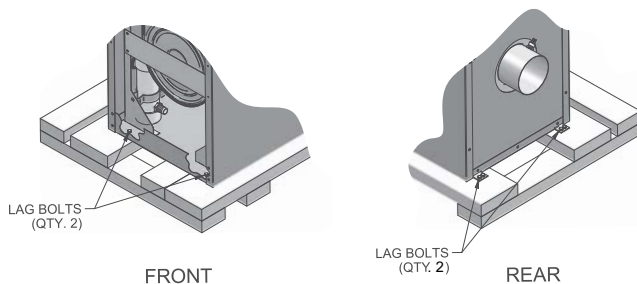
Remove boiler from wood pallet

1. After removing the outer shipping carton from the boiler, remove the parts box.
2. Remove the front door to access the lag bolts in front of the unit (FIG. 2-1).
3. To remove the boiler from the pallet (after removing the front door):
 - a. Remove the two lag bolts from the wood pallet inside the boiler (FIG. 2-1).
 - b. Detach the boiler from the lag bolts in the rear of the unit, see FIG. 2-1.

NOTICE

Do not drop the boiler or bump the jacket on the floor or pallet. Damage to the boiler can result.

Figure 2-1 Boiler Mounted on Shipping Pallet



Gas conversions

WARNING

For a boiler already installed, you must turn off gas supply, turn off power and allow boiler to cool before proceeding. You must also completely test the boiler after conversion to verify performance as described under Start-up, Section 10 of this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

For the 400 Model you must install a propane orifice to operate the Knight XL on propane gas. Verify when installing that the orifice size marking matches boiler size (Model 400 - 8.0 LP orifice stamping).

Models 501 - 801 do not require an orifice installation for propane operation, but they will require a valve adjustment.

Model 400

1. Remove the top and front access covers from the unit (no tools required for removal).
2. Remove the three screws securing the venturi to the blower. **Note:** When separating the venturi from the blower, take care not to damage the O-ring inside the blower (FIG. 2-2).
3. Remove the four star-drive screws securing the gas valve to the venturi (FIG. 2-2).
4. Locate the propane orifice disk from the conversion kit bag. Verify that the stamping on the orifice disk matches the boiler size (Model 400 - 8.0 LP orifice stamping).
5. Remove the existing orifice from the O-ring in the side of the gas valve and replace it with the orifice from the kit. Position and secure the orifice in the valve as shown in FIG. 2-2.
6. Reposition the gas valve against the venturi and replace the star-drive screws (FIG. 2-2) securing the valve to the venturi.
7. Inspect the O-ring inside the blower. Handle the O-ring with care, do not damage. Reposition the venturi against the blower and replace the screws securing the venturi to the blower (FIG. 2-2).
8. After installation is complete, attach the propane conversion label (in the conversion kit bag) next to the boiler rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
9. Replace the top and front access covers.

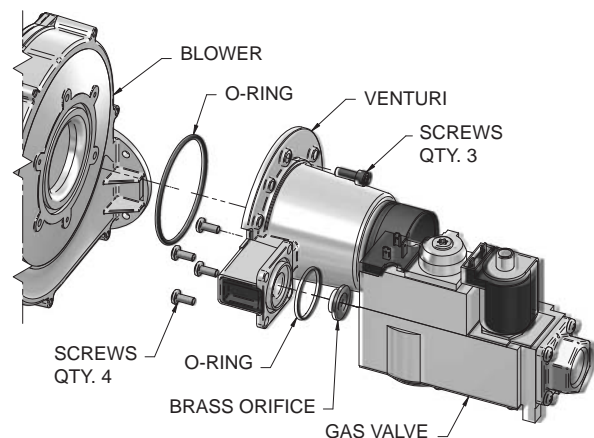
WARNING

After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

DANGER

Model 400: Inspect the O-ring when the blower is disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

Figure 2-2 Installing Propane Orifice - Model 400



2 Prepare boiler

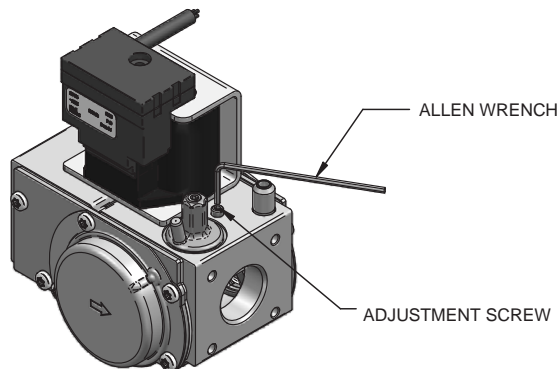
Model 501

1. Remove the top access cover from the unit (no tools required for removal).
2. Turn the adjustment screw on the gas valve clockwise until it stops. Then turn the adjustment screw counterclockwise four and three quarter (4 3/4) turns (see FIG. 2-3).
3. Use a combustion analyzer to verify CO₂ is within the range of 9.6 – 10.5%. If not, adjust the screw **counterclockwise** incrementally to raise CO₂ and **clockwise** to lower CO₂ (FIG. 2-3).
4. After adjustment is complete, attach the propane conversion label (in the conversion kit bag) next to the boiler rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
5. Replace the top access cover.

WARNING

After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

Figure 2-3 Gas Valve Adjustment - Model 501



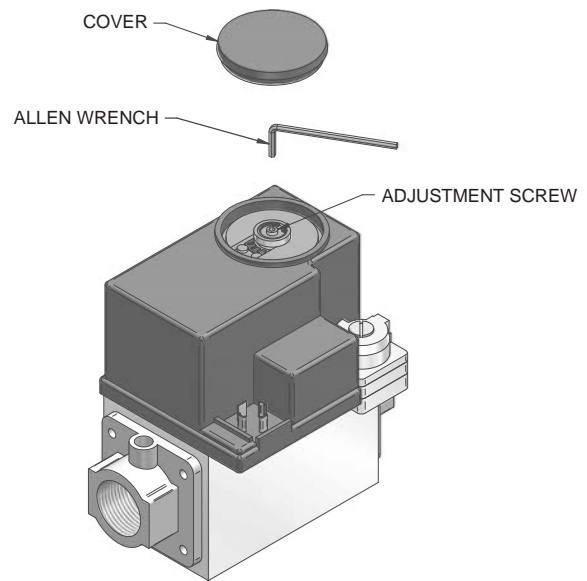
Models 601 - 801

1. Remove the top access cover from the unit (no tools required for removal).
2. Remove the cover on top of the gas valve (FIG. 2-4).
3. Turn the adjustment screw on top of the gas valve clockwise one and three quarter (1 3/4) turns on the 601 Model, one and a half (1 1/2) turns on the 701 Model, and one turn on the 801 Model (see FIG. 2-4).
4. Use a combustion analyzer to verify CO₂ is within the range of 9.6 – 10.5%. If not, adjust the screw **counterclockwise** incrementally to raise CO₂ and **clockwise** to lower CO₂ (FIG. 2-4).
5. After adjustment is complete, attach the propane conversion label (in the conversion kit bag) next to the boiler rating plate. Attach the LP caution label (in the conversion kit bag) to the left side of the unit in the lower left corner.
6. Replace the gas valve cover along with the top access cover.

WARNING

After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

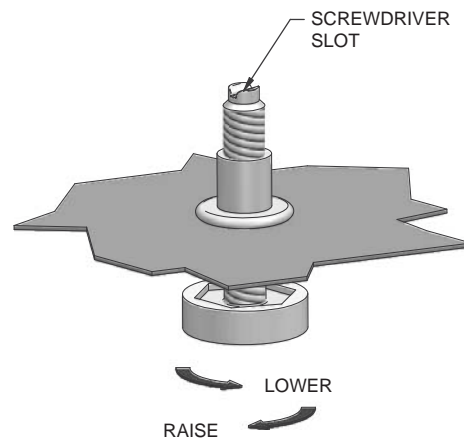
Figure 2-4 Gas Valve Adjustment - Models 601 - 801



Leveling the boiler

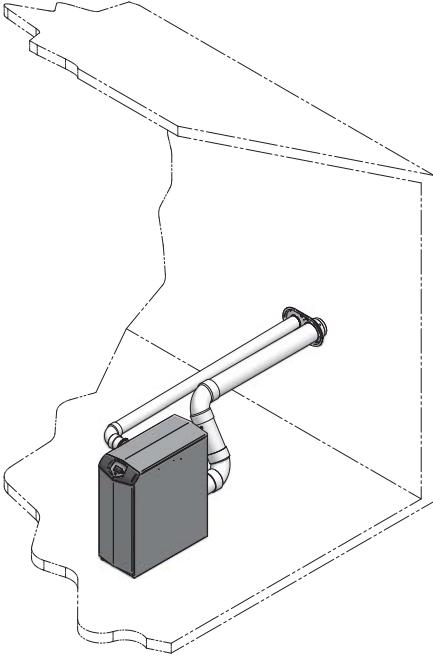
1. Set the boiler in place and check level.
 - a) Adjust legs if necessary to level boiler, see FIG. 2-5 below.

Figure 2-5 Leveling Legs on the Boiler

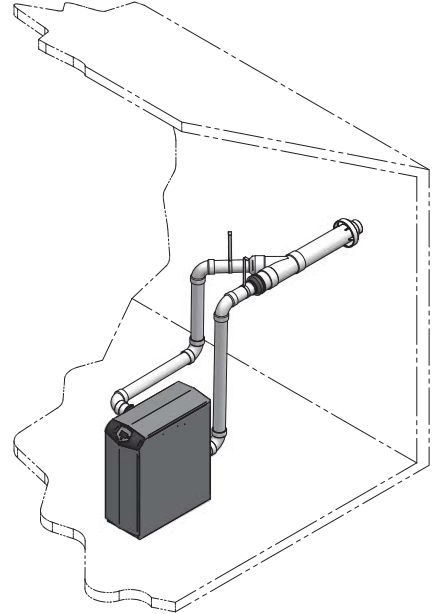


3 General venting

Direct venting options - Sidewall Vent

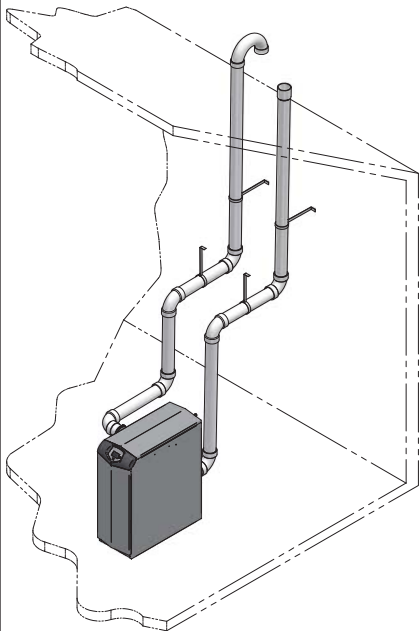


Two Pipe Sidewall
See page 23 for more details

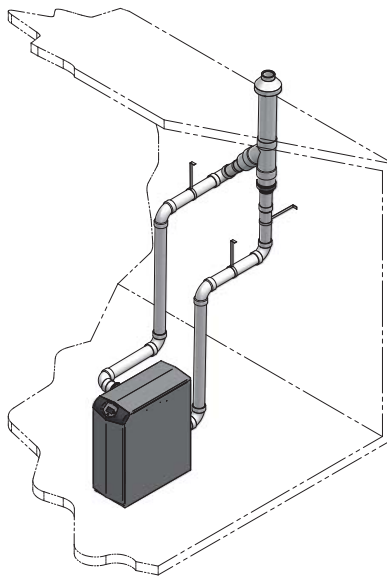


PVC/CPVC Concentric Sidewall
Models 400 - 601 Only
See page 27 for more details

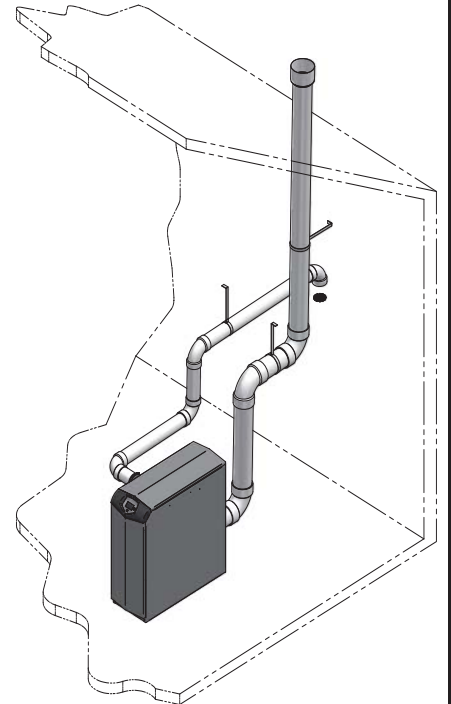
Direct venting options - Vertical Vent



Two Pipe Vertical
See page 30 for more details



PVC/CPVC Concentric Vertical
Models 400 - 601 Only
See page 32 for more details



Vertical Vent, Sidewall Air
See page 19 for more details

3 General venting

Install vent and combustion air piping

⚠ DANGER

The Knight XL boiler must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING

This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 3D, 3E, and 3G for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING

DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE

Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING

For closet and alcove installations, CPVC, polypropylene or stainless steel material **MUST BE** used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION

Improper installation of venting systems may result in injury or death.

NOTICE

Follow the instructions in Section 1, page 12 of this manual when removing a boiler from an existing vent system.

⚠ WARNING

Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The Knight XL boiler vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

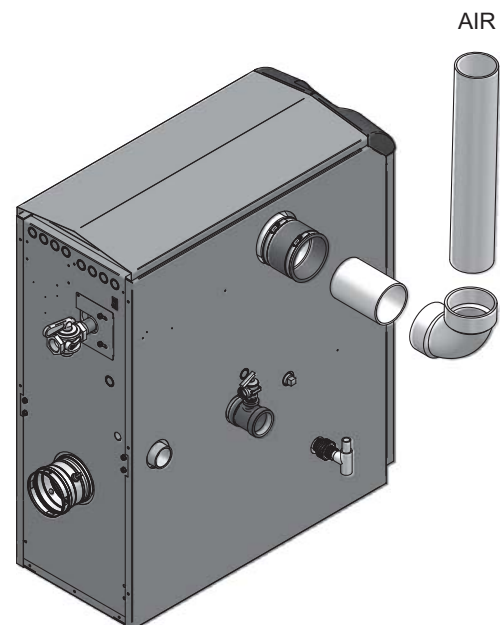
You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Knight XL boiler using any other means.

You must also install air piping from outside to the boiler air intake adapter unless following the Optional Room Air instructions on page 19 of this manual. The resultant installation is direct vent (sealed combustion).

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 3-1) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG.'s 3-2 thru 3-6) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 3-1 Near Boiler Air Piping



3 General venting *(continued)*

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.
4. The 4" Concentric Vent Kit available from Lochinvar (see Section 4 – *Sidewall Termination – Optional Concentric Vent*) and the 4" Concentric Vent Kit available from IPEX are both approved for use on the Knight XL (400 - 601 models only) boiler. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The Knight XL uses model specific combustion air intake and vent piping sizes as detailed in Table 3A below.

Table 3A Air Intake/Vent Piping Sizes

Model	Air Intake	Vent
400 - 601	4 inches (102 mm)	4 inches (102 mm)
701 - 801	4 inches (102 mm)	6 inches (152 mm)

NOTICE

Increasing or decreasing combustion air or vent piping sizes is not authorized.

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet (3.7 m) minimum / 100 equivalent feet (30.5 m) maximum

Vent = 12 equivalent feet (3.7 m) minimum / 100 equivalent feet (30.5 m) maximum

When determining equivalent combustion air and vent length, add 5 feet (1.5m) for each 90° elbow and 3 feet (.9 m) for each 45° elbow.

EXAMPLE: 20 feet (6 m) of PVC pipe + (3) 90° elbows + (3) 45° elbows + (1) concentric vent kit (CVK3007) = 49 equivalent feet (15 m) of piping.

NOTICE

The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length.

Table 3B Concentric Vent Kit Equivalent Vent Lengths

Model	Kit Number	Equivalent Vent Length
400	CVK3007	5 Feet (1.5 m)
501	CVK3007	30 Feet (9 m)
601	CVK3007	30 Feet (9 m)

3 General venting

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

- PVC, CPVC, Polypropylene or ABS
- Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
- Galvanized steel vent pipe with joints and seams sealed as specified in this section.
- Type “B” double-wall vent with joints and seams sealed as specified in this section.
- AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠ WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type “B” double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

- a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.
- b. Do not install seams of vent pipe on the bottom of horizontal runs.
- c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.
- d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer’s recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer’s instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

3 General venting *(continued)*

Optional room air

NOTICE

Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the Knight XL boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit **MUST** be installed with the appropriate room air kit (Table 3C).
- The equipment room **MUST** be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the room air kit.
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air kit makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

WARNING

When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

Table 3C Optional Room Air Kit

Model	Description	Kit Number
400 - 801	Filter Box Assembly	KIT30022
	90° Elbow with Screen	KIT30053

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the boiler, they can form strong acids. The acid can eat through the boiler wall, causing serious damage and presenting a possible threat of flue gas spillage or boiler water leakage into the building.

Please read the information given in Table 1A, page 11, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the boiler combustion air inlet, have your installer pipe the boiler combustion air and vent to another location, per this manual.

WARNING

If the boiler combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

WARNING

To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 11 before installing the boiler or air inlet piping.

If contaminants are found, you **MUST**:

- Remove contaminants permanently.
- OR—
- Relocate air inlet and vent terminations to other areas.

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 3D on page 20.

Installing vent and air piping

WARNING

The vent connection to the appliance must be made with the starter CPVC pipe section provided with the appliance if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an “All Purpose Cement” suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 3D to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE

Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE

All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

WARNING

Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

3 General venting

Table 3D PVC/CPVC Vent Pipe, and Fittings

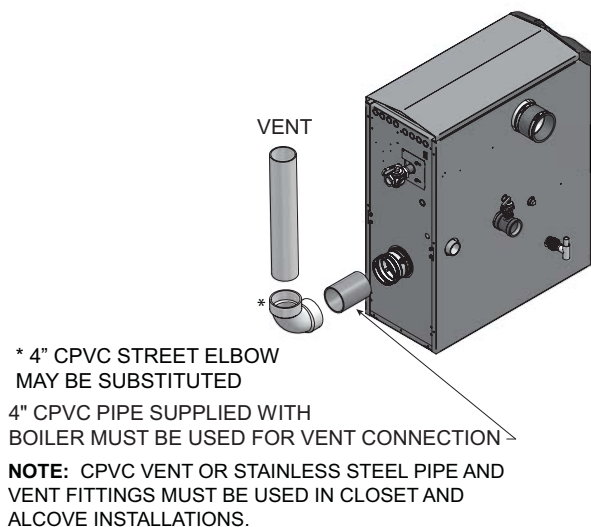
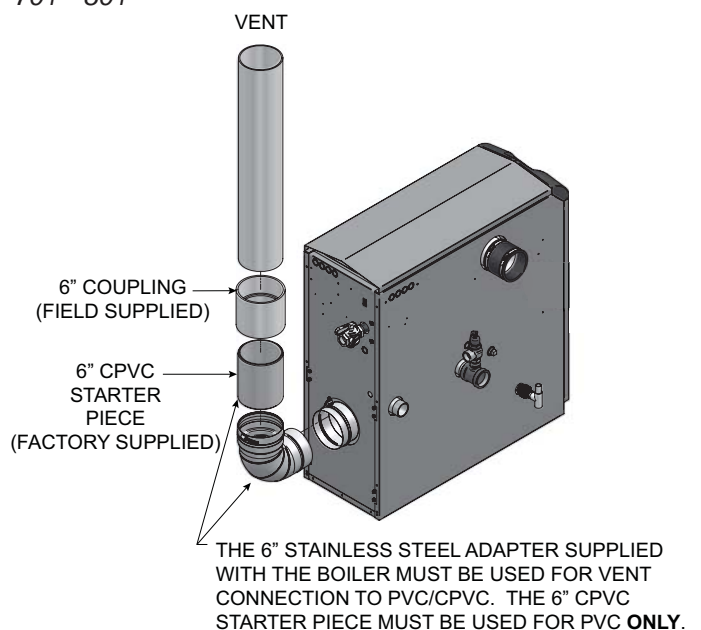
Approved PVC/CPVC Vent Pipe and Fittings		
Item	Material	Standard
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493

NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

1. Work from the boiler to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)

5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
 - a. Handle fittings and pipes carefully to prevent contamination of surfaces.
 - b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
 - c. Apply a second primer coat to the fitting socket.
 - d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
 - e. Apply a second coat of cement to the pipe.
 - f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
 - g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

Figure 3-2 Near Boiler PVC/CPVC Venting - Models 400 - 601

Figure 3-3 Near Boiler PVC/CPVC Venting - Models 701 - 801


3 General venting *(continued)*

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 3E.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

Table 3E Polypropylene Vent Pipe and Fittings

Approved Polypropylene Vent Manufacturers	
Make	Model
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 3F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 3-4).

WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

WARNING Use only the adapters and vent system listed in Tables 3E and 3F. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

Figure 3-4 Near Boiler Polypropylene Venting

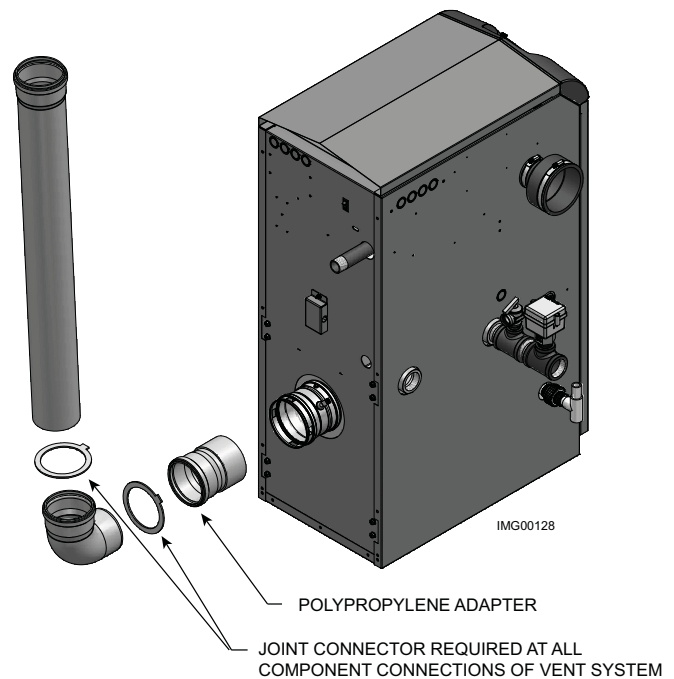


Table 3F Approved Polypropylene Terminations

Model	Centrotherm InnoFlue SW				Duravent Polypro		
	Polypropylene Adapter	Joint Connector	Sidewall Retaining Bracket*	Sidewall Adapter*	Polypropylene Adapter	Joint Connector	Sidewall Kit*
400-601	ISAAL0404	IANS04	IATP0404	ISTAGL0404	4PPS-AD	4PPS-LB	4PPS-HLK
701-801	ISAAL0606	Not Required	IATP0606	ISTAGL0606	FSA-6PVC-6PPS	Not Required	6PPS-HLK

* These parts are only needed if the sidewall termination assembly is used (see FIG. 4-5B on page 26).

3 General venting

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 3G.

WARNING Use only the materials, vent systems, and terminations listed in Tables 3G and 3I. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 3I for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Table 3G Stainless Steel Vent Pipe and Fittings

Approved Stainless Steel Vent Manufacturers	
Make	Model
Dura Vent (M & G Group)	FasNSeal Vent / FasNSeal Flex* Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Table 3H Stainless Steel Sidewall Vent Termination Kit(s)

Model	Kit Number
701 - 801	KIT3137

Table 3I Approved Stainless Steel Terminations and Adapters

Model	ProTech			Heat Fab			Z Flex		
	FasNSeal			Saf-T Vent			Z-Vent		
	Boiler Adapter	Flue Termination	Intake Air Termination	Boiler Adapter	Flue Termination	Intake Air Termination	Boiler Adapter	Flue Termination	Intake Air Termination
400-601	F303759	FSBS4 FSRC4(R.C)	FSAIH04 303888	9401PVC	9492 5400CI	9414TERM	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
701-801	F303759 (Intake Only)	FSBS6	FSAIH04 303888						

Figure 3-5 Near Boiler Stainless Steel Venting Models 400 - 601

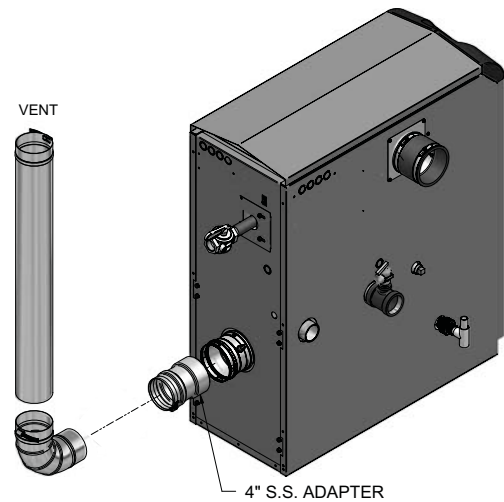
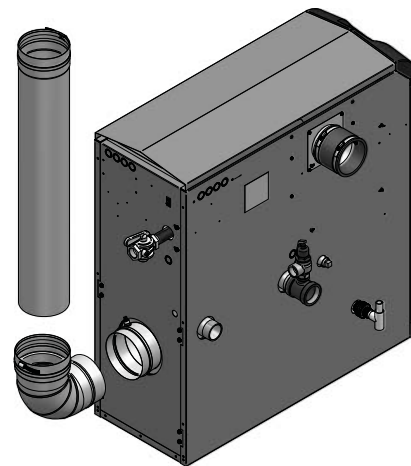


Figure 3-6 Near Boiler Stainless Steel Venting Models 701 - 801



4 Sidewall direct venting

Vent/air termination – sidewall

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

- The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
- You must consider the surroundings when terminating the vent and air:
 - Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
 - The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
 - Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
 - Avoid possibility of accidental contact of flue products with people or pets.
 - Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠ WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

- Do not terminate above any door or window. Condensate can freeze, causing ice formations.
- Locate or guard vent to prevent condensate damage to exterior finishes.

Figure 4-1A PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent

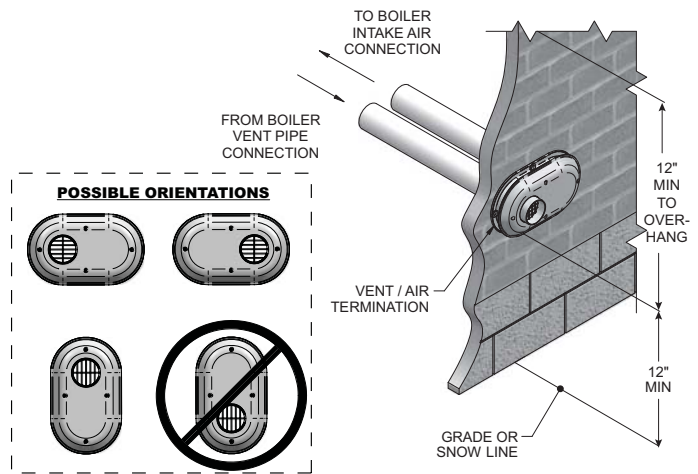


Table 4A Sidewall Vent Kits

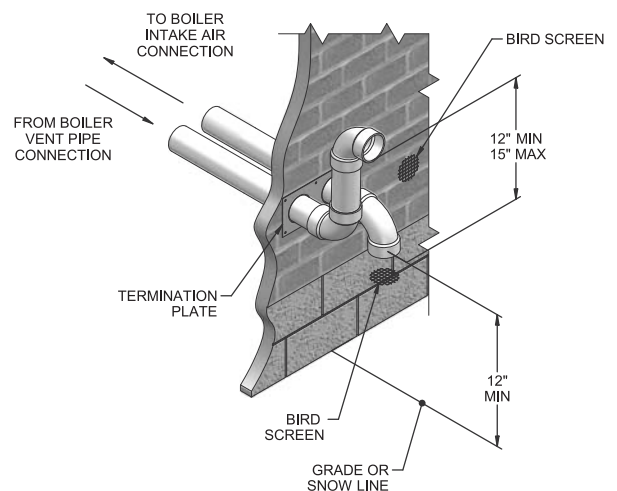
Model	Kit Number	Vent Size
400 - 601	KIT30046	4 inch vent
701 - 801	KIT30048	6 inch vent

If using the alternate sidewall termination:

- The air piping must terminate in a down-turned elbow as shown in FIG. 4-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
- The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 4-1B.

⚠ WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 4-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown.

Figure 4-1B Alternate PVC/CPVC/ Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings



4 Sidewall direct venting Vent/air termination – sidewall

Figure 4-2A Alternate PVC/CPVC/Polypropylene Sidewall Termination Models 400 - 801 w/Field Supplied Fittings

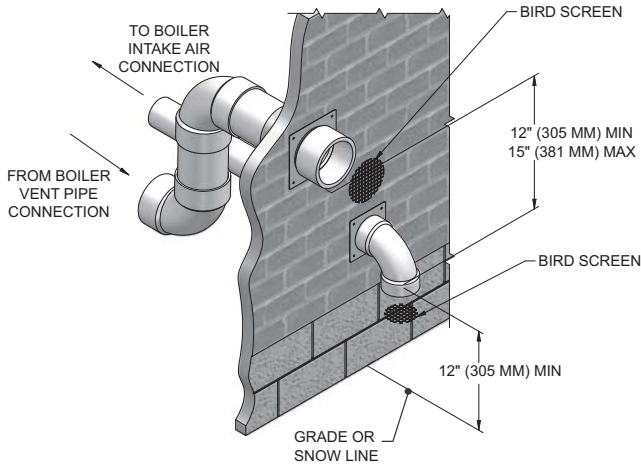
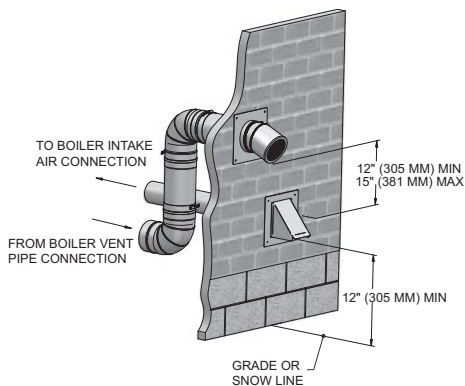


Figure 4-2B Alternate Stainless Steel Sidewall Termination Models 701 - 801 w/Field Supplied Fittings



NOTICE PVC/CPVC or ABS is acceptable air inlet pipe material.

5. Maintain clearances as shown in FIG.'s 4-1A thru 4-4B, pages 23 thru 25. Also maintain the following:
 - a. Vent must terminate:
 - At least 6 feet (1.8 m) from adjacent walls.
 - No closer than 12 inches (305 mm) below roof overhang.
 - At least 7 feet (2.1 m) above any public walkway.
 - At least 3 feet (.9 m) above any forced air intake within 10 feet (3 m).
 - No closer than 12 inches (305 mm) below or horizontally from any door or window or any other gravity air inlet.
 - b. Air inlet must terminate at least 12 inches (305 mm) above grade or snow line; at least 12 inches (305 mm) below the vent termination (FIG. 4-1B); and the vent pipe must not extend more than 24 inches (610 mm) vertically outside the building.

- c. Do not terminate closer than 4 feet (1.2 m) horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet (1.2 m) horizontally.

6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 4-3A Clearance to Gravity Air Inlets

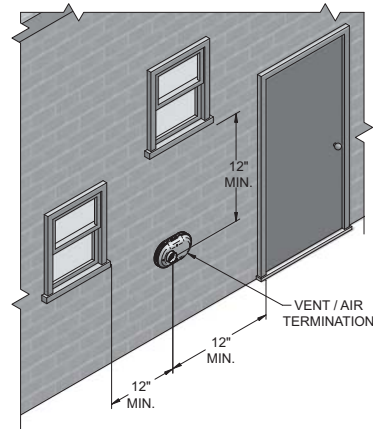
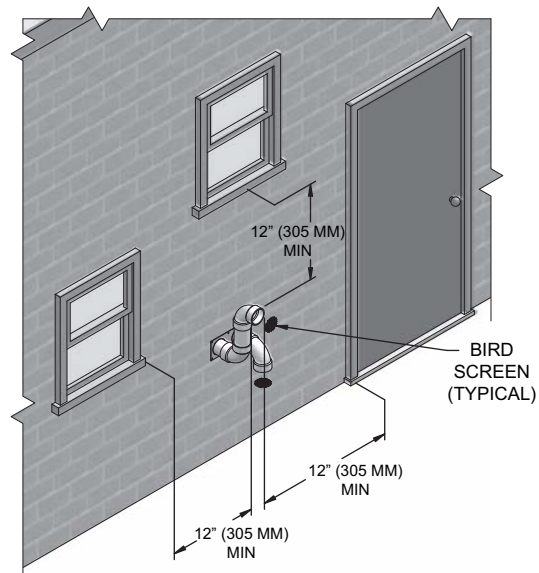


Figure 4-3B Alternate Clearance to Gravity Air Inlets w/Field Supplied Fittings



4 Sidewall direct venting *(continued)*

Vent/air termination – sidewall

Figure 4-4A Clearance to Forced Air Inlets

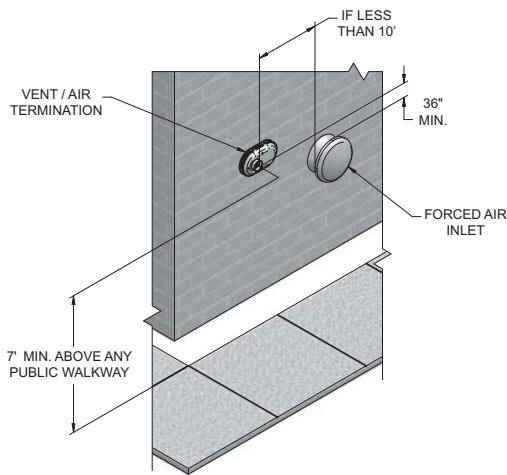
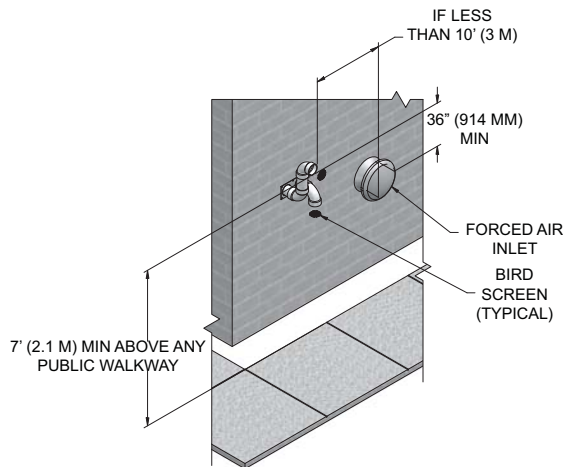


Figure 4-4B Alternate Clearance to Forced Air Inlets w/Field Supplied Fittings



Prepare wall penetrations

- Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.

Air pipe penetration:

- Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

Vent pipe penetration:

- Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
 - 5½ inch (140 mm) hole for 4 inch (102 mm) vent pipe
 - 7½ inch (191 mm) hole for 6 inch (152 mm) vent pipe

Drill 3/16" diameter holes for inserting the plastic anchors into the wall.

- For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 3F on page 21 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate (FIG. 4-4B).
- For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 3D on page 20 to seal the vent pipe.
- Mount and secure the vent plate to the wall using stainless steel screws.
- Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
- Assemble the vent cap to the vent plate (see FIG.'s 4-5A and 4-5B). Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
- Seal all wall cavities.
- PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
- Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 4-5A PVC/CPVC Sidewall Termination Assembly

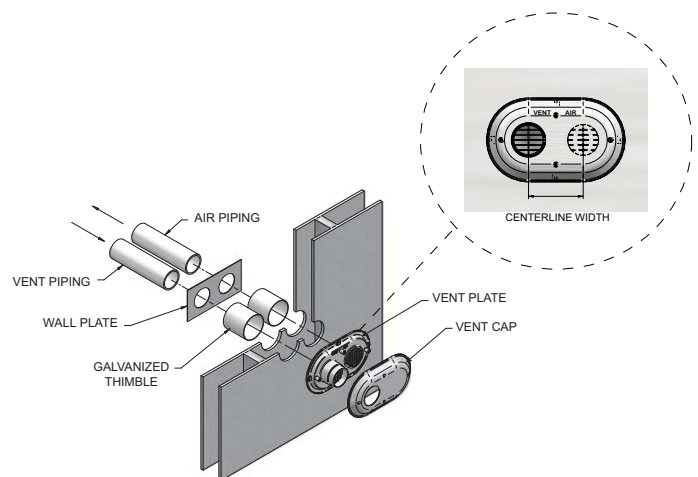
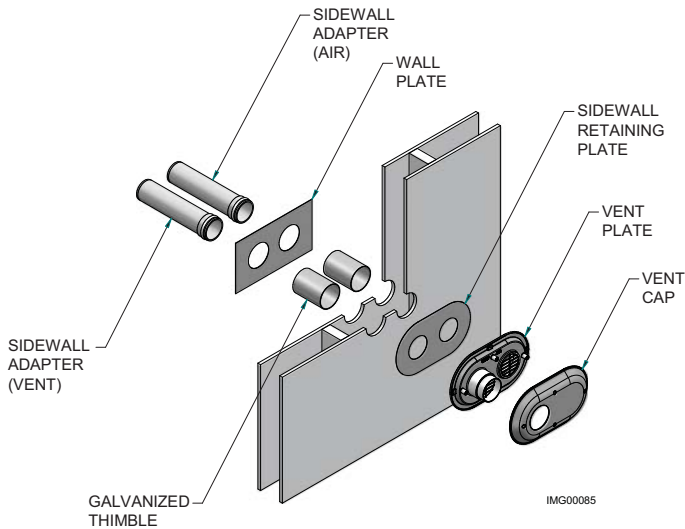


Table 4B Sidewall Vent Centerline Dimensions

Model	Air	Vent	Centerline Width
400 - 601	4"	4"	5 5/8"
701 - 801	4"	6"	7 3/4"

4 Sidewall direct venting

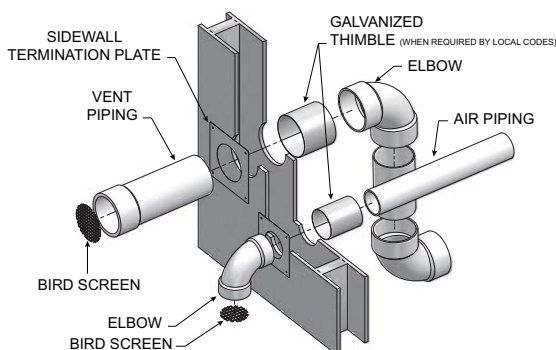
Figure 4-5B Polypropylene Sidewall Termination Assembly



Prepare wall penetrations (Alternate - Field Supplied Option)

- Air pipe penetration:
 - Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
- Vent pipe penetration:
 - Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
 - 5½ inch hole (140 mm) hole for 4 inch (102 mm) vent pipe
 - 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe
 - Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 4-5C.
- Use a sidewall termination plate as a template for correct location of hole centers.
- Follow all local codes for isolation of vent pipe when passing through floors or walls.
- Seal exterior openings thoroughly with exterior caulk.

Figure 4-5C A Typical Sidewall Termination Assembly - Models 400 - 801 PVC/CPVC/ Polypropylene or Stainless Steel



Multiple vent/air terminations

- When terminating multiple Knight XL's terminate each vent/air connection as described in this manual (FIG. 4-6A).

⚠ WARNING

All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

- Place wall penetrations to obtain minimum clearance of 12 inches (305 mm) between vent pipe and adjacent air inlet elbow, as shown in FIG. 4-6A for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
- The air inlet of a Knight XL is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 4-6A Multiple Vent Terminations (must also comply with Figure 4-1A)

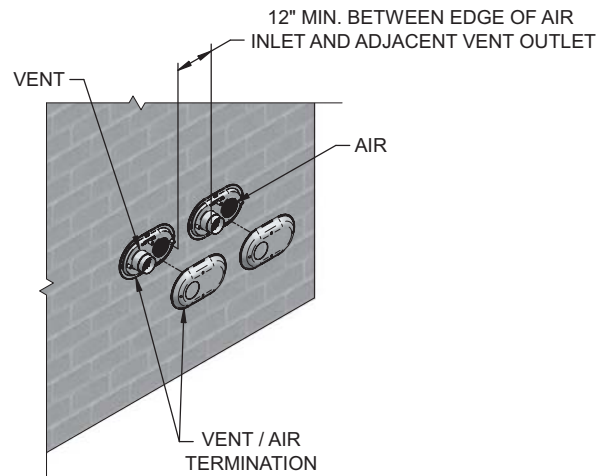
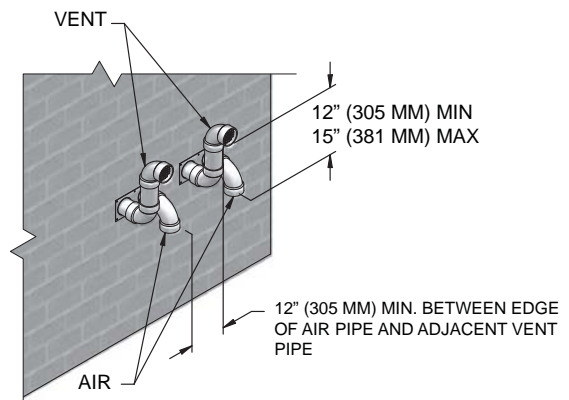


Figure 4-6B Alternate Multiple Vent Terminations w/Field Supplied Fittings (must also comply with Figure 4-1B)



4 Sidewall direct venting *(continued)*

Sidewall termination – optional concentric vent: Models 400 - 601 Only

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit (#CVK3007 for 4" (102 mm) diameter - Models 400 - 601). Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown below in FIG. 4-7.

The required combustion vent pipe materials are listed in Table 3D, on page 20 of this manual.

3. Cut one (1) hole (7 inch (178 mm) diameter for #CVK3007 installations into the structure to install the termination kit.
4. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.
 - a. Cement the Y concentric fitting to the larger kit pipe (FIG. 4-8).
 - b. Cement the rain cap to the smaller diameter kit pipe (FIG. 4-8).

Figure 4-7 Concentric Sidewall Termination - Models 400 - 601

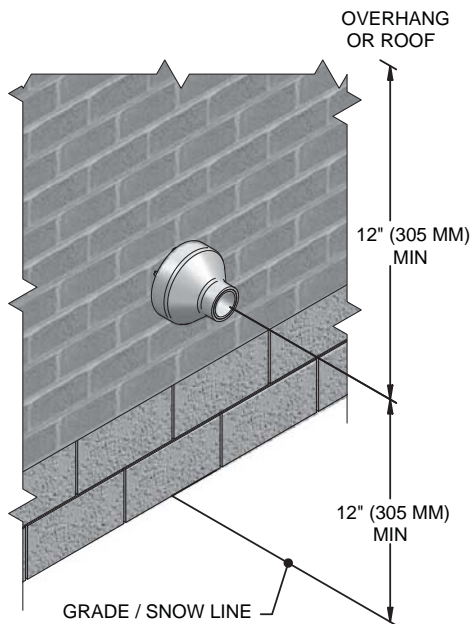
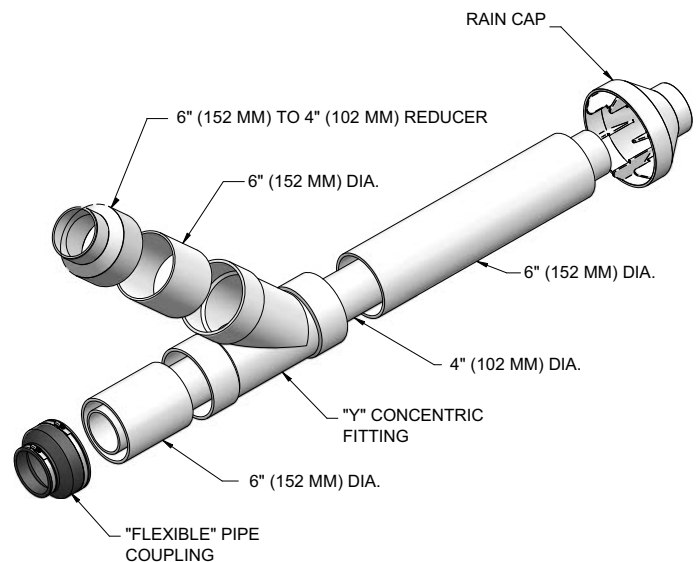


Figure 4-8 Kit Contents_CVK3007 - Models 400 - 601



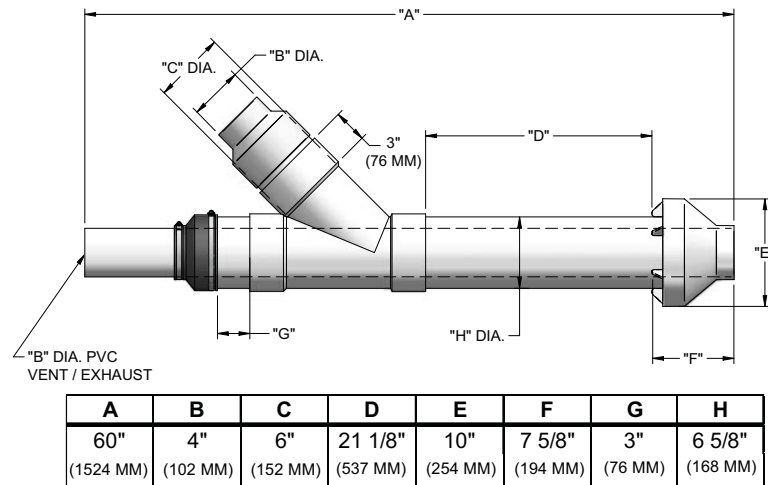
Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-7).
2. Reference the *Determine Location Section* on page 23 of this manual for general termination considerations.

4 Sidewall direct venting

Sidewall termination – optional concentric vent: Models 400 - 601 Only

Figure 4-9 Concentric Vent Dimensional Drawing - Models 400 - 601



NOTICE

Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-10).

WARNING

When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

WARNING

Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

5. Install the Y concentric fitting and pipe assembly through the structure's hole from an inside wall.

NOTICE

Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

6. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly from an outside wall. Ensure small diameter pipe is fastened tightly into the rubber adapter for #CVK3007 installations.
7. Secure the assembly to the structure as shown in FIG. 4-11 using field-supplied metal strapping or equivalent support material.

NOTICE

Ensure termination location clearance dimensions are as shown in FIG. 4-7.

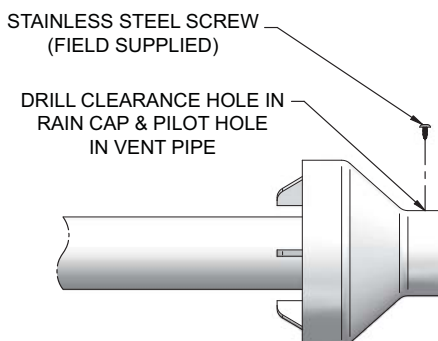
NOTICE

If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied standard schedule 40 PVC for CVK3007. Do not extend dimension D* more than 60 inches (1524 mm) (see FIG. 4-9).

NOTICE

If assembly depth needs to be reduced, dimension D can be as short as possible.

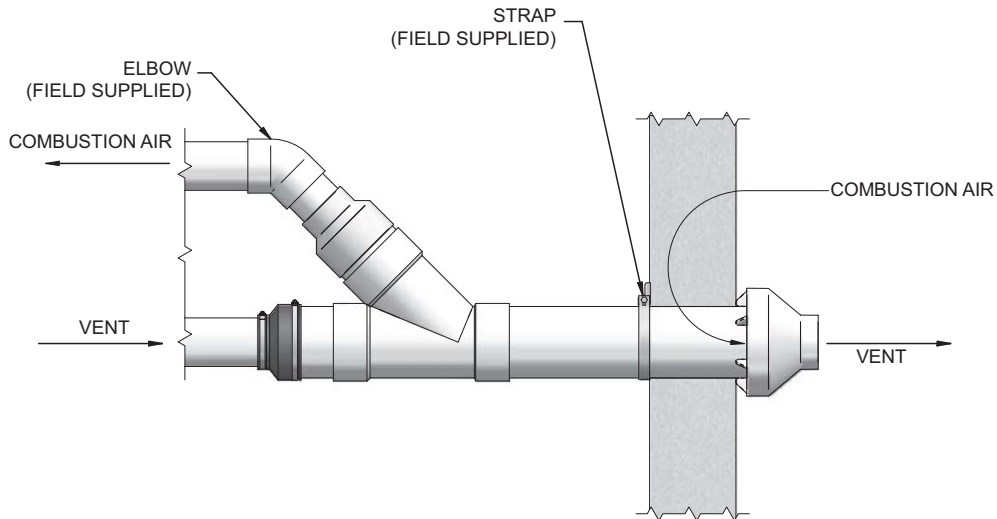
Figure 4-10 Rain Cap to Vent Pipe Alternate Assembly



4 Sidewall direct venting *(continued)*

Sidewall termination – optional concentric vent: Models 400 - 601 Only

Figure 4-11 Concentric Vent Sidewall Attachment



CAUTION

DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

8. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-11 for proper pipe attachment.
9. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-12). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-12. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

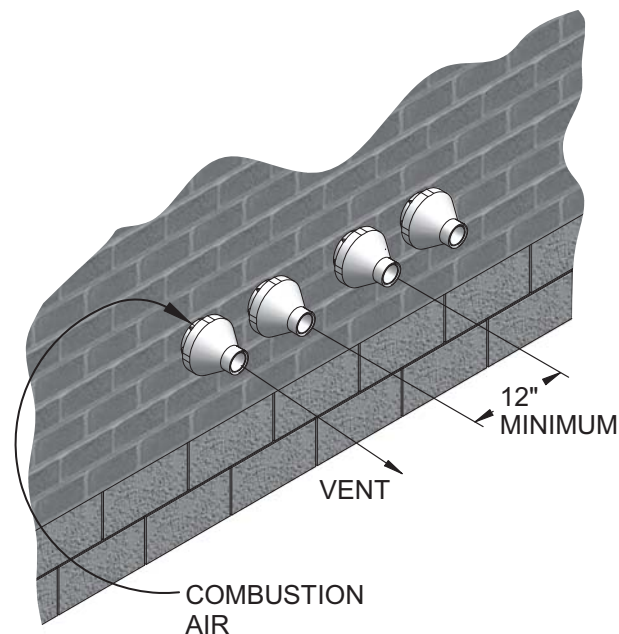


Figure 4-12 Concentric Vent and Combustion Air Termination

5 Vertical direct venting

Vent/air termination – vertical

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. Prepare the vent termination and the air termination elbow (FIG. 5-1A) by inserting bird screens. Bird screens should be obtained locally.
3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet (.6 m) from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
5. The vent piping must terminate in an up-turned coupling as shown in FIG. 5-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 5-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot above the air intake.
6. Maintain the required dimensions of the finished termination piping as shown in FIG. 5-1A.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠ WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 5-1A PVC/CPVC/Polypropylene Vertical Termination of Air and Vent

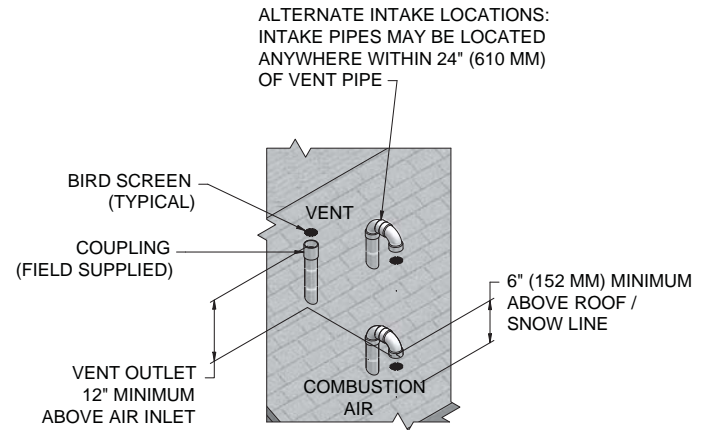
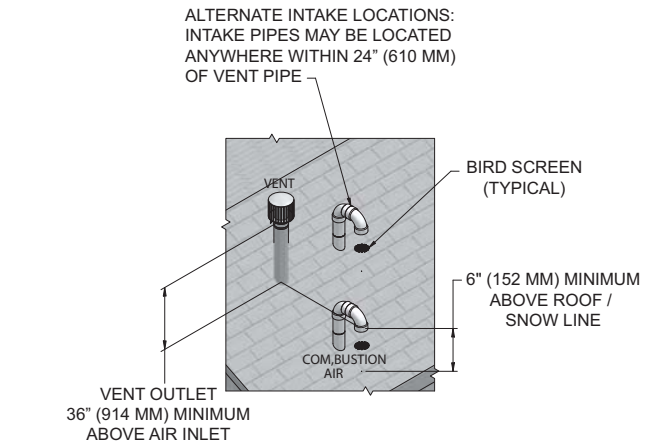


Figure 5-1B Stainless Steel Vertical Termination of Air and Vent



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

5 Vertical direct venting *(continued)*

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
 - a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
 - a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
 - 5½ inch hole (140 mm) hole for 4 inch (102 mm) vent pipe
 - 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe
 - b. Insert a galvanized metal thimble in the vent pipe hole (when required by local codes).
3. Space the air and vent holes to provide the minimum spacing shown in FIG.'s 5-1A and 5-1B, page 30.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple Knight XL boilers, terminate each vent/air connection as described in this manual (FIG. 5-2).

⚠ WARNING

Terminate all vent pipes at the same height and all air pipes at the same height to avoid recirculation of flue products and the possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches (305 mm) between edge of air intake elbow and adjacent vent pipe of another boiler for U.S. installations (see FIG. 5-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Knight XL boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 5-2 Vertical Terminations with Multiple Boilers

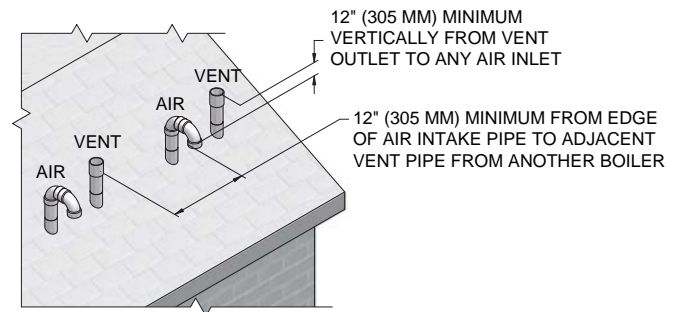
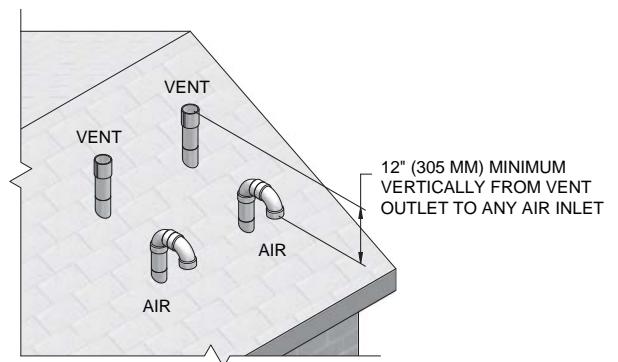


Figure 5-3 Alternate Vertical Terminations with Multiple Boilers



5 Vertical direct venting

Vertical termination – optional concentric vent: Models 400 - 601 Only

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 5-4.

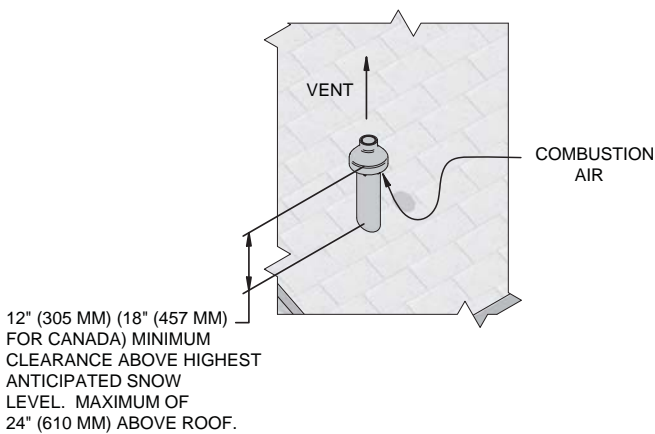
Field supplied pipe and fittings are required to complete the installation.

The required combustion vent pipe fittings are listed in Table 3D, on page 20 of this manual.

Vertical termination installation

1. See Section 5, Vertical Direct Venting - Determine Location (where applicable).

Figure 5-4 Concentric Vertical Termination



2. Cut one (1) hole (7 inch (178 mm) diameter for #CVK3007 installations) into the structure to install the termination kit.
3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.
 - a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG. 4-8, page 27).
 - b. Cement rain cap to the smaller diameter kit pipe (see FIG. 4-8, page 27).

NOTICE

Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-10, page 28).

WARNING

When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

Figure 5-5 Do Not Install U-Bend to Rain Cap



5 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent: Models 400 - 601 Only

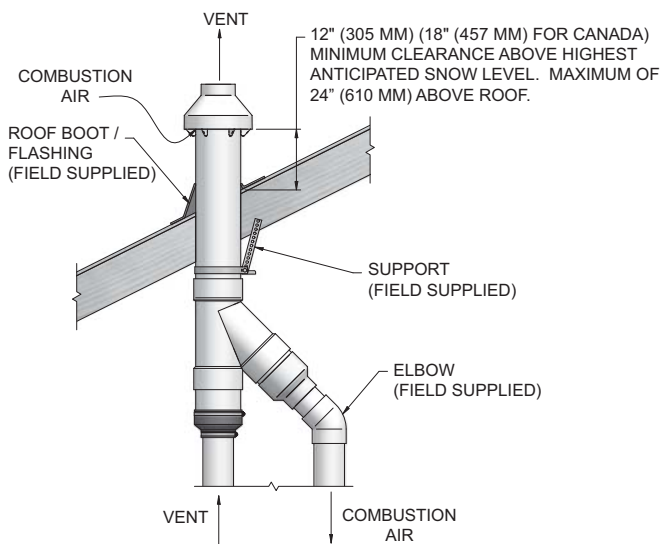
⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 5-6 using field supplied metal strapping or equivalent support material.

Figure 5-6 Concentric Vent Roof Installation



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches (305 mm) in U.S.A. or 18 inches (457 mm) in Canada) as shown in FIG. 5-4, page 32.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied standard schedule 40 PVC for CVK3007. Do not extend dimension D* more than 60 inches (1524 mm) (see FIG. 4-9, page 28).

CAUTION

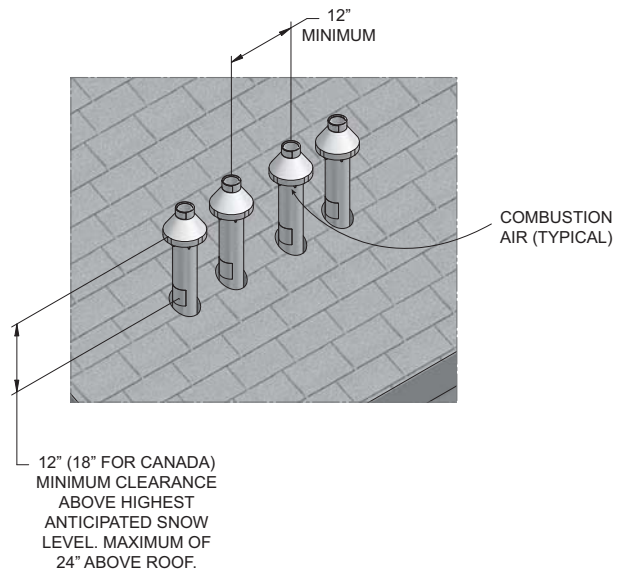
DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is fastened tightly into the rubber adapter for #CVK3007 installations.
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 5-6 for proper pipe attachment.
8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 5-7). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 5-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 5-7 Concentric Vent and Combustion Air Vertical Termination



5 Vertical direct venting

Alternate vertical concentric venting

This appliance may be installed with a concentric vent arrangement where the vent pipe is routed through an existing unused venting system; or by using the existing unused venting system as a chase for vent and combustion air routing.

Concentric Venting Arrangement

The venting is to be vertical through the roof. The annular space between the O.D. of the vent pipe and the I.D. of the existing unused venting system is utilized for the combustion air source.

The minimum size of the existing vent system required to achieve enough annular space for combustion air can be found in Table 5A.

The upper and lower termination as well as any other unsealed joints in the existing vent system **must be** sealed to ensure that all combustion air is drawn from under the vent cap as shown in FIG.'s 5-8 and 5-9.

Approved venting materials must be used as specified in Table 3D on page 20.

Follow all vent / air termination and clearance requirements per this section to the appropriate example. Installation must comply with local requirements and with the National Fuel Gas Code.

The maximum allowable equivalent vent and air intake lengths for this venting arrangement are to be determined from the General Venting Section.

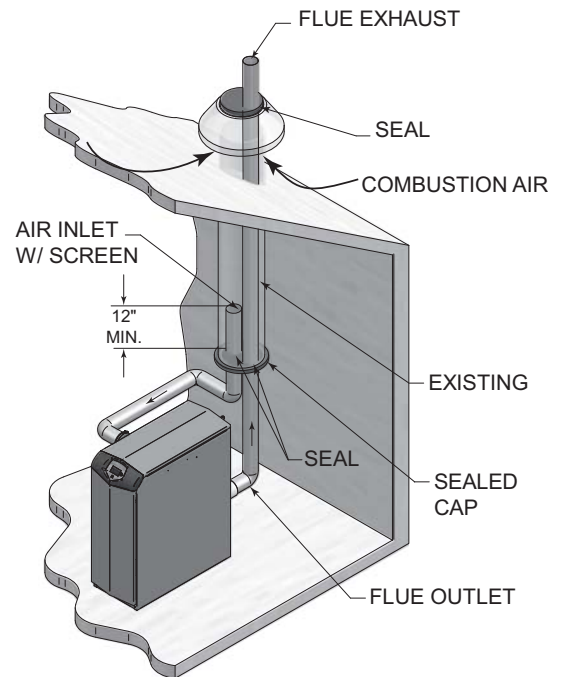
If an existing unused venting system is converted for use with this method of concentric venting, the installer must ensure that the existing venting system is clean and free from particulate contamination that will harm this appliance and cause increased nuisance calls or maintenance. See Table 1A on page 11 for a list of corrosive contaminants and sources.

Two example scenarios of a concentric venting arrangement are shown for illustrative purposes in FIG.'s 5-8 and 5-9.

Table 5A Alternate Vertical Concentric Vent / Chase Sizes

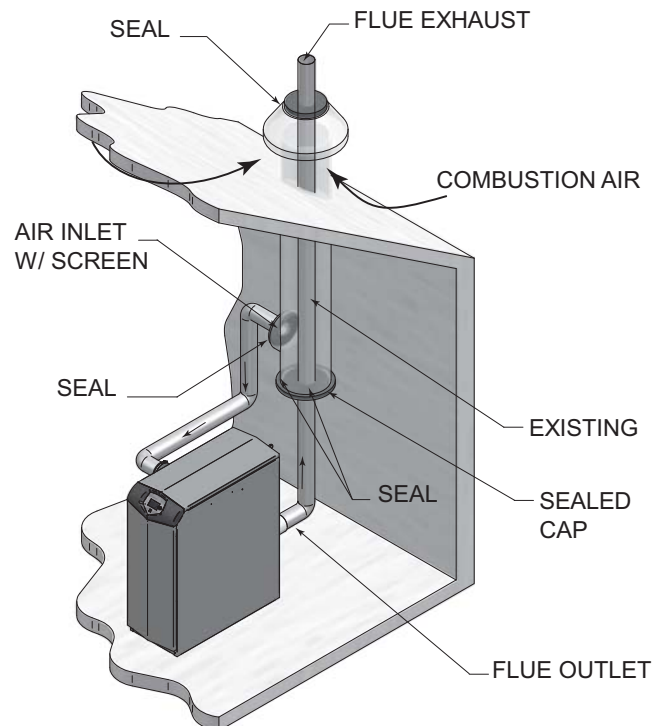
Model	Vent / Air Inlet Size	Minimum Existing Vent / Chase Size
400 - 601	4"	7"
701 - 801	6"	10"

Figure 5-8 Concentric Vent Example 1



*For concept illustration only. Individual installations may vary due to job site specific equipment.

Figure 5-9 Concentric Vent Example 2



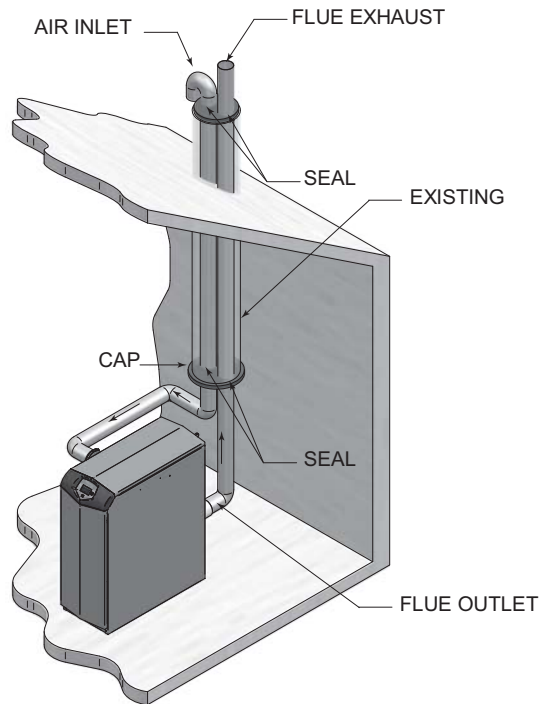
*For concept illustration only. Individual installations may vary due to job site specific equipment.

5 Vertical direct venting *(continued)*

Existing vent as a chase

Follow all existing termination and clearance requirements and allowable pipe lengths. Use only approved venting materials listed in the General Venting Section of this manual.

Figure 5-10 Existing Vent as a Chase



*For concept illustration only. Individual installations may vary due to job site specific equipment.

12 Maintenance

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that boiler vent discharge and air intake are clean and free of obstructions.

⚠ WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 psi (82.7 kPa)).
3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. See Section 6 - Hydronic Piping for suggested best location of expansion tanks and air eliminators.

Check boiler relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 6 - Hydronic Piping before proceeding further.

⚠ WARNING

Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the boiler until a new relief valve has been installed.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

12 Maintenance *(continued)*

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the boiler heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect boiler ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all boiler wiring

1. Inspect all boiler wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the SMART SYSTEM control module display to Parameter Mode and check all settings. See Section 1 of the Knight XL Service Manual. Adjust settings if necessary. See Section 1 of the Knight XL Service Manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

1. Start boiler and perform checks and tests specified in Section 10 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off boiler and allow boiler to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG.'s 12-2 thru 12-4.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG.'s 12-2 thru 12-4).

Figure 12-2 Burner Assembly - Model 400

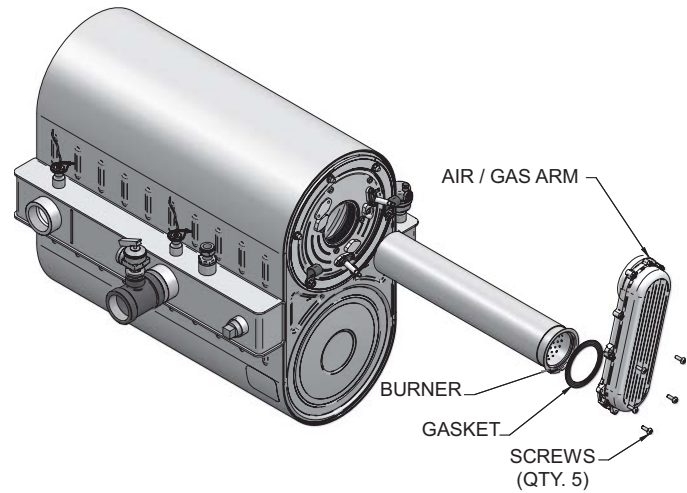


Figure 12-3 Burner Assembly - Model 501

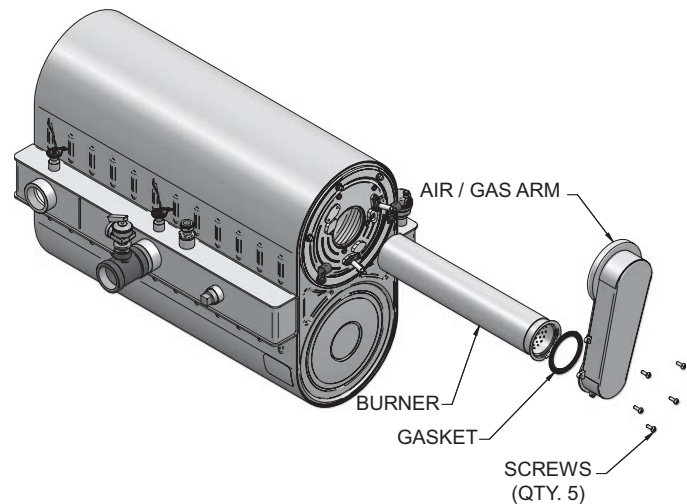
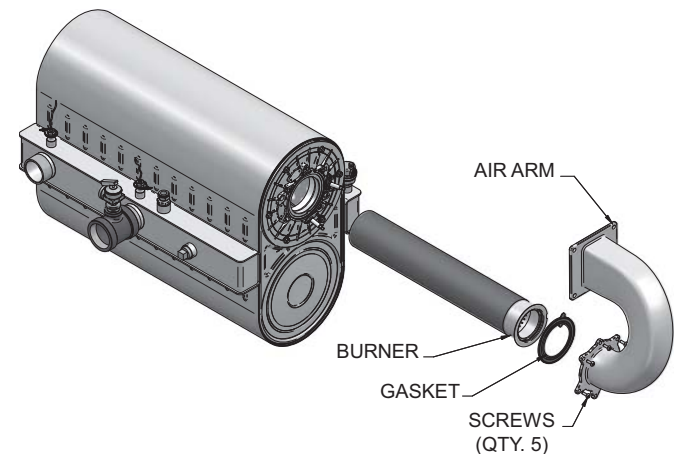


Figure 12-4 Burner Assembly - Models 601 - 801



12 Maintenance

Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 3 - Troubleshooting in the Knight XL Service Manual for other procedures to deal with low flame signal.

Review with owner

1. Review the Knight XL User's Information Manual with the owner.
2. Emphasize the need to perform the maintenance schedule specified in the Knight XL User's Information Manual (and in this manual as well).
3. Remind the owner of the need to call a licensed contractor should the boiler or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up at the beginning of the next heating season.

Cleaning boiler heat exchanger

For recommended materials; including brush, appropriate extension(s), refractory cover, and detailed instructions see Table 12B - Heat Exchanger Cleaning Kits.

1. Shut down boiler:
 - Follow the "To Turn Off Gas to Appliance" instructions for the boiler in Section 10 - Startup.
 - Do not drain the boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the boiler to cool to room temperature if it has been firing.
3. Remove the nuts securing the heat exchanger access cover to the heat exchanger and set aside.
4. Remove the heat exchanger access cover, burner, and gas/air arm assembly.

⚠ WARNING

The boiler contains ceramic fiber materials. Use care when handling these materials per instructions in the Service Manual. Failure to comply could result in severe personal injury.

5. Remove the condensate hose from the heat exchanger end. Connect a field supplied 3/4" diameter hose to a drain pan. Using field supplied means, cover the refractory in the back of the combustion chamber of the heat exchanger.

6. Use a vacuum cleaner to remove any accumulation on the boiler heating surfaces. Do not use any solvent.
7. Brush the heat exchanger while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water. Rinse out debris with a low pressure water supply.
9. Allow the heat exchanger to thoroughly dry.
10. Remove the field supplied rear refractory cover from the back of the combustion chamber of the heat exchanger and reassemble.
11. Close isolation valves on piping to isolate boiler from system. Attach a hose to the boiler drain and flush boiler thoroughly with clean water by using purging valves to allow water to flow through the water make-up line to the boiler.
12. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 10 - Startup on pages 57 and 59 of this manual.
13. Replace the access cover and restore boiler to operation.

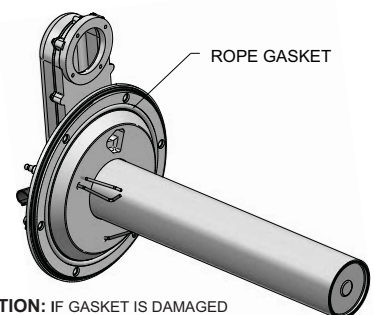
Table 12B Heat Exchanger Cleaning Kits

Model	Kit Number	Part Number	Component Description
400	KIT30063	CTN20005	Rear Refractory Cover
		MSC20083*	Nylon 4" Wheel Brush*
		MSC20084	3mm Allen Wrench
		MSC20086	1/4" x 24" Drill Extension
501 - 801	KIT30064	CTN20005	Rear Refractory Cover
		MSC20083*	Nylon 4" Wheel Brush*
		MSC20085	1/4" x 12" Drill Extension
		MSC20086	1/4" x 24" Drill Extension

⚠ CAUTION

* Do NOT use a metal brush. Only use the kit provided brush or an equivalent replacement nylon brush.

Figure 12-5 Rope Gasket - Heat Exchanger Door



CAUTION: IF GASKET IS DAMAGED DO NOT REUSE, THE HEAT EXCHANGER DOOR MUST BE REPLACED.

NOTICE

Rope gasket is intended for sealing combustion (FIG. 12-5). If damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door (kit WTR3080 and WTR3086).

13 Diagrams

Figure 13-2 Ladder Diagram
