

## INSTALLATION & OPERATING



**EX**  
SERIES

Commercial Condensing Boilers

EX 400  
EX 500  
EX 700  
EX 850

### WARNING

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

Do not store or use gasoline or other flammable vapors and liquids or other combustible materials in the vicinity of this or any other appliance.

#### If you smell gas:

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

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

# Water quality



## Warning

Water quality has a significant impact on the lifetime and performance of a boiler's heat exchanger.

Improperly prepared water in a heating circuit may cause damage to the heat exchanger through fouling or corrosion. Repeated or uncontrolled water fills will increase the potential for damage.

High levels of dissolved solids or minerals may precipitate out of the fluid onto the hottest part of the heat exchanger, impairing heat transfer and resulting in overheating and premature failure. The amount of solids that may form on the heat exchanger will depend on the degree of hardness and the total water volume in the system. A high water volume system with a low hardness count may cause as much damage as a system with less volume and higher hardness, so it is recommended to treat water so as to reduce dissolved solids to the minimum 10 ppm, and to no more than 30 ppm. Water chemistry allowable limits are as follows:

- » TDS is to be between 10 and 30 ppm
- » Acidity pH is to be between 6.6 and 8.5
- » Chloride is to be less than 125 mg/l
- » Iron is to be less than 0.3 mg/l
- » Cu less than 0.1 mg/l
- » Conductivity is to be between 20  $\mu$ S/cm and 400  $\mu$ S/cm at 77°F (25°C)

**Important:** Ensure that these limits are acceptable for the other water-side components in the system.

Shipped with the boiler:

- » 4 x anchor brackets (installed on pallet)
- » Condensate trap IBC # P-1221
- » Tridicator IBC # P-1234
- » Relief valve IBC # P-1205
- » 2 x Inlet gas pressure test fittings, IBC part # 190-206
- » 2 x spare air filters, IBC # P-381
- » Outdoor sensor, IBC part 240-025

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# Safety information



## Manual safety markings

	<b>Danger</b> Points out an immediate hazardous situation that must be avoided to prevent serious injury or death.
	<b>Warning</b> Points out a potential hazardous situation that must be avoided to prevent serious injury or death.
	<b>Caution</b> Points out a potential hazardous situation that must be avoided to prevent possible moderate injury and/or property damage.
	<b>Note</b> Points out installation, maintenance and operational notes to enhance efficiency, longevity and proper operation of the boiler.

## Important safety instructions

Installation, start-up and servicing of IBC boilers must be performed by competent, qualified, licensed and trained heating technicians.

Failure to read and comply with all instructions and applicable national and local codes may result in hazardous conditions that could result in property damage and injury to occupants, and in extreme cases to death. Keep instructions near the appliance for future reference.

	<b>Danger</b> Do not store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance. If you smell gas vapors, do not try to operate any appliance - do not touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a phone located remotely. Follow the gas supplier's instructions, or if the supplier is unavailable, contact the fire department.
	<b>Warning</b> Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, or loss of life. Read and understand the entire manual before attempting installation, start-up, operation, or service. Installation and service must be performed only by an experienced, skilled installer or service agency.  Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers' manuals before installing, starting up, operating, maintaining, or servicing the appliance.

**Warning**

Disconnect power supply before any wiring/service is performed. Failure to do so could result in damage to appliance and/or electric shock.

**Caution**

The boiler must be installed so that electrical components are not exposed to water during operation.

## Known contaminants

### Known Corrosive Contaminants to Avoid

Cements and glues	Refrigerant leaks from cracks in coils
Paint or varnish removers	Sodium chloride or potassium chloride used for water softening
Adhesives used to fasten building products and other similar products	Chemicals in perming solutions
Chlorinated waxes or cleaners	Chlorofluorocarbon chemicals found in spray cans
Chlorine-based swimming pool chemicals	Antistatic dryer sheets in clothes dryers
Hydrochloric acid or muriatic acid used in household cleaning and stain removal	Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Calcium chloride used for snow clearing	



# Specifications

Specifications	EX 400	EX 500	EX 700	EX 850
CSA Input (natural gas or propane)	40-399 MBH	50-500 MBH	70 - 700 MBH	85 - 850 MBH
CSA Input (natural gas or propane)	11.7 - 117 kW	14.6 - 146.5 kW	20.5 - 205 kW	24.9 - 249 kW
CSA Output	388 MBH	485 MBH	679 MBH	824.5 MBH
CSA Output	114 kW	142 kW	199 kW	241.6 kW
Thermal Efficiency ANSI-AHRI-1500	97.9%	97.5%	97.0%	97.0%
Minimum gas supply pressure (natural gas or propane)	4 inch w.c.	4 inch w.c.	4 inch w.c.	4 inch w.c.
Maximum gas supply pressure (natural gas or propane)	14 inch w.c.	14 inch w.c.	14 inch w.c.	14 inch w.c.
Ambient temperature Low	32°F / 0°C	32°F / 0°C	32°F / 0°C	32°F / 0°C
Ambient temperature High	122°F / 50°C	122°F / 50°C	122°F / 50°C	122°F / 50°C
Max. relative humidity (non-condensing)	90%	90%	90%	90%
Minimum water temp.	34°F / 1°C	34°F / 1°C	34°F / 1°C	34°F / 1°C
Maximum water temp. (electronic hi-limit)	190°F / 88°C	190°F / 88°C	190°F / 88°C	190°F / 88°C
Max. ΔT - supply/return (electronic fence)	80 °F / 44°C	80 °F / 44°C	80 °F / 44°C	80 °F / 44°C
Max. Water Temperature Lockout Limit	201°F / 94°C	201°F / 94°C	201°F / 94°C	201°F / 94°C
Power use (120Vac/60Hz) @ full fire - (less pumps)	150 W	210 W	195 W	228 W
Weight (empty)	Approx. 414 lbs/ 188 Kg	Approx. 441 lbs / 200 Kg	Approx. 486 lbs / 220 Kg	Approx. 510 lbs / 231 Kg
Heating surface area	55.3 ft <sup>2</sup> / 5.14 m <sup>2</sup>	72.9 ft <sup>2</sup> / 6.77 m <sup>2</sup>	84.6 ft <sup>2</sup> / 7.86 m <sup>2</sup>	99.88 ft <sup>2</sup> / 9.28 m <sup>2</sup>
Pressure vessel water content	13.5 USG / 51.1 Liters	12.4 USG / 46.9 Liters	17.5 USG / 66.3 Liters	16.4 USG / 62.0 Liters
Maximum boiler flow rate	100 USgpm / 378 lpm	100 USgpm / 378 lpm	100 USgpm / 378 lpm	100 USgpm / 378 lpm
Minimum boiler flow rate	10 USgpm / 38 lpm	12 USgpm / 45 lpm	18 USgpm / 68 lpm	21 USgpm / 80 lpm
Maximum operating water pressure	160 psig / 1,103 kPa	160 psig / 1,103 kPa	160 psig / 1,103 kPa	160 psig / 1,103 kPa

Specifications	EX 400	EX 500	EX 700	EX 850
Minimum water pressure	8 psig / 55 kPa	8 psig / 55 kPa	8 psig / 55 kPa	8 psig / 55 kPa
Relief valve pressure (supplied) - psig*	50 psig / 345 kPa	50 psig / 345 kPa	50 psig / 345 kPa	50 psig / 345 kPa
Approved installation altitude - ASL	0 - 12,000'	0-12,000'	0 - 12,000'	0-12,000'
Maximum equivalent vent length each side (vent & air intake) (natural gas or propane)	170'	170'	120'	120'

Air intake options: either direct vent or indoor supply

\*These alternative relief valves can be purchased: 30, 100, 125 and 150.

Ignition Stages Timings	
Fan Pre-purge	15 seconds
Trial for Ignition	4 seconds
Flame Failure Response	<0.8 second

**Table 1** Ignition Timings

## Connection specifications

The following table displays the required connection specifications for each model.

	EX 400, EX 500	EX 700, EX 850
Flue Outlet	4" Schedule 40	6" Schedule 40
Combustion Air Inlet	4" Schedule 40	4" Schedule 40 (See note below)
Water Outlet	2" NPT-M	2½" NPT-M
Water Inlet	2" NPT-M	2½" NPT-M
Knock-outs (8)	½"	½"
Gas Inlet	1" NPT-F	1" NPT-F
Condensate Outlet	¾" Hose	¾" Hose

**Table 2** Connections

**Note**

EX 700 and EX 850 combustion air venting must be in 6". You must transition to 6" vent piping within three feet of the 4" vent collar. See [Figure 25](#).

## Cabinet dimensions

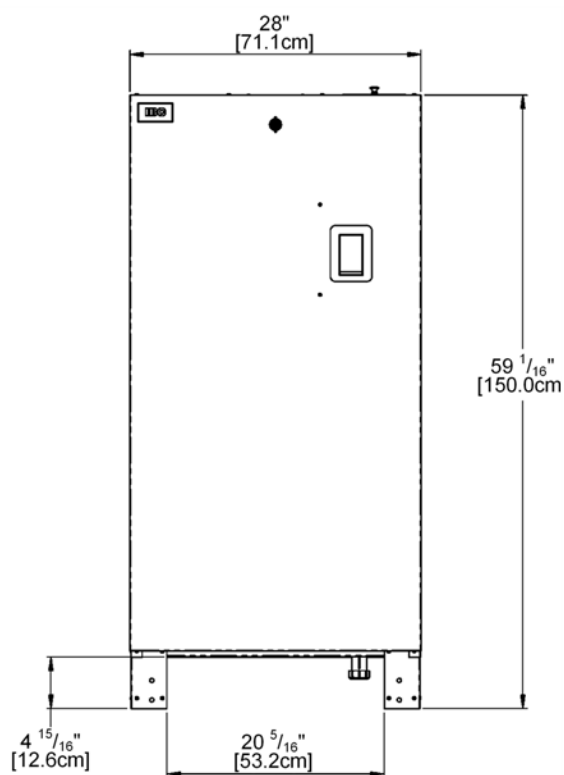


Figure 1 Frontal view - EX 400, EX 500

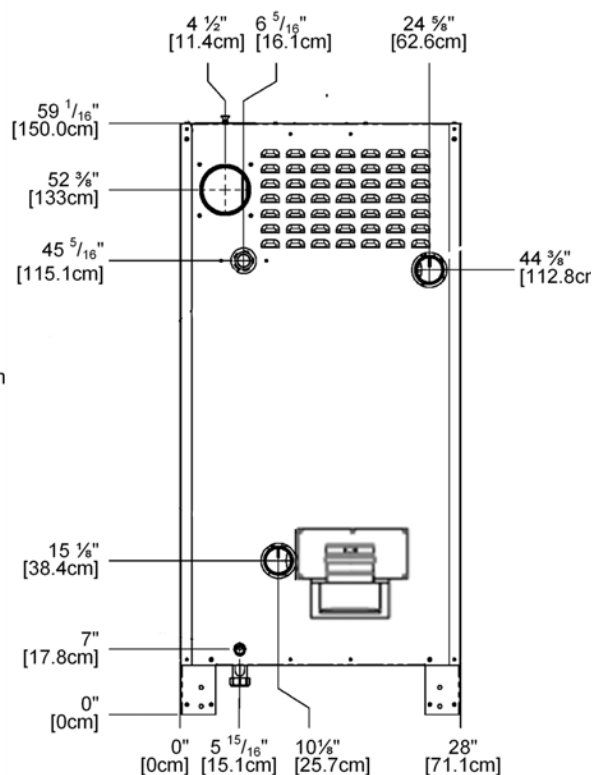


Figure 2 Back view - EX 400, EX 500

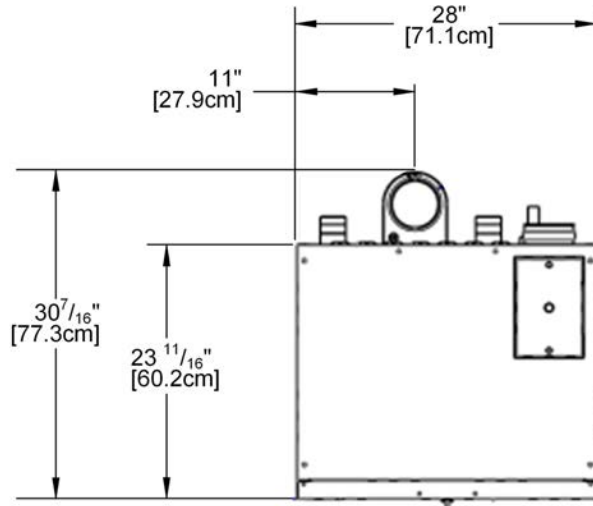


Figure 3 Top view - EX 400, EX 500

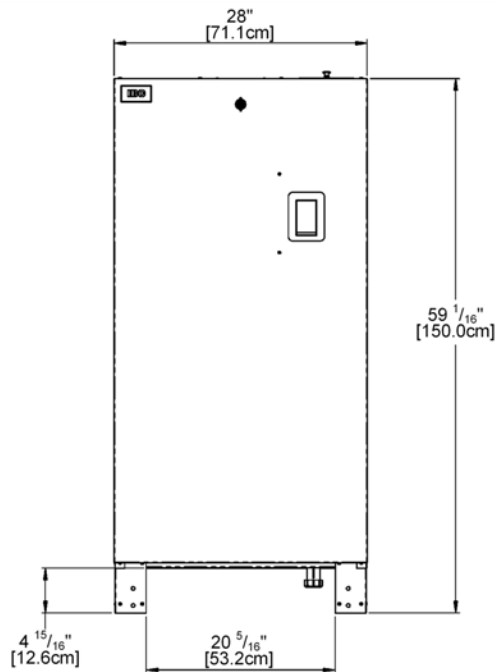


Figure 4 Frontal view - EX 700, EX 850

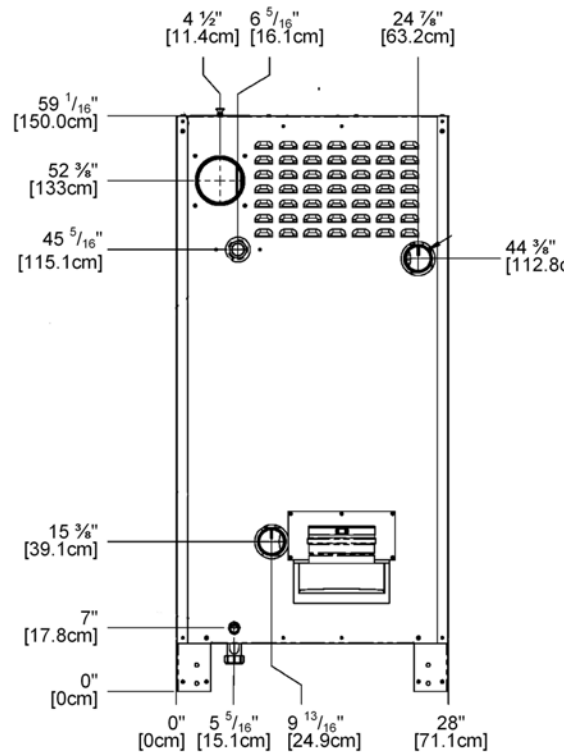


Figure 5 Back view - EX 700, EX 850

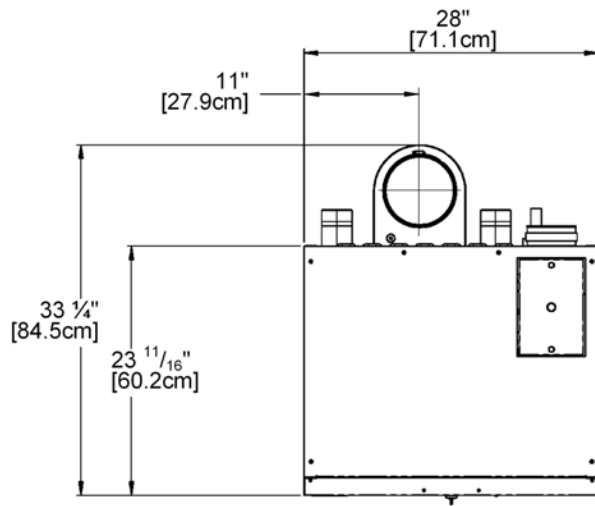


Figure 6 Top view - EX 700, EX 850

Intentionally left empty

## 2.0 Introduction

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IBC's range of large commercial boilers is the solution for large-scale projects such as apartment buildings, office buildings, big schools, hospitals, and hotels.

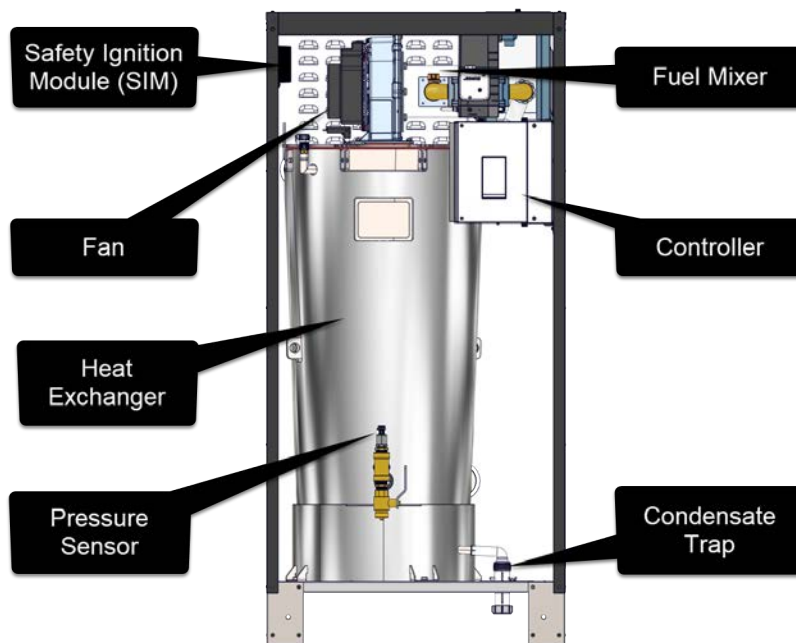


Figure 7 Front internal view

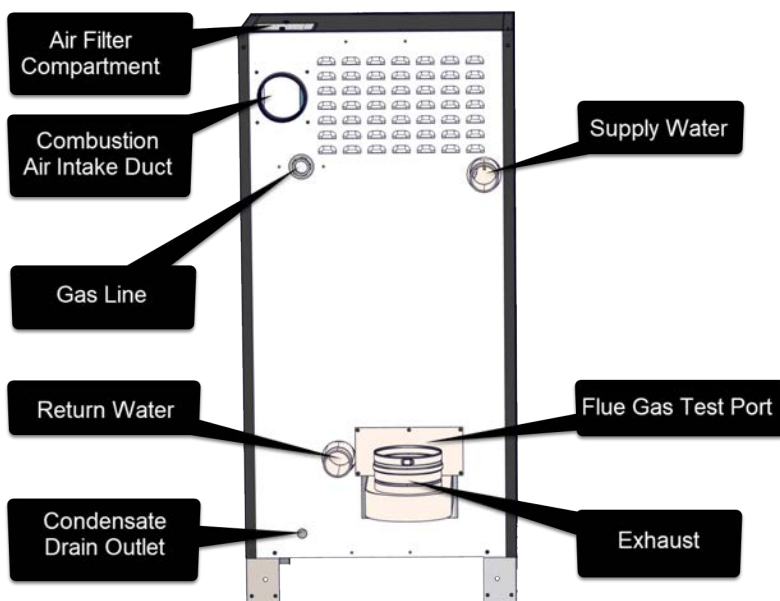


Figure 8 Back view of boiler

## 2.1 Standard features and benefits

- » High thermal efficiency
- » Built-in BACnet option
- » Turn-down ratio 10 to 1
- » Built-in 4-zone pump control
- » Multiple boilers: Up to 24 boilers can be connected without external controls
- » Maximum allowable  $\Delta T = 80^\circ\text{F}$  ( $44^\circ\text{C}$ )
- » 50 psi relief valve (345 kPa)
- » Boiler pump control up to  $\frac{3}{4}$  H.P. 120V or 208/240V

## 2.2 Warranty

IBC offers a 10-year-limited warranty on the EX series heat exchanger and a 2-year warranty on all parts against defects in materials or workmanship and failures due to thermal shock.


For more information and to obtain the EX series warranty form, go to [ibcboiler.com](http://ibcboiler.com).



## 3.0 Before installation

Before installing the appliance, it is important to review and observe the following checklist of precautions:

Precautions	Check
Care must be taken to properly size the boiler for its intended use.	<input type="checkbox"/>
Prolonged full fire run time, over-sizing or under-sizing, and incorrect flow rates through the boiler can lead to increased maintenance costs, equipment stress and premature failure.	
Ensure you install the boiler where the combustion air source is not subject to chemical fouling or agricultural vapors.	<input type="checkbox"/>
Exposure to corrosive chemical fumes such as chlorinated and/or fluorinated hydrocarbons can reduce the life of a boiler. Cleaners, bleaches, air fresheners, refrigerants, aerosol propellants, dry-cleaning fluids, de-greasers and paint-removers all contain vapors that can form corrosive acid compounds when burned in a gas flame. Airborne chlorides such as those released with the use of laundry detergents are also to be avoided.	
Locate the boiler where water leakage will not result in damage to the area.	<input type="checkbox"/>
If there is no suitable location, install a suitable drain pan under the boiler. Do not install above carpeting.	
At a new construction site, or during renovations, protect the boiler from drywall dust or other construction related contaminants.	<input type="checkbox"/>
Draw combustion air from a <b>clean</b> source (e.g., outdoors) and isolate the boiler from interior dust sources. Do not seal boiler case openings directly when firing - allow for air circulation and ventilation in the immediate area.	
Place the exhaust outlet 12" minimum above the down-turned intake to avoid exhaust re-ingestion.	<input type="checkbox"/>
For sidewall venting options, place the inlet and exhaust terminations on the same side of the building.	<input type="checkbox"/>
The elevation of both pipes can be raised in "periscope style" after passing through the wall to gain required clearance above grade and snow level.	
If using the indoor combustion air option, ensure combustion air openings to the boiler room remain unblocked and free of obstructions.	<input type="checkbox"/>
Examine the condensate outlet to ensure proper disposal of condensate will occur during operation. If condensates are to be discharged into building drain piping materials that are subject to corrosion, a neutralization package must be used.	<input type="checkbox"/>
Ensure that the pressure relief valve is installed with no valves or other means of isolation	<input type="checkbox"/>

Precautions	Check
between its inlet and the boiler. Make sure the relief valve outlet is piped with unobstructed piping (minimum 1" diameter) to a safe discharge location.	
If the boiler is likely to be exposed to fluid temperatures below 34° F (1° C), a method of protection to prevent freezing of condensate should be employed. Contact the factory for further information.	<input type="checkbox"/>
When the boiler is in operation, assess the impact of the steam plume normally at the exhaust terminal of a condensing boiler.	<input type="checkbox"/>
<p>Generally, intake and exhaust pipes should terminate at a rooftop or sterile wall location. Boiler condensate is corrosive. Protective measures must be taken to prevent corrosion damage to metal roofs or other metal building components in contact with the condensate. Keep exhaust plumes well away from all building air intakes including those of neighboring properties.</p>	
<div>  <p><b>Caution</b></p> <p>Care must be taken to properly size the boiler for its intended use. Prolonged full fire run time, over-sizing or under-sizing, and incorrect flow rates through the boiler can lead to increased maintenance costs, equipment stress and premature failure.</p> </div>	

## 4.0 Installation

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The gas-fired modulating boilers are low pressure, fully condensing appliances having a variable input range. Approved as “Category IV” vented appliances, the boilers use either Direct Vent (sealed combustion) or indoor combustion air, providing a great degree of installation flexibility.

### 4.1 Code requirements

The boilers are tested and certified under CSA 4.9 / ANSI Z21.13 (latest edition). Below are the code requirements for every installation.

Canada	US
Conform to local codes, or in the absence of these, with the latest editions of CAN/CGA B149.1 and the Canadian Electrical Code Part 1 CSA C22.2 No. 1.	Conform to the current National Fuel Gas Code ANSI Z223.1 and the National Electrical Code ANSI/NFPA 70.
Where required by jurisdiction, installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.	Where required by jurisdiction, installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.
If there is any conflict, follow the more stringent regulations.	If there is any conflict, follow the more stringent regulations.

**Table 3** Code requirements by country

### 4.2 Determining location of the appliance

The boilers are designed and approved for indoor installation in areas such as an alcove, basement, or utility room. These areas should have a surrounding temperature of 32 °F (0°C) to 122 °F (50 °C) and less than 90% relative humidity.

Even though EX models are approved for installation on combustible floors, do not install them on carpet.



### Warnings

- » Keep the area around a boiler clear of combustible materials, gasoline, and other flammable vapors and liquids.
- » Ensure combustion air is not drawn from areas containing corrosive air such as swimming pools or spas, including air directly next to outdoor pools and spas.
- » Ensure that a boiler is not exposed to water leaks from piping or components located overhead, including condensation from uninsulated cold water lines overhead.
- » Protect the gas ignition system components from water (dripping, spraying, rain, etc.) during appliance operation and when servicing (pump replacement, condensate trap servicing, control replacement, etc.).
- » Ensure that combustible materials do not make contact with exposed water piping and associated components (relief valves, circulators, etc.). Check local codes for required clearances and/or provide adequate insulation.

## 4.2.1 Factors to consider for best installation conditions

- » Install the boiler in areas where the combustion air source is not subject to chemical fouling or agricultural vapors. Exposure to corrosive chemical fumes such as chlorinated and/or fluorinated hydrocarbons can reduce the life of a boiler. See list of [Known contaminants on page 8](#). For this reason, do not use the indoor air venting option (using air surrounding the boiler) in a laundry room. Similarly, ensure any direct vent air source is not near a clothes dryer exhaust terminal. Avoid agricultural applications where the boiler and/or the intake air source are affected by ammonia and/or dust.
- » Avoid installing a boiler where water leakage will cause damage; for example, above carpeting. If unavoidable, install a suitable drain pan under the appliance.

Other factors to consider:

- » The minimum clearance requirements for combustible materials (see [Table 4](#)).
- » For adequate servicing, we recommend a minimum 30" clearance at the front and 12" above the boiler. Check local codes for additional access and service clearance requirements.
- » At a new construction site, or when renovating:
  - » Protect the boiler from drywall dust or other construction related contaminants.
  - » Ensure combustion air is drawn from a **clean** source (e.g., outdoors).
  - » Isolate the boiler from interior dust sources.

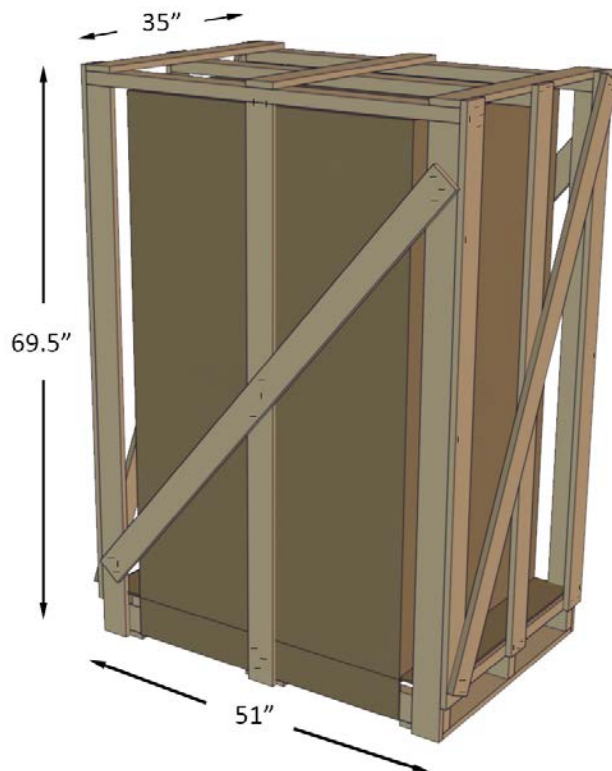
#### 4.2.1.1 Anchoring the boiler

Boiler weight – without water and any effect of system piping and components – is approximately 500 lbs / 225 kg.

Use the brackets provided to secure the boiler to the floor.

### 4.3 Unpacking a boiler

The boiler is shipped bolted to a pallet with four (4) anchor brackets and 3/8" Hex head bolts. Once the anchor brackets are removed they can be used to secure the boiler to the floor.



**Figure 9** Boiler packaging dimensions (inches)

## 4.4 Installation clearances



### Warning

Exposed water piping and associated components (relief valves, circulators, etc., should not be in contact with combustibile materials. Check local codes for required clearances and / or provide adequate insulation.

EX 400, EX 500, EX 700, EX 850		
Surface	Minimum distance from combustibile surfaces	Recommended clearance for installation and service
Front	2"	30"
Rear flue connection	2"	24"
Left side	1"	2"
Right side	1"	4"
Top	6"	12"
(required for filter replacement)		
Bottom	0	0

**Table 4** Clearance distances for boiler mounting sites

## 4.5 Exhaust venting and air intake venting



### Warning

Venting, condensate drainage, and combustion air systems for all IBC boilers must be installed in compliance with all applicable codes and with instructions provided in the respective installation manuals.

Inspect finished vent and air piping thoroughly to ensure all are airtight, and comply with the instructions provided as well as with the requirements of applicable codes. Failure to comply will result in severe personal injury or death.

When planning a boiler's installation, consider the appropriate vent materials, travel and termination.

An important consideration is managing the impact of the steam plume normally at the exhaust terminal of a condensing boiler. Generally, intake and exhaust pipes should terminate at a rooftop or sterile wall location to maximize customer satisfaction. Keep exhaust plumes well away from all building air intakes including those of neighboring properties.



① Flue gas exhaust to outdoors

Figure 10 Flue gas venting



**Danger**

Do not common vent EX series modulating boilers with any other existing or new appliance.

## 4.5.1 Code

All venting must be installed in accordance with the requirements of the jurisdiction having authority: in Canada, Part 8, Venting Systems of the B149.1-10 Code and any other local building codes are to be followed. In the USA, the National Fuel Gas Code, ANSI Z223.1, latest edition, prevails. Where there is a discrepancy between the installation instructions provided, and the code requirements, apply the more stringent.

Provisions for the combustion and air ventilation must be in accordance with the section “Air for Combustion and Ventilation” of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or Clause 8.2, 8.3 or 8.4 of the Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

#### 4.5.1.1 Important considerations when removing an existing boiler

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances that remain connected to it. When resizing any portion of the common venting system, use the minimum size according to the appropriate tables in the National Fuel Gas Code, ANSI Z223.1 - latest edition. In Canada, use the B149.1 Installation Code.

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:

- » Seal any unused opening in the common venting system.
- » Visually inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies that could cause an unsafe condition.
- » (Where practical) Close all building doors and windows such as doors adjacent to appliances remaining connected to the common venting system 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.
- » Place in operation the appliance being inspected.
  - » Follow the lighting instructions.
  - » Adjust the thermostat so that the appliance operates continuously.
- » After determining that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition.
- » Any improper operation of the common venting system should be corrected, so the installation conforms with the National Fuel Gas Code, ANSI Z223.1 - latest edition. In Canada, all installations must conform with the current CAN/CGA - B149.1-10 Installation Code and/or local codes.

**Warning**

Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.



## 4.5.2 Applications

All EX series boilers are approved with alternative venting options: either 2-pipe direct vent or vent pipe with indoor air. With the direct vent case, combustion air is piped directly to the boiler's air intake from outdoors (see [Installation on page 19](#) for air intake piping requirements). Using the indoor air alternative, air for combustion is drawn from the indoor air surrounding the boiler.

Provided the maximum overall vent length limit is not exceeded, the boiler may be vented through the wall, directly through the roof, or upward using an existing - but otherwise unused - chimney as a vent raceway.

## 4.5.3 Exhaust vent material



### Warning

Condensate can cause corrosion of metal roofing components and other roofing materials. Check with the builder or roofing contractor to ensure that materials are resistant to acidic condensate. pH levels can be as low as 3.0.

### Exhaust vent material – CANADA

Use PVC, CPVC, Polypropylene (PP), or Stainless Steel (SS) vent component systems approved under ULC-S636 Standard for Type BH Gas Venting Systems, or stainless steel Type BH venting systems. The vent temperature is limited by the boiler controller with the use of a flue temperature sensor to ensure the maximum temperature of the PVC venting material is not exceeded.

### Exhaust vent material – USA

PVC, CPVC, PP, or SS venting materials are approved for use with these boilers in most of the USA. Check local codes to determine if any materials are prohibited. The vent temperature is limited with the use of the flue temperature sensor and software to ensure that the maximum temperature of the PVC venting material is not exceeded. PVC venting material shall be certified to Sch. 40 ASTM D1785 or D2665. CPVC material shall be certified to Sch. 40/ASTM F441.

### Exhaust vent material

Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in venting systems is prohibited.

Do not use ABS or any cellular core pipe for exhaust venting.

The exhaust fitting of the EX 400 and EX 500 has a 4-inch PVC (Schedule 40) connection while the exhaust fitting for the EX 700 and EX 850 has a 6-inch PVC (schedule 40) connection. Use fittings to adapt to either PP or SS venting material. Insert exhaust venting directly into the female stainless steel fitting, and secure with the built-in clamp (see [Figure 11](#)).

For PP material use the 6" (EX700/850) transition / adapter fitting (Sch 40 to PP) offered by the respective PP manufacturers Centrotherm / Innoflue™ (their part # ISAAL0606) or M&G Dura Vent / PolyPro™ (# 6PPS-06PVCM-6PPF [10004281]), (# 6PPS-AD). For PP material exposed to outdoor weather, follow the venting supplier's recommendations on UV protection.

For SS material, use the 6" transition / adapter fitting offered by the SS manufacturers M&G Dura Vent (# FSA-6PVCM-6FNSF [300538]) or Heat Fab (Saf-T-Vent) 9601PVC. The EX400/500 uses the respective 4" transitions.

**Warning**

Ensure that you lubricate the gasket with silicone grease before inserting the venting material. Fully insert the approved venting material into the boiler's exhaust outlet, and tighten clamp to ensure the venting connection is locked in place (as shown below).

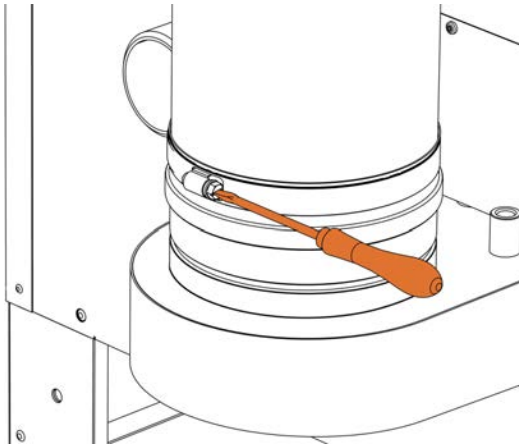


Figure 11 *Securing the vent connection*

Venting must be supported in accordance with the applicable code and instructions supplied by the manufacturers.

**Warning**

Do not mix PP venting materials from different manufacturers. These venting materials are designed to be installed as part of a complete system. Failure to comply may result in severe personal injury or death.

#### 4.5.4 Vent travel

PVC/CPVC (Schedule 40), PP (Rigid Single Wall), or SS approved piping are the standard venting options that can be sited from the vent termination.

**Warning**

Follow all installation instructions supplied by the pipe and fitting manufacturer.

The actual vent travel allowance is reduced for fittings as shown in the following tables:

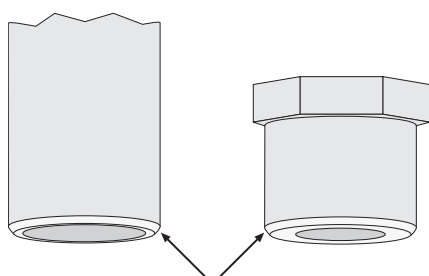
Exhaust / Fittings	EX 400, EX 500	EX 700, EX 850
4-inch rigid pipe	170 ft (max.) each side	Not allowed
6-inch rigid pipe	n/a	120 ft (max.) each side
90° vent elbow	allow 5 ft for each elbow	
45° elbow	allow 3 ft for each elbow	
PPs 87-90° elbows	allow 5 ft for each elbow	

**Table 5** Maximum Exhaust Venting Length for EX 400, 500, 700, and 850 models

For example, for an EX 850 using 6 x 90° CPVC vent elbows, the maximum lineal measure of pipe allowed is 90 feet ( $120' - (6 \times 5') = 90'$ ).

**Note**

Unused intake travel cannot be added to the exhaust. Unequal intake and exhaust piping is allowed.



ENSURE PIPE AND FITTINGS ARE BEVELED  
FOR TROUBLE-FREE INSERTION THROUGH  
EXHAUST AND INTAKE PIPE GASKETS  
WET GASKETS AND PIPE BEFORE INSERTION

Exhaust venting must slope down towards the boiler with a pitch of at least 1/4" per foot (PP vent: follow PP manufacturer requirements for slope), so condensate runs back towards the trap. Support should be provided for intake and vent piping, particularly for horizontal runs (follow local code)

**Figure 12** Pipe and fitting beveling

- » Check that material meets local codes including fire stopping requirements. Some local jurisdictions require a minimum initial length of pipe be exposed or accessible for inspection. Pipe clearances - no IBC requirements; follow local codes. All piping must be liquid and pressure tight.
- » Ensure all venting components are clear of burrs/debris prior to assembly. Clear plastic debris left in the combustion air piping to avoid intake into the fan.
- » Secure joints using appropriate solvent cement to bond the respective regionally-approved pipe material (CPVC cement approved under ULC-S636, in accordance with its manufacturer instructions; PVC (ASTM D2564), or PVC/ABS (D2235)). - Use transition glue anywhere that PVC and CPVC are joined. Follow the cement manufacturer's instructions closely when joining various components. For PP, connections shall be secured using approved retainer clips supplied by the respective PP manufacturer.
- » Check that vent connections are liquid and pressure tight. Prior to firing the boiler, and before any of the venting run is concealed by the building construction, the installer must test the exhaust joints under fan pressure with the vent blocked, using a soap and water solution. The installer must fill the condensate trap prior to testing.

To drive the fan into manual high speed operation for vent leak testing, from the touchscreen controller go to ●●● (More) > **Test Operation** > Set **Vent Test** to "On". Paint all joints with an approved leak test solution just as you would joints in a gas line, and make sure there are no leaks. We suggest attaching a tag on the vent line near the condensate drain tee with the type of test, the date and the installer's name.

### 4.5.5 Venting passage through ceiling and floor

- » Confirm material meets local codes including fire stopping requirements.
- » Check the local jurisdiction on the minimum initial length of pipe that should be exposed or accessible for inspection.
- » Follow the local codes for pipe clearances - no IBC requirements.
- » Ensure that piping is liquid and pressure tight.

## 4.5.6 Rooftop vent termination



### Warning

Condensate can cause corrosion of metal roofing components and other roofing materials. Check with the builder or roofing contractor to ensure that materials are resistant to acidic condensate. pH levels can be as low as 3.0.

- a. Rooftop vents must terminate as follows:
  - » The exhaust pipe can terminate in an open vertical orientation without concern about rain infiltration; rain will drain away through the condensate trap.
  - » Optional bird screen may be placed in a termination fitting. Leave unglued, and hold in place with a short nipple. This permits easy access for cleaning.
  - » **Do not** exhaust vent into a common venting system.
- b. For rooftop direct vent systems:
  - » Rooftop, two pipe, direct vent configurations, including typical clearance requirements are shown below in the following images.

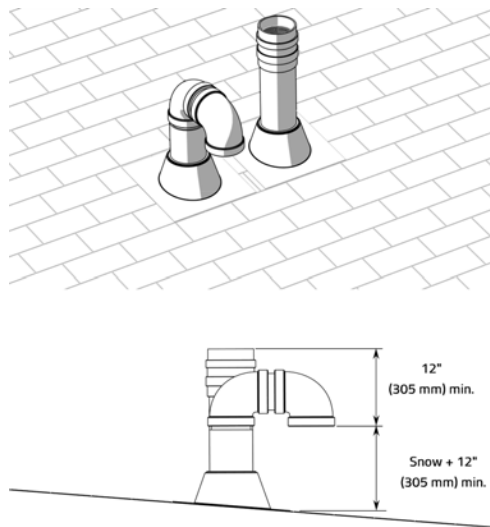


Figure 13 Rooftop vent terminal configurations

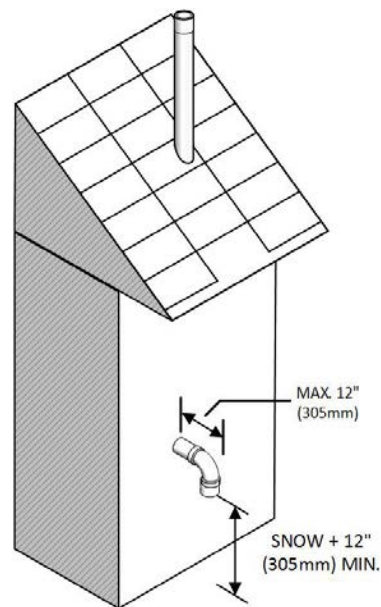
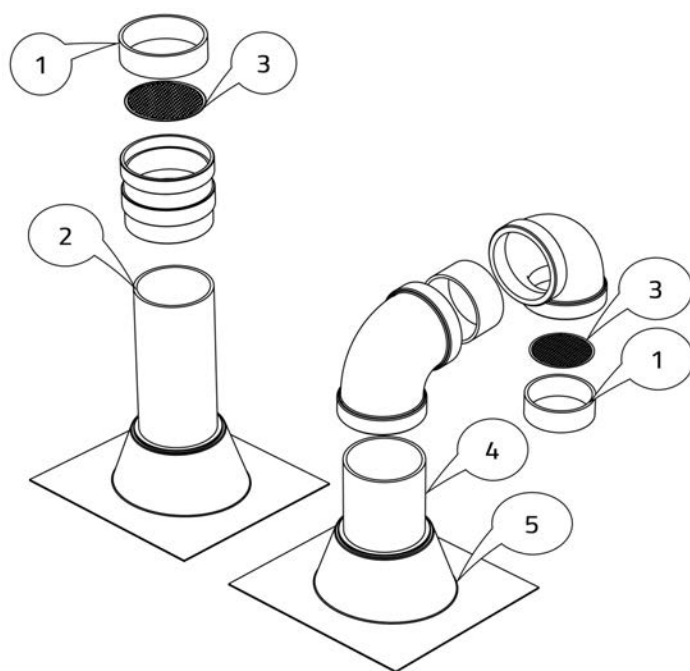


Figure 14 Rooftop vent termination with sidewall combustion air



① Vent screen retainer

② Exhaust

③ Vent screen

④ Inlet

⑤ Flashing

**Figure 15** Rooftop vent terminal vent screen and retainer

- » The intake air pipe is not typically drained, so it must be terminated with a down-turned elbow as shown.
- » The intake pipe does not need to penetrate the roof at the same elevation as the exhaust (as shown); lower down on the roof is acceptable.

**Best Practice:** To reduce the possibility of expansion noise, allow a ¼" gap around the exhaust and air intake piping.

- » For roof top venting of multiple boiler sets, group all intake terminals together for a common penetration through a custom cap. Alternatively, place close together using commonly available pipe flashing. Similarly, group the exhaust pipes and place the two separate groups of pipes at least 3' apart (the closest intake and exhaust pipes shall be 36", or more, apart). Use the same 12" (minimum) vertical separation for all termination options. For alternate group terminations, contact the IBC Factory for written guidance.
- » Roof top termination kits, e.g. concentric kits, are approved for use with the boiler model. Installation of the vertical roof top termination must follow the installation instructions supplied with the venting material manufacturer. Care must be taken to install the termination kit a minimum horizontal distance of 10' (305 cm) away from any portion of the building and a minimum of 2' (61 cm) above the roof line plus the anticipated snow line.

**Caution**

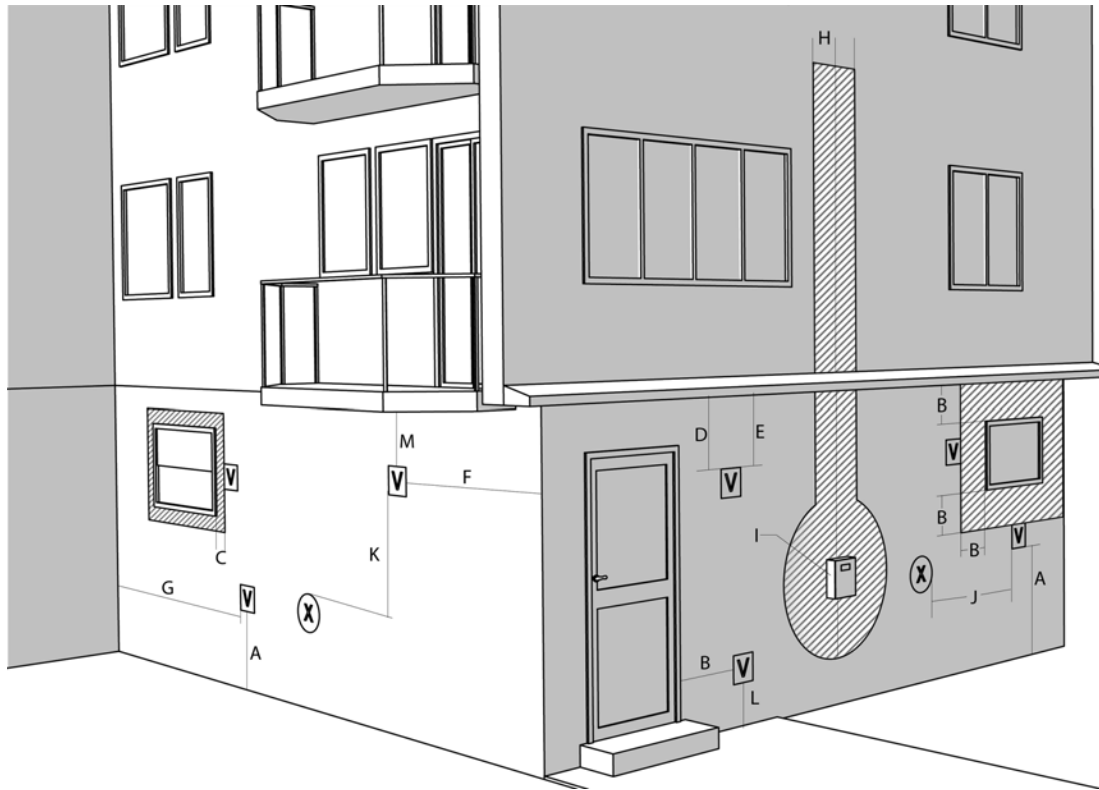
Take care installing Termination kits when the outdoor temperature drops below 5°F/-15°C. Possible blockage of the combustion air intake can occur when the outdoor temperature drops below this temperature.

## 4.5.7 Sidewall vent termination

### Sidewall vent termination

**Caution**

Vent termination clearances in this section are code minimum, or IBC-recommended minimum requirements, and may be inadequate for your installation. Building envelope details must be examined carefully. Take action to avoid moisture entering building structures. Serious structural damage may occur if adequate precautions and clearances are not considered. These precautions apply to neighboring structures as well as to the structure the boiler(s) are installed in.



- V Vent terminal
- X Air supply inlet
- Area where terminal is not permitted

**Figure 16** Minimum clearances from vent/air inlet terminations



	Description	Canadian Installations <sup>1,2</sup>	US Installations <sup>2,3</sup>
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36 in (91 cm) for appliances >100,000 Btuh (30 kW)	12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	4 ft (1.22 m)	4 ft (1.22 m)
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft above the meter/regulator assembly	*
I	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	36 in (91 cm) for appliances >100,000 Btuh (30 kW)	12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K	Clearance to mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally

<sup>1</sup>In accordance with the current CAN/CSA-B149 Installation Codes.

<sup>2</sup>If locally adopted installation codes specify clearances different than those illustrated, then the most stringent shall apply.

<sup>3</sup>In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code.

\*Clearances in accordance with local installation codes and the requirements of the gas supplier. The minimum distance from adjacent public walkways, adjacent buildings, openable windows, and building openings shall not be less than those values specified in the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CSA 8149.1.

	Description	Canadian Installations <sup>1,2</sup>	US Installations <sup>2,3</sup>
L	Do not terminate above paved sidewalk or paved driveway	7 ft (2.13 m) <sup>4</sup>	Vents cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard
M	Clearance under veranda, porch, deck or balcony	12 in (30 cm) <sup>5</sup>	*

**Table 6** Vent/air inlet termination clearances

Sidewall direct vent with separate vent and air pipes must be terminated as follows:

- » Locate the intake air and exhaust vent terminations on the same plane (side) of the building.
- » Place the exhaust vent termination so that it reaches minimum 12" above the down-turned intake to avoid exhaust re-ingestion.
- » (Optionally) Raise the elevation of exhaust termination "periscope style" after passing through the wall, to gain the required clearance as shown in [Figure 17](#) and [Figure 18](#).
- » Use a 45° elbow on the exhaust termination to launch the plume up and off the sidewall (for protection of wall). A short piece of venting cut at 45° gives a horizontal termination protected from wind loads (see [Figure 18](#), and [Figure 20](#)).
- » Recommended: the use of a bird screen of ¼" stainless steel or plastic mesh (IPEX System 636 drain grate) to guard against foreign objects.
- » 'Pancake-style' sidewall termination kits are not approved for use with the EX-series.



**Caution**

Refer to local code requirements or restrictions when installing concentric side wall termination kits. Ensure that the termination and venting slope back to the appliance.

<sup>1</sup>In accordance with the current CAN/CSA-B149 Installation Codes.

<sup>2</sup>If locally adopted installation codes specify clearances different than those illustrated, then the most stringent shall apply.

<sup>3</sup>In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code.

<sup>4</sup>A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

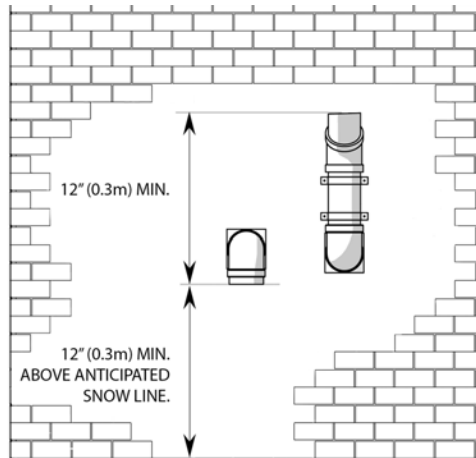
<sup>5</sup>Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

\*Clearances in accordance with local installation codes and the requirements of the gas supplier. The minimum distance from adjacent public walkways, adjacent buildings, openable windows, and building openings shall not be less than those values specified in the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CSA 8149.1.

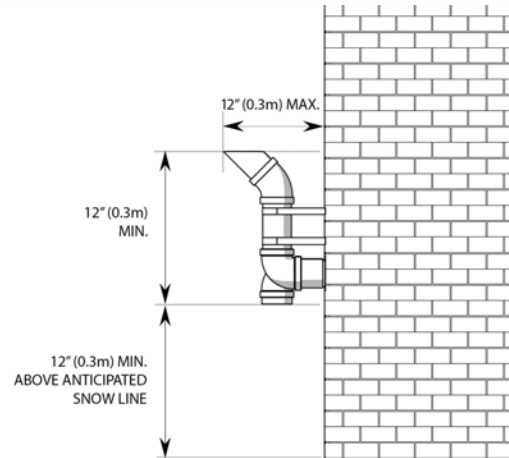


### Warning

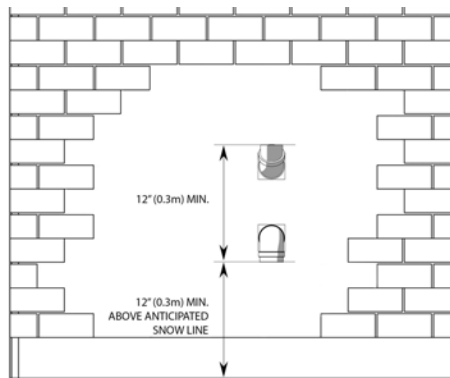
**Important!:** Maintain at least the minimum separation of exhaust vent termination from boiler intake air as illustrated in [Figure 17](#), [Figure 18](#), [Figure 19](#) and [Figure 20](#). Failure to do so can result in a dangerous situation where exhaust gasses are re-ingested with combustion air. Damage to the boiler can result from a failure to maintain these separations. Third party vent termination kits and concentric wall penetration kits that do not maintain these minimum separations must **not** be used. Improper installation will void the warranty.



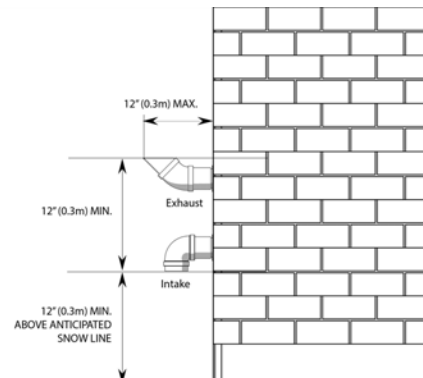
**Figure 17** Vent termination clearance, side-by-side perforations



**Figure 18** Vent termination clearances, side-by-side perforations, side view



**Figure 19** Vent termination clearance, stacked



**Figure 20** Vent termination clearances, stacked, side view

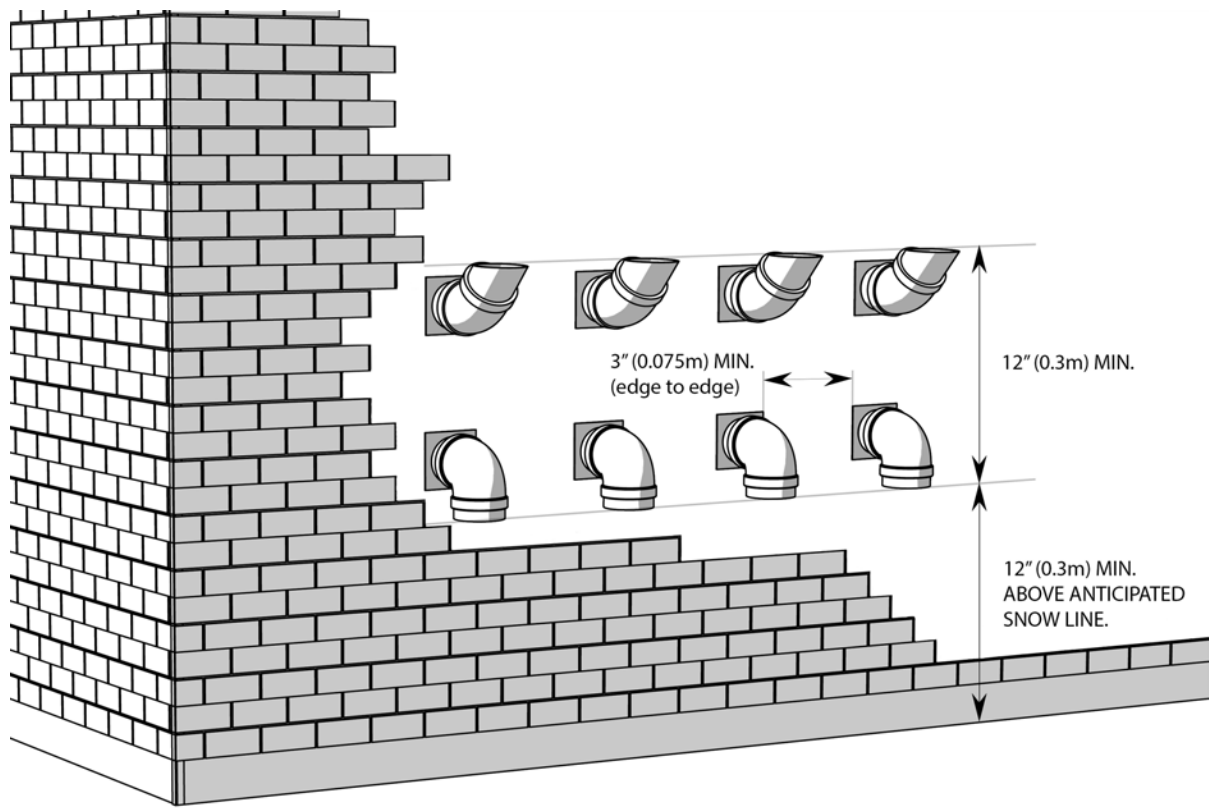


Figure 21 Sidewall multi-vent terminations, stacked option

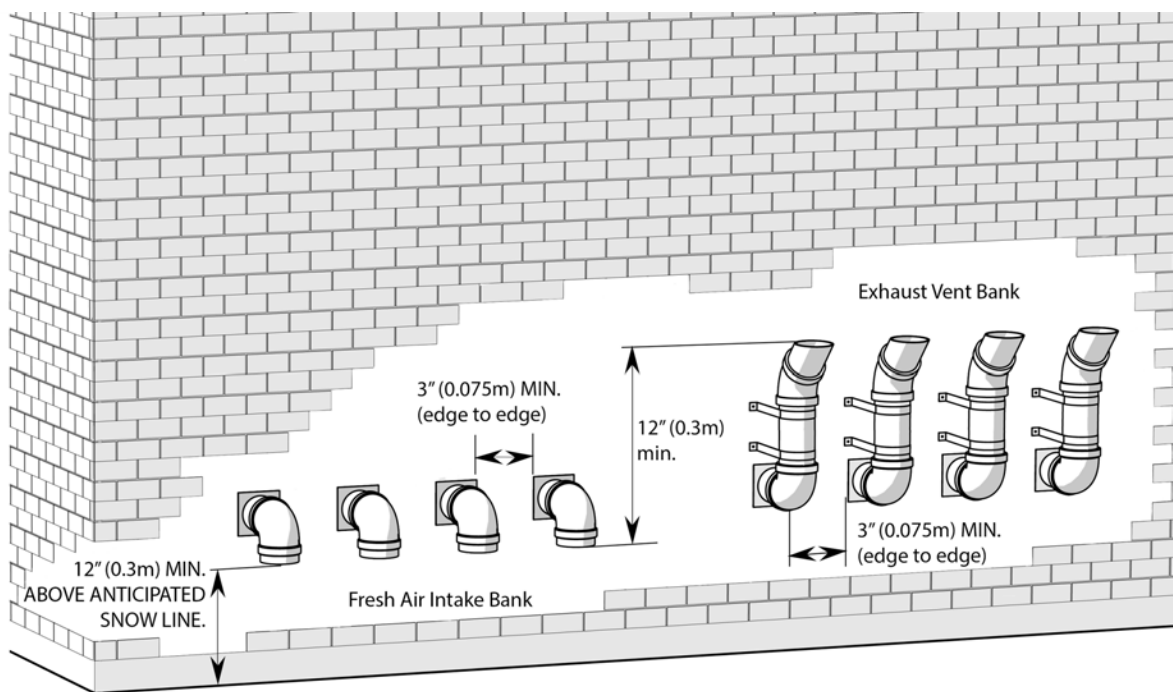


Figure 22 Sidewall multi-vent terminations, side-by-side option

**Warning**

In areas of high snowfall, users must be advised to check side wall vent and air intake terminations on a regular basis to ensure blockage does not occur.

- » Where an exhaust passes through a sidewall too close to a soffit, the venting must extend past the soffit by transitioning to vertical as shown in [Figure 23](#).

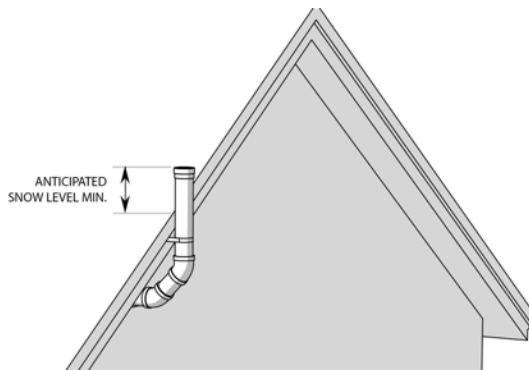


Figure 23 Sidewall vent termination transition to vertical to clear soffit

- » This illustrates the scenario where indoor air is used for combustion. Where combustion air is drawn from outdoors, combustion venting should also transition to vertical and terminations should observe the limitations set out in Fig. 5.

## 4.5.8 Direct vent combustion air intake piping

The direct vent option uses piping from the outside to supply combustion air directly to the boiler's combustion air connection. Combustion air piping - if used - is inserted directly into the 4" PVC-sized fitting, and increased to 6" within 3 feet.


At a new construction site, or during renovations, action must be taken to protect the boiler from drywall dust or other construction related contaminants; combustion air should be drawn from a **clean** source (e.g. outdoors) and the boiler should be isolated from interior dust sources. Do not seal boiler case openings directly when firing.

### Known Corrosive Contaminants to Avoid

Cements and glues	Refrigerant leaks from cracks in coils
Paint or varnish removers	Sodium chloride or potassium chloride used for water softening

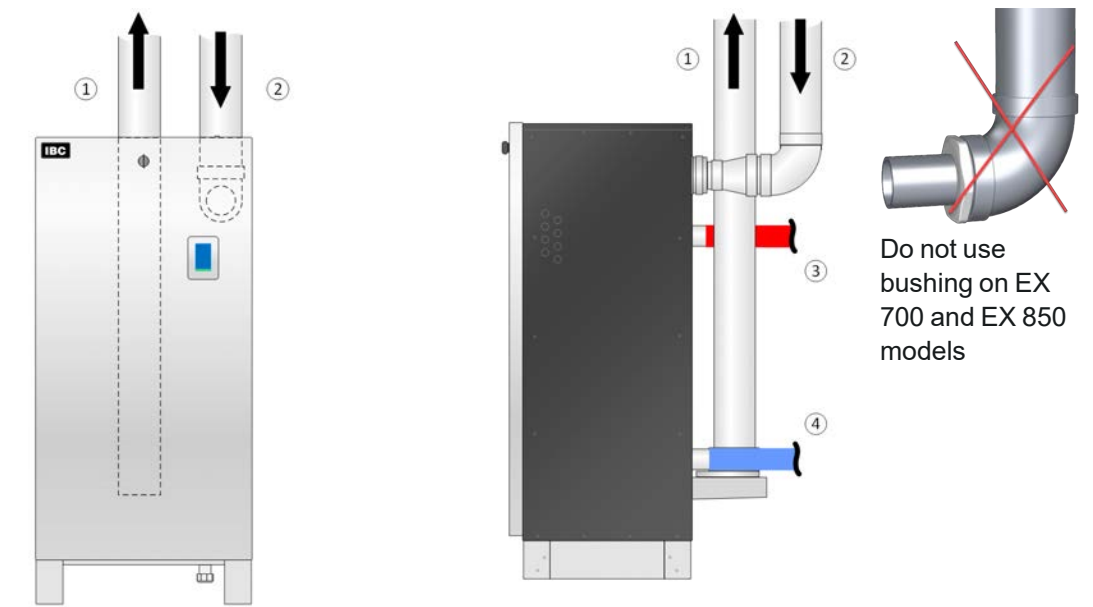
Known Corrosive Contaminants to Avoid

Adhesives used to fasten building products and other similar products	Chemicals in perming solutions
Chlorinated waxes or cleaners	Chlorofluorocarbon chemicals found in spray cans
Chlorine-based swimming pool chemicals	Antistatic dryer sheets in clothes dryers
Hydrochloric acid or muriatic acid used in household cleaning and stain removal	Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Calcium chloride used for snow clearing	



**Warnings**

- » In addition to preventing ingestion of chemical contaminants, ensure air intake terminals are not installed in locations where contamination might occur due to ingestion of particulate foreign material (dust, dirt and debris).
- » Configure intake air openings, so that rain or other forms of moisture cannot enter the air intake piping system. Otherwise serious damage to the boiler may result.

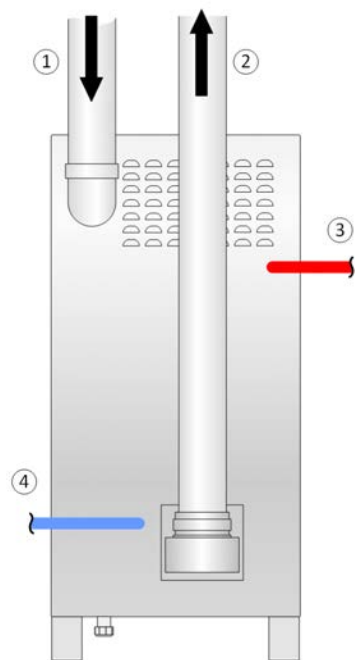


1	Flue gas exhaust to outdoors (connection at rear of boiler)	Flue gas exhaust to outdoors
2	Combustion air from outdoors. "Direct Vent" installation: check air intake outside is clear of obstructions.	Combustion air from outdoors. Use reducing coupling to transition from 4" connection to 6" venting within 3 feet.
3	n/a	Boiler supply

④	n/a	Boiler return
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Figure 24 Direct vent combustion air intake

Figure 25 Combustion air intake - side view



①	Combustion air from outdoors	
②	Flue gas exhaust to outdoors	
③	Boiler supply connection at rear of boiler	
④	Boiler return connection at rear of boiler	

Figure 26 Rear view - combustion air intake

**Notes**

- » When installing air intake piping, ensure that a "trap" is not formed in the piping causing a build-up of water and blockage of intake air. Such blockages will cause a boiler safety shut-down.
- » Filters require checking and cleaning or replacing on a regular schedule based on the severity of the problem.

Intake / Fittings	EX 400, EX 500	EX 700, EX 850
4-inch rigid pipe	170 ft max. each side	Not allowed
6-inch rigid pipe	n/a	120 ft max. (See note below)
90° vent elbow		allow 5 ft for each elbow
45° elbow		allow 8 ft for each elbow
PPs 87-90° elbows		allow 3 ft for each elbow

**Table 7** Maximum intake pipe venting length for EX 400, 500, 700, and 850

**Note**

EX 700 and EX 850 combustion air venting must be in 6". You must transition to 6" vent piping within three feet of the 4" vent collar. See [Figure 25](#).

For the inlet air – Schedule 40 PVC, CPVC, ABS, PP or SS piping of any type is permitted.

**Note**

Unused intake travel cannot be added to the exhaust. Unequal intake and exhaust piping is allowed.

Ensure that adequate separation is maintained between the air intake inlet and the vent terminal. Refer to the vent terminal configuration drawings in the Vent Termination section above.

Use support for intake piping, particularly for horizontal runs (follow local codes).

## 4.5.9 Indoor air combustion air intake

An "Indoor Combustion Air installation" can be described as air for combustion that is taken from the air surrounding the boiler.



**Warning**

When using indoor air options, supply adequate combustion air to the boiler room according to the requirements of all applicable codes.





- ① Flue gas exhaust to outdoors
- ② Combustion air from boiler room. For indoor air installation, check air intake and boiler room combustion air opening(s) to ensure they are clear of obstructions.

Figure 27 Indoor combustion air intake

To support combustion, an ample air supply is required. This may require direct openings in the boiler room to the outside. If the boiler is not in a room adjacent to an outside wall, air may be ducted from outside wall openings.

Provisions for combustion and ventilation air must be made as follows:

- » in the USA, in accordance with the National Fuel Gas Code, ANSI Z223.1 (latest edition), or applicable provisions of the local building codes.
- » in Canada, in compliance with B149.1 (latest edition), or applicable provisions of the local building codes.

## 4.5.10 Combustion air filtration system

A built-in combustion air filter system is supplied with the boiler, and is located at the top of the appliance. The boilers use a 10" x 10" x 1" (MERV 8) filter.

End users will need to be instructed on how to maintain the filter in the boiler. For instructions on how to replace the filter, see [Replacing the air filter on page 114](#).

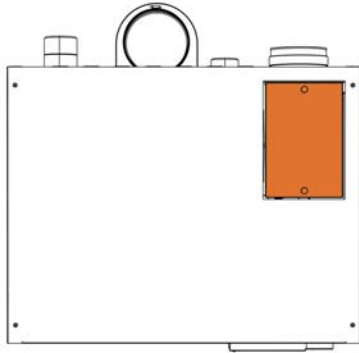


Figure 28 Filter door - top view of boiler

## 4.6 Installing a condensate trap

IBC's specified vent configuration promotes the safe drainage of moisture from the boiler and exhaust venting without flowing liquids back through the heat exchanger (as done by some other condensing boilers).

Reliable system operation requires:

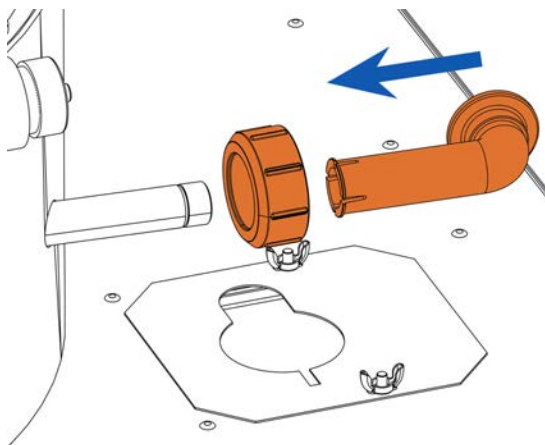
1. Proper design and installation of exhaust venting to allow condensate to run back to the drain/trap.
2. Acid neutralization as appropriate.

To achieve these:

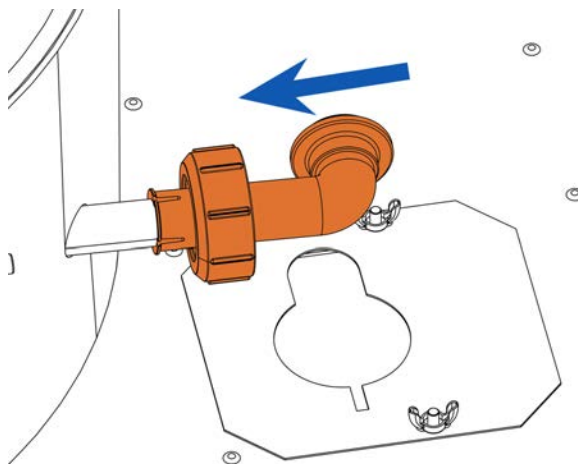
- » Allow a minimum  $\frac{1}{4}$ " per foot slope back to the vent connection, with appropriate hangers to maintain that gradient. For PP venting, follow the manufacturer's requirements. This will ensure proper drainage and prevent condensate from clogging.
- » Ensure the supplied trap is correctly installed and filled with water.
- » When required, add (and maintain in good condition) a neutralization tank. For information on installing a condensate neutralizer, see [Installing a condensate neutralizer on page 45](#).

The condensate trap must be installed on the drain connection at the base of the boiler. The condensate drain must be piped to within 1" of a drain or connected to a condensate pump. The drainage line must slope down to the drain at a pitch of  $\frac{1}{4}$ " per foot so condensate runs towards the drain.

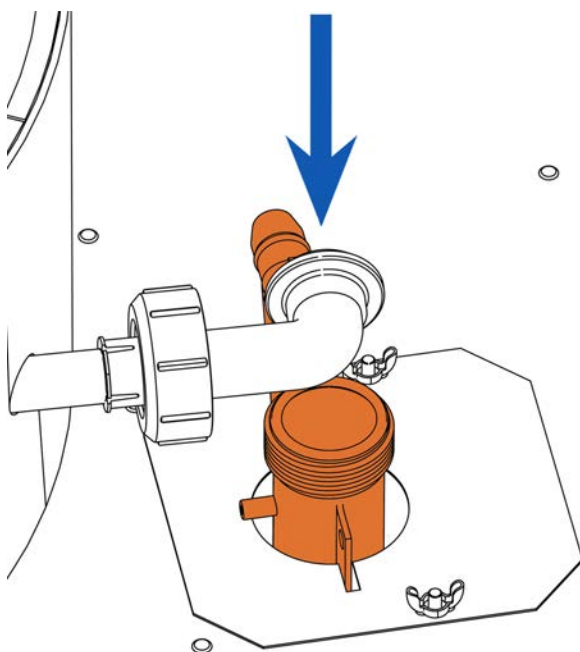
- 1.** Slide the union nut onto the elbow. The union nut must include an embedded O-ring. Ensure that the O-ring seal is in place on the heat exchanger's stainless steel outlet tube.



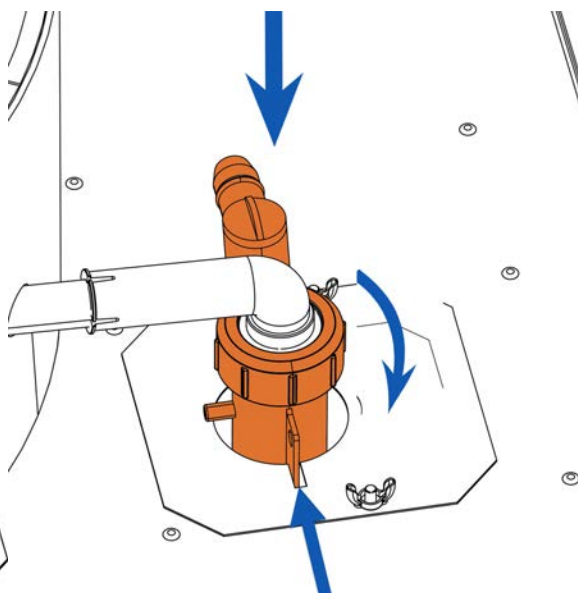
- 2.** Attach the elbow and union nut firmly to the boiler's outlet tube, making sure that you rotate the elbow sideways.

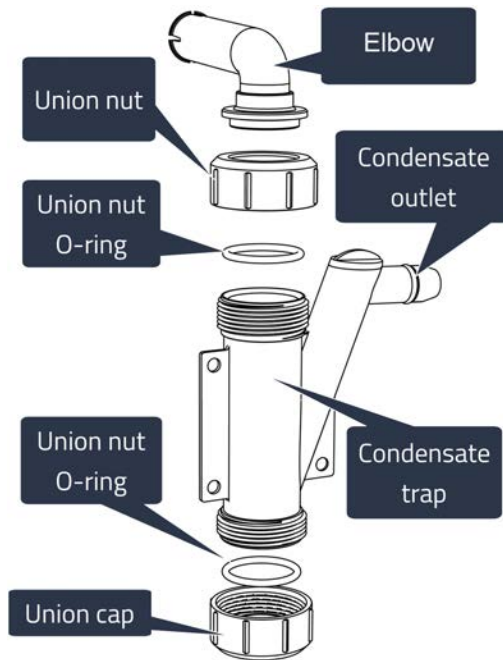


- 3.** Fill the condensate trap with water and insert the trap into the hole of the metal plate.



- 4.** Rotate the elbow, and tighten the union nut, so that the elbow and condensate trap are secured. Ensure the union nut O-ring is included. Check for leaks.





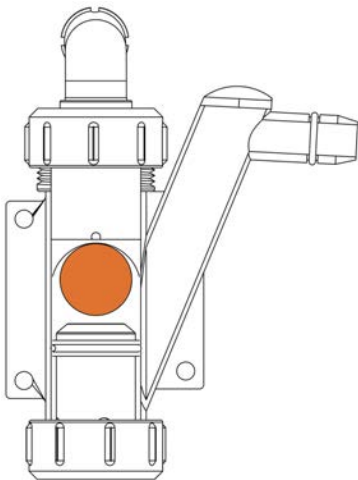
### Warning

Fill the trap with water before initially firing the boiler to prevent exhaust fumes from entering the room. Never operate the boiler unless the trap is filled with water. Failure to comply will result in severe personal injury or death.

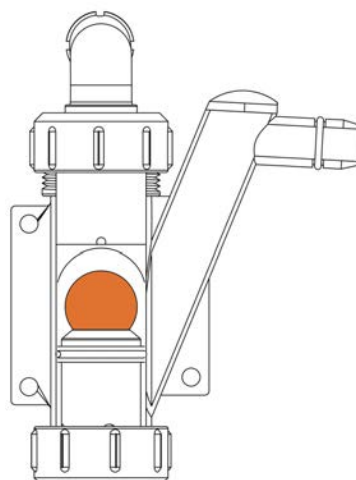


### Caution

Sometimes at startup, after filling the trap with water, the ball remains wedged at the bottom of the trap.



**Figure 29** *Correct* position of the ball after filling the trap with water.



**Figure 30** *Incorrect* position of ball after filling the trap with water.

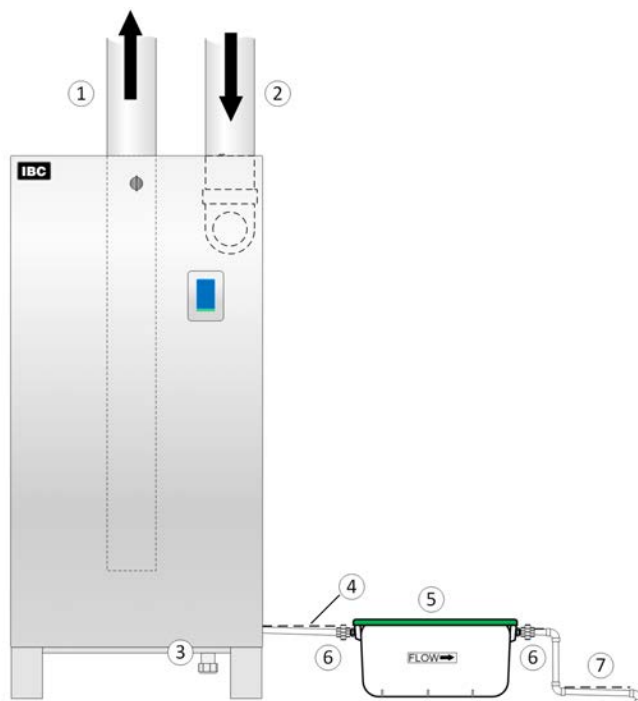
## 4.7 Installing a condensate neutralizer

If discharging condensate into building drain piping materials that are subject to corrosion, use a neutralization package.



### Warning

After installing a condensate neutralization package, the pH of the condensate discharge must be measured on a regular schedule to ensure the neutralizing agent is active and effective.



- ① Flue gas exhaust (connection at rear of boiler): condensate, and potentially rain water, flow back from the venting system.
- ② Air intake piping: **Warning** - Risk of damage to appliance. Ensure rain water is prevented from entering.
- ③ Free flow of condensate from venting systems and the pressure vessel must be maintained at all times. Trap and condensate drain piping must be accessible to allow regular inspection and cleaning.
- ④ Condensate water line: **Warning** - Risk of damage to appliance. All condensate discharge lines, including neutralization tank inlet, must be at a lower elevation than the condensate water line of the appliance.
- ⑤ Condensate neutralizer: Drain materials subject to corrosion must be protected by acid

neutralization. Access to the discharge, before the drain, is necessary for proper maintenance in order to check the effectiveness of the neutralizing agent. A simple pH test should be performed annually to ensure neutralizing agent is still effective. If the pH falls below 6.5 the neutralizing material should be replaced. The agent (limestone chips with a minimum calcium carbonate content of 85%) can be purchased from a local supplier.

- ⑥ 1" FPT inlet and outlet. Unions for ease of maintenance (ships with shown model NT-25, IBC part P-9126).
- ⑦ To drain. Confirm slope. Slope the condensate hose and drain piping toward the drain and secure to prevent accidental dis-assembly.

**Figure 31** *Condensate neutralization tank*



**Danger**

The water in the condensate neutralizer can cause severe burns to the skin. Wear protective gloves and eye wear when servicing the condensate neutralizer.

## 4.8 Water Piping



### Warning

Water quality has a significant impact on the lifetime and performance of a boiler's heat exchanger.

Improperly prepared water in a heating circuit may cause damage to the heat exchanger through fouling or corrosion. Repeated or uncontrolled water fills will increase the potential for damage.

High levels of dissolved solids or minerals may precipitate out of the fluid onto the hottest part of the heat exchanger, impairing heat transfer and resulting in overheating and premature failure. The amount of solids that may form on the heat exchanger will depend on the degree of hardness and the total water volume in the system. A high water volume system with a low hardness count may cause as much damage as a system with less volume and higher hardness, so it is recommended to treat water so as to reduce dissolved solids to the minimum 10 ppm, and to no more than 30 ppm. Water chemistry allowable limits are as follows:

- » TDS is to be between 10 and 30 ppm
- » Acidity pH is to be between 6.6 and 8.5
- » Chloride is to be less than 125 mg/l
- » Iron is to be less than 0.3 mg/l
- » Cu less than 0.1 mg/l
- » Conductivity is to be between 20  $\mu$ S/cm and 400  $\mu$ S/cm at 77°F (25°C)

**Important:** Ensure that these limits are acceptable for the other water-side components in the system.

Boiler Head Loss - EX 400, EX 500									
Flow rate (gpm)	20	30	40	50	60	70	80	90	100
Head @ flow (ft)	2.6	3.0	3.7	4.4	5.2	6.3	7.4	8.9	10.7

**Table 8** Boiler Head Loss - EX 400, EX 500

Boiler Head Loss - EX 700, EX 850									
Flow rate (gpm)	20	30	40	50	60	70	80	90	100
Head @ flow (ft)	2.6	2.9	3.2	3.7	4.2	4.8	5.5	6.4	7.2

**Table 9** Boiler Head Loss - EX 700, EX 850

Ensure that the pump is rated for the design circulating water temperatures; some pumps have a minimum water temperature rating above the low temperature potential of the boiler. Following installation, confirm the actual performance by measuring  $\Delta^{\circ}\text{T}$  (under high and low flow conditions) after establishing the correct firing rate.

To use legacy heat, we recommend water flow after burner shutdown. There can be significant build-up of energy due to the volume of heated water in the system. Default load settings will run the boiler's primary pump for up to 5 minutes (300 seconds) after burner shutdown. Secondary pumps can be set to run up to 15 minutes after burner shutdown (for the last calling load). As shipped, the default settings will run the Load pump for 5 minutes to place the legacy heat where it is useful. Any secondary pump can be set to run for 0 – 900 seconds in the heat purge mode. Guard against deadheading pumps when all zone valves are closed by setting the load Pump Post Purge (sec) to '0'.

The primary pump must be under the control of the boiler to allow pump purge after burner shutdown.

Installers must conform to the piping design configurations provided to simplify the control application, promote good loads and flow management.

### ***Propylene glycol usage***



#### **Warning**

Do not use automotive-type ethylene or other types of automotive glycol antifreeze, or undiluted antifreeze of any kind. This may result in severe boiler damage. Installers must ensure that glycol solutions are formulated to inhibit corrosion in hydronic heating systems of mixed materials. Improper mixtures and chemical additives may cause damage to ferrous and non-ferrous components as well as non-metallic, wetted components, normally found in hydronic systems. Ethylene glycol is toxic, and may be prohibited for use by codes applicable to your installation location. For environmental and toxicity reasons, IBC recommends only using non-toxic propylene glycol.

Propylene glycol solution is commonly used in a closed loop where freeze protection is required. Its density is lower than that of water, resulting in lower thermal performance at a given flow and pressure. Generally, a 50%:50% solution of propylene glycol and water requires an increased system circulation rate (gpm up 10%), and system head (up 20%) to provide performance equivalent to straight water.

These boilers are designed for use within a closed loop, forced circulation, low pressure system. A 50 psi pressure relief valve (3/4" NPT inlet, 1" NPT outlet) is supplied for field installation on the boiler outlet piping. An optional relief valve, with a rating of up to 150 psi, can be used where required on closed loop systems. Relief valve discharge piping must terminate between 6" (15 cm) and 12" (30 cm) above the floor or per local code.



**Warning**

During operation, the relief valve may discharge large amounts of steam and/or hot water. To reduce the potential for bodily injury and property damage, install a discharge line that:

- » Is connected from the valve outlet with no intervening valve and directed downward to a safe point of discharge.
- » Allows complete drainage of both the valve and the discharge line.
- » Is independently supported and securely anchored, so as to avoid applied stress on the valve.
- » Is as short and straight as possible.
- » Terminates freely to atmosphere where any discharge will be clearly visible and is at no risk of freezing. terminates with a plain end which is not threaded.
- » Is constructed of a material suitable for exposure to temperatures of 375° F or greater.
- » Is, over its entire length, of a pipe size equal to or greater than that of the valve outlet (1" NPT).

**Do not cap, plug or obstruct the discharge pipe outlet.**

## 4.8.1 General piping best practices

Primary/secondary piping, or the use of a hydraulic separator (such as the Caleffi 549 SEP4™ 4-in-1 Magnetic Hydraulic Separators) is recommended for maximum flexibility in multi-load applications. Piping loads in parallel is also encouraged in systems that only have two loads, or when loads are operating simultaneously. The extremely low pressure drop through the heat exchanger of the EX series affords more flexible options unavailable in other designs.

**Caution**

Contact local water purveyors about the suitability of the supply for use in hydronic heating systems. If unsure about water quality, request testing and assessment (and treatment, if required) from a local water treatment expert. Alternatively, water or hydronic fluid of known quality can be brought to the site.

## 4.8.2 System piping

System piping is connected to the boiler using 2½" NPT-Male threaded fittings. To simplify servicing, we recommend using unions or flanged fittings, gate or ball valves at the boiler's supply and return water connections. You must install un-insulated hot water pipes with a minimum ¼" clearance from combustible materials.

Fluid fill is most often accomplished by using a boiler regulator & fill valve set at 12 psig or more, with the appropriate backflow prevention device as required by local code. This is acceptable in areas where municipal water or well water has been treated and filtered to remove excessive minerals and sediment, and water chemistry is known to be suitable for closed loop hydronic systems. In areas where water quality is in question, or when chemical treatment or glycol is required, other options should be considered. Follow the applicable codes and good piping practice.

**Warning**

Close the fill valve after any addition of water to the system, to reduce risk of water escapement.

There are a number of boiler feed and pressurization devices on the market today that may be a better choice than a raw water fill from the mains. When regular maintenance requires relief valve blow-off, the discharge may be directed back into the pressurization appliance for recycling of boiler fluid and chemicals back into the system. In buildings that may be unoccupied for long periods of time, pressurization appliances are useful to prevent flood damage should leakage occur from any component in the system. An additional benefit is that backflow prevention devices are not required when using these devices.

Do not place any water connections above the boiler; leaks can damage the fan and controls. If needed, create a shield over the top of the cover, but allow clearance for airflow and service access.

For best results, use a Primary/Secondary piping system, with a pumped boiler loop using 2½" piping. Refer to [Table 8](#) or to [Table 9](#) for boiler head loss information.

Example: In these EX models, the minimum flow rate required through the heat exchanger is 18 or 21 gpm (depending on model) and a maximum of 100 gpm is allowed. Primary/Secondary piping ensures adequate flow and de-couples  $\Delta^{\circ}\text{T}$  issues (boiler vs. distribution). Aim for a 20° to 30° F  $\Delta^{\circ}\text{T}$  across the heat exchanger at high fire (there is a boiler protection throttle fence limiting the  $\Delta^{\circ}\text{T}$  to 80°F).

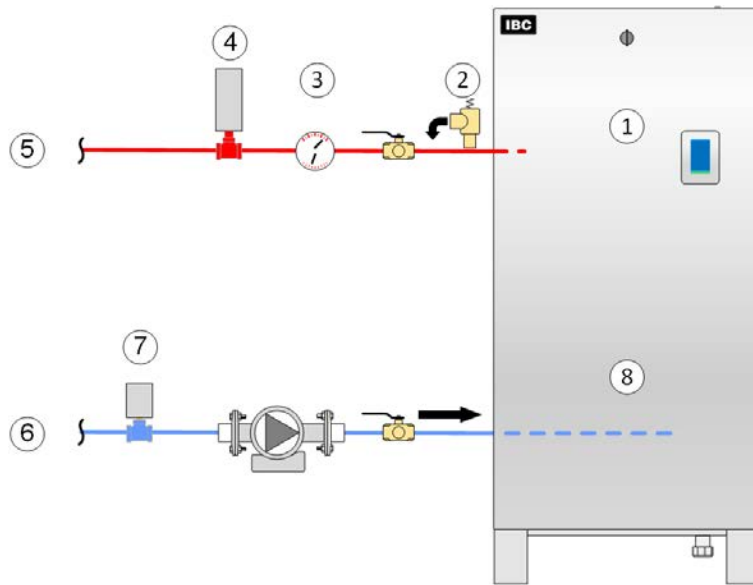
Check valves or thermal traps should be used to isolate both the supply and return piping for each load - to avoid thermal siphoning and reverse flow.

To ensure adequate water flow through the boiler under high-head / single zone space heating conditions, a pressure activated bypass or other means of bypass must be used on any load where the flow rate might drop below minimum requirements (18 or 21 gpm - depending on model).

For further information and details, consult our Concept Drawings – which provide detail on specific single and multiple boiler applications “Piping”, “Wiring” and “Settings”. (available at [www.ibcboiler.com](http://www.ibcboiler.com) or from your IBC Representative).

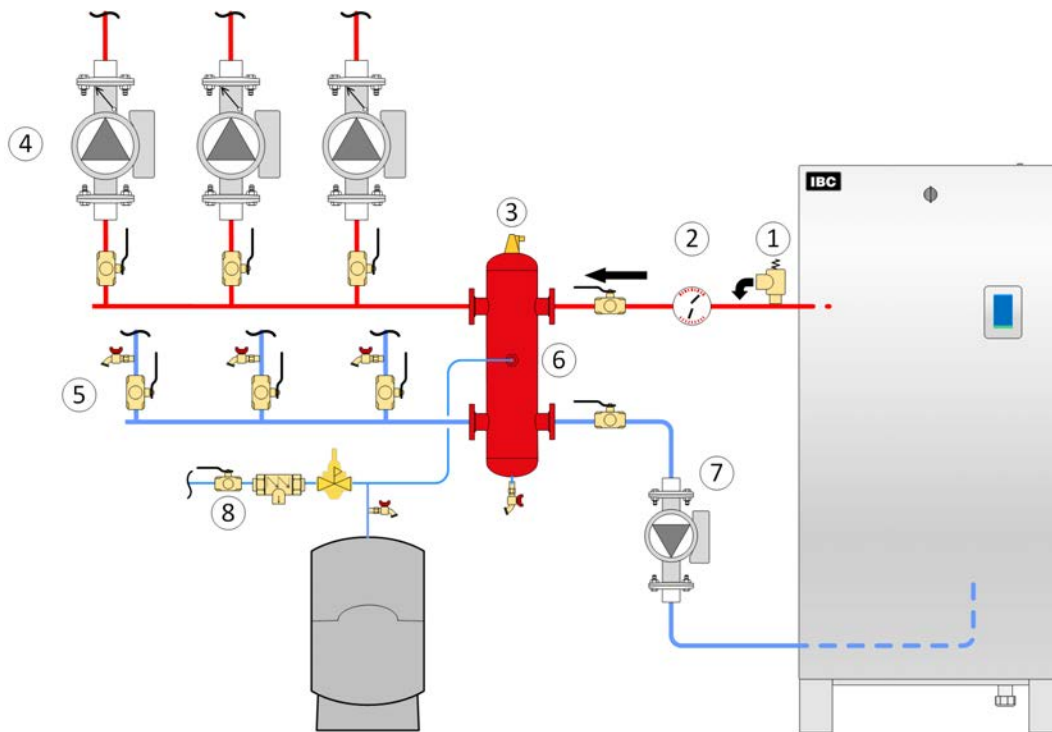
**Note**

The piping drawings in this manual are simple schematic guides to a successful installation. There are many necessary components not shown, and details such as thermal traps are left out so the drawings have greater clarity. We require that our boilers be installed by licensed and experienced trades people who are familiar with the applicable local and national codes. System design is to be completed by an experienced hydronic designer or Engineer. It is necessary to carefully read and follow these installation instructions along with the application drawing that fits your system.



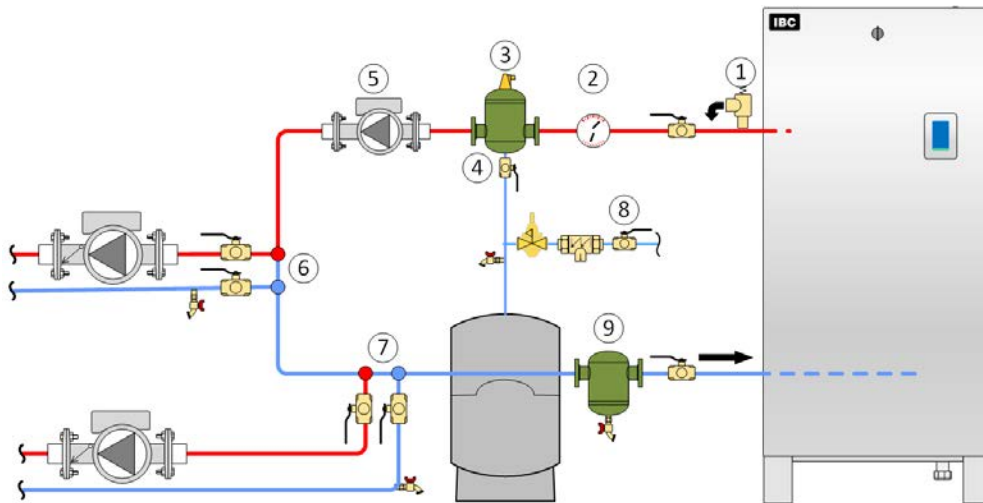
- ① Low water cut-off (LWCO): the IBC EX series comes factory-equipped with an internally mounted Certified Low Water Cut-Off. Sometimes an external device is required by local jurisdiction. These devices have specific installation requirements not illustrated here. Consult the IBC factory or the LWCO manufacturer for proper application of these devices.
- ② Pressure relief valve (ships with boiler): no isolation valve permitted between boiler and relief valve.
- ③ Tridicator / external pressure and temperature gauge (ships with boiler).
- ④ Optional external water high limit (manual reset). The IBC EX series comes factory-equipped with an internally mounted manual reset mechanical water temperature high limit. It can be fitted with an external manual reset mechanical water temperature high limit if required by local jurisdiction.
- ⑤ To supply manifold
- ⑥ From return manifold
- ⑦ Optional flow switch: follow manufacturer's instructions. Typical requirements include installing on a horizontal run, with at least five (5) pipe diameters of straight piping both upstream and downstream of flow switch, and ensuring proper paddle engagement for the piping size.
- ⑧ Integrated boiler drain

Figure 32 Trim for multiple boiler installations



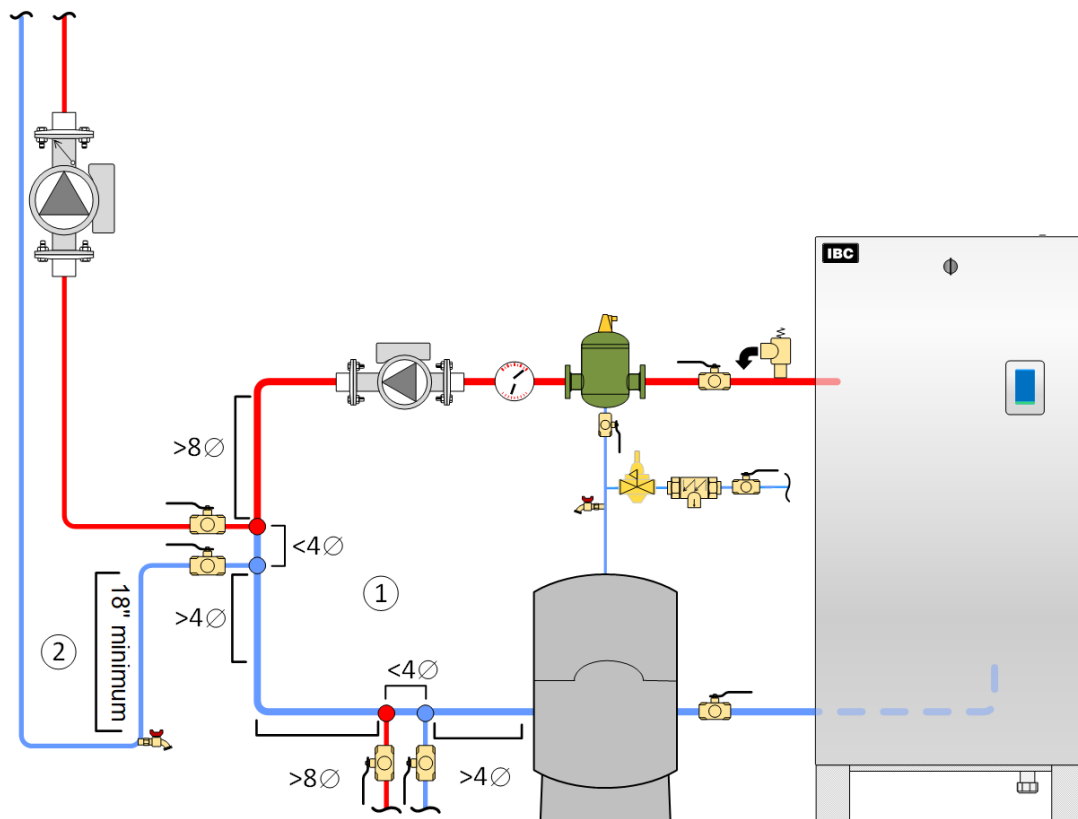
- ① Pressure relief valve (shipped with boiler): no isolation valve is permitted between the boiler and relief valve.
- ② Tridicator or external pressure and temperature gauge (shipped with boiler).
- ③ Hydraulic separator (low-loss header) provides primary/secondary hydraulic separation, a microbubble air eliminator and a dirt separator. Air eliminator is installed at the most effective point, where the fluid is at the highest temperature and lowest pressure.
- ④ Secondary pumps to multiple loads or zones. All receive identical temperatures. Note integrated check valves.
- ⑤ Return lines from loads.
- ⑥ Expansion tank connection (point of no pressure change) should be on the suction side of the circulator.
- ⑦ Primary pump or boiler circulator into connection at rear of boiler.
- ⑧ Fill station with isolation valve closed, or fill tank.

**Figure 33** *Primary/Secondary piping concept with hydraulic separator*



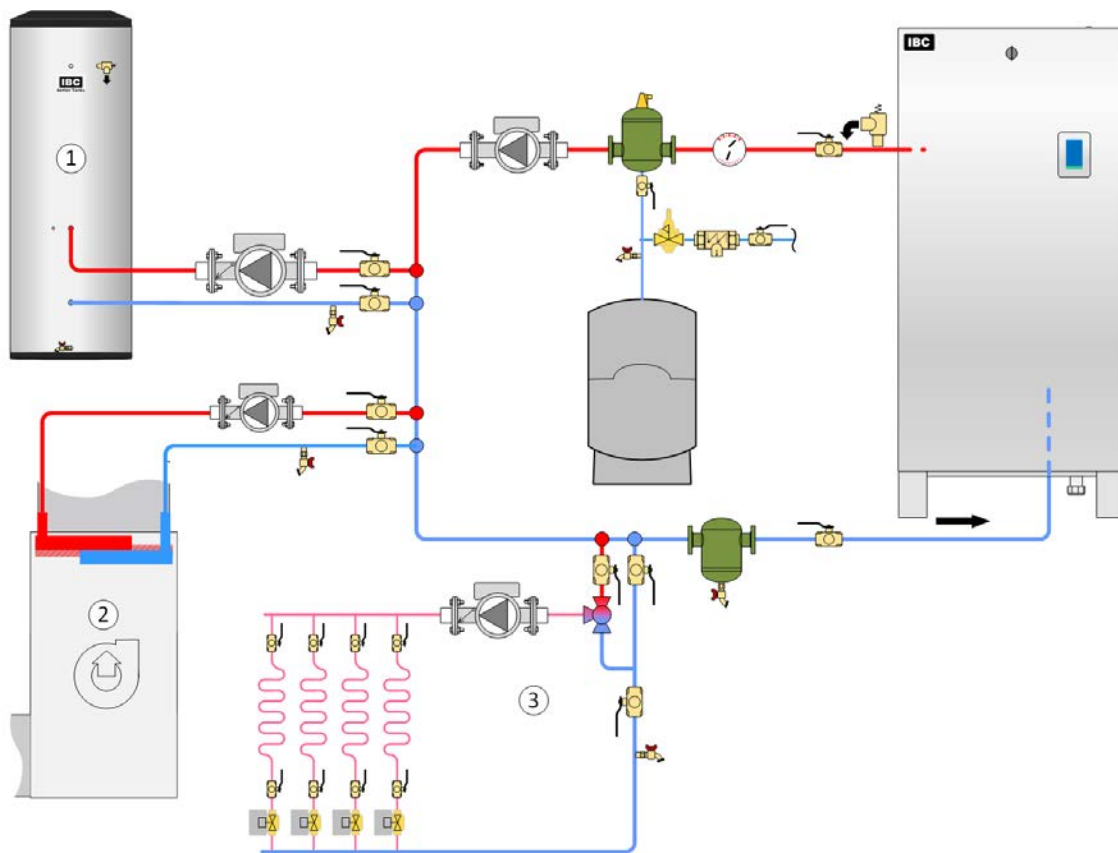
- ① Pressure relief valve (field-supplied): no isolation valve is permitted between the boiler and relief valve.
- ② Tridicator or external pressure and temperature gauge (field-supplied).
- ③ Microbubble air eliminators are best installed where the fluid is at the highest temperature and lowest pressure.
- ④ Expansion tank connection (point of no pressure change) should be on the suction side of the circulator.
- ⑤ Primary pump or boiler circulator.
- ⑥ Closely-spaced tees to or from load 1.
- ⑦ Closely-spaced tees to or from load 2.
- ⑧ Fill station with isolation valve closed, or fill tank.
- ⑨ Dirt separator recommended.

Figure 34 Boiler trim options - single boiler



- ① Closely-spaced tees: To avoid induced flow, install each set of tees with straight piping a minimum of 8 pipe diameters upstream and 4 pipe diameters downstream. Avoid using elbow or other component that may create turbulent flow. Position tees as close together as possible (maximum 4 pipe diameters apart) and ensure that there are no restrictions between the fittings that would result in a pressure drop.
- ② Heat migration: On secondary loops that extend vertically to a load that is above the primary loop, steps must be taken such as fabricating a thermal trap in the return piping - minimum 18" (46 cm) drop - to prevent thermal siphoning and heat migration to the load when there is no demand for heat to that loop. Alternatively, use check valves on both supply and return of secondary piping.

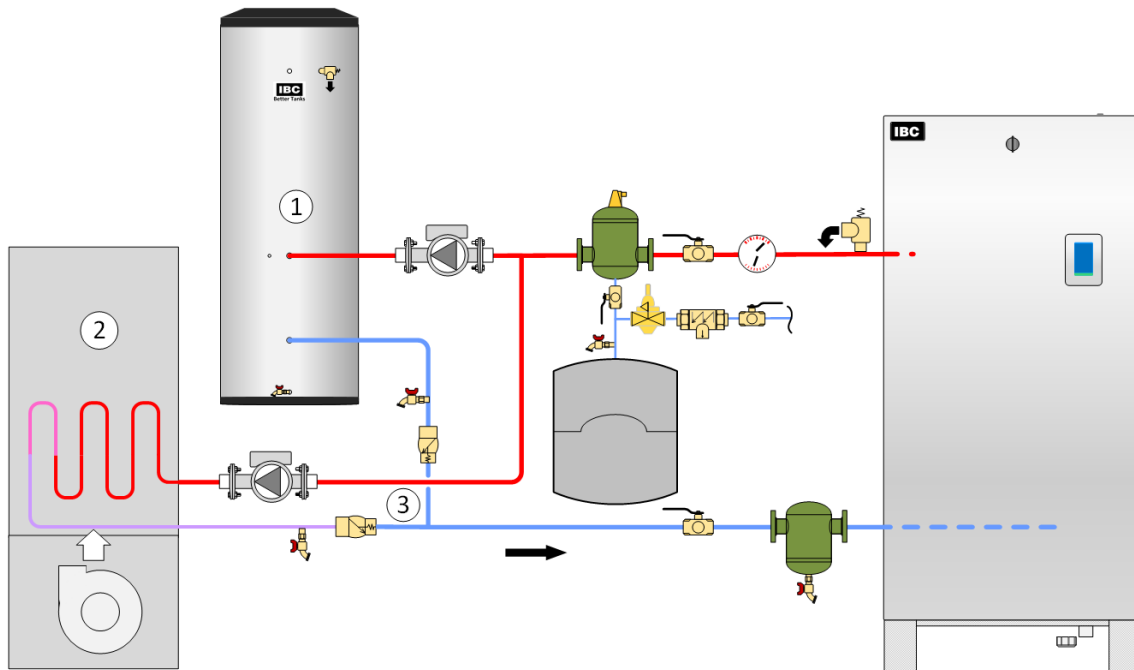
Figure 35 Important Primary/Secondary piping details with closely-spaced tees



- ① DHW indirect tank
- ② Air handler
- ③ Low temperature radiant protected by a mixing valve for simultaneous heating during higher temperature air handler operation. Boiler can return to lower supply temperature when radiant alone is operating.

Figure 36 Primary/Secondary piping concept with simultaneous heating calls

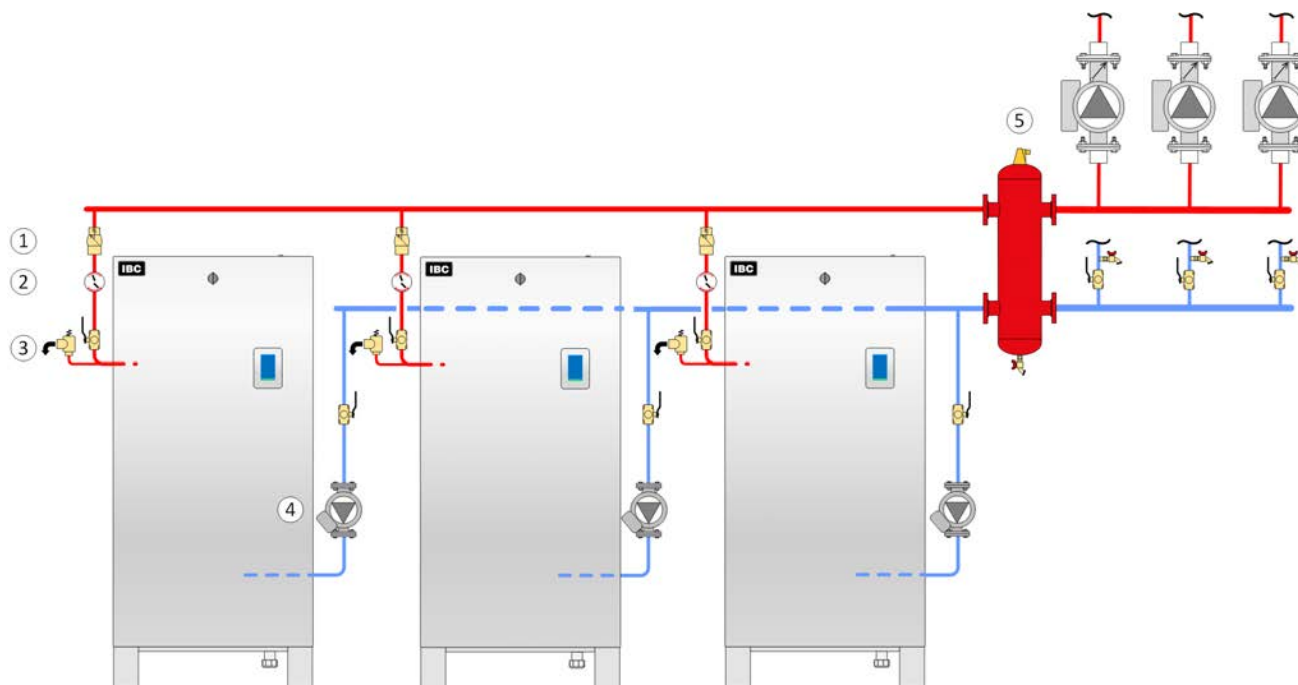




- ① DHW indirect tank
- ② Air handler
- ③ Check valves (may be integral to pumps - not shown)

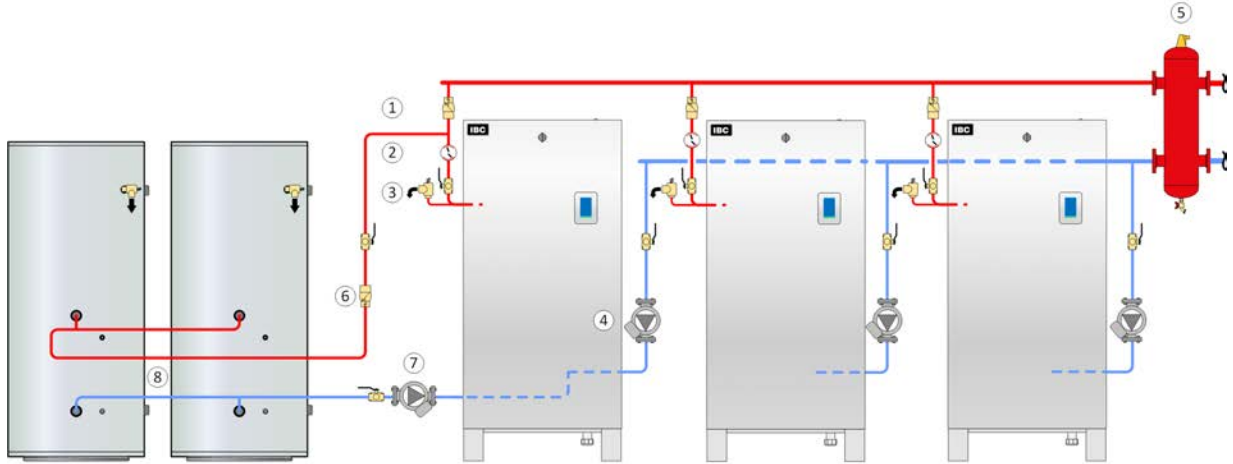
Figure 37 Two pump, two load - parallel piping concept

The boilers can supply multiple heating loads with compatible supply temperature requirements. Always ensure that loads sensitive to high temperatures are protected using means such as mixing valves.



- ① Check valve (typical of each boiler - may be integral to pump).
- ② Tridicator (shipped with boiler) typical of each boiler.
- ③ Pressure relief valve (shipped with boiler) typical of each boiler.
- ④ Boiler pump into rear connection (typical of each boiler).
- ⑤ Low-loss header / hydraulic separator (shown) or closely-spaced tees 'bridge' to load piping.

**Figure 38** Multiple boiler piping



- ① Pressure relief valve (shipped with boiler) typical of each boiler.
- ② Tridicator (shipped with boiler) typical of each boiler.
- ③ Check valve (typical of each boiler)
- ④ Boiler pump into rear connection (typical of each boiler)
- ⑤ Low-loss header / hydraulic separator (shown) or closely-spaced tees 'bridge' to load piping
- ⑥ Check valve for opt-out circuit.
- ⑦ Opt-out pump into rear side (opt-out boiler(s) only)
- ⑧ Opt-out load piping in reverse-return for balanced flows

Figure 39 Multiple boiler opt-out piping

## 4.9 Gas piping

### Note

Due to the precision of modern modulating boilers it is important to pay special attention to gas pressure regulation.

**Important:** Check gas supply pressure to each boiler with a manometer or other high-quality precision measuring device. Pressure should be monitored before firing the boiler, during operation throughout the boiler's full modulation range, and after the call when the regulator is in a "lock-up" condition.

Pay special attention to retrofit situations where existing regulators may have an oversized orifice and/or worn seats, causing pressure "creep" and high lock-up pressures.

A high quality regulator will maintain constant pressure above the boiler's minimum specification at all firing rates, and will not exceed the boiler's maximum pressure rating when locked-up with no load.

### 4.9.1 Gas pressure

The boilers require a minimum inlet gas supply pressure of 4.0" w.c. for natural gas or propane during high fire operation. For either fuel, the inlet pressure shall be no greater than 14.0" w.c. Confirm this pressure range is available with your local gas supplier.

The inlet gas connection to the boiler is 1" NPT (female).

The high gas pressure switch setpoint is set at 14" wc and the low gas pressure setpoint is set at 3.5" wc. To locate the switches on the boiler, see [7.0](#) or [Figure 49](#).

Adequate gas supply piping must be installed with no smaller than 1¼" Schedule 40 (e.g. Iron Pipe Size (IPS) and using a 1" w.c. pressure drop, in accordance with the following chart.

Maximum Gas Pipe Length (ft)				
Model	1¼" IPS	1½" IPS	2" IPS	2½" IPS
EX 400 (Natural Gas)	150'	350'	1000'	>2000'
EX 400 (Propane)	400'	900'	>2000'	>2000'
EX 500 (Natural Gas)	100'	200'	700'	1800'
EX 500 (Propane)	250'	600'	2000'	>2000'
EX 700 (Natural Gas)	50'	100'	350'	800'
EX 700 (Propane)	150'	300'	900'	2000'
EX 850 (Natural Gas)	40'	80'	250'	600'
EX 850 (Propane)	100'	200'	700'	1600'

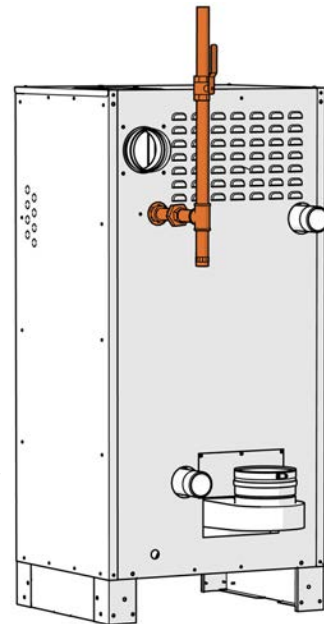
**Table 10** Maximum Gas Pipe Length (ft)

Gas piping must have a sediment trap ahead of the boiler's gas valve. A manual shutoff valve must be located outside the boiler, in accordance with local codes or standards. All threaded joints in gas piping should be made with an approved piping compound resistant to the action of natural gas or propane. Use proper hangers to support gas supply piping as per applicable codes.

The boiler must be disconnected or otherwise isolated from the gas supply during any pressure testing of the system at test pressures in excess of ½ psig. Dissipate test pressure prior to reconnecting. The boiler and its gas piping shall be leak tested before being placed into operation.

The gas valve is provided with pressure taps to measure gas pressure upstream (supply pressure) and downstream (manifold pressure) of the gas valve (see 7.0 or Figure 49). Note that manifold pressure varies slightly in accordance with firing rates with the modulating series boilers, but will always be close to 0" wc. An adapter fitting is supplied with the boiler.

**Figure 40** Typical gas piping



## 4.10 Electrical connections

All electrical wiring to the boiler (including grounding) must conform to local electrical codes and/or to the National Electrical Code, ANS/NFPA No. 70 – latest edition, or to the Canadian Electrical Code, C22.1 - Part 1.

### 4.10.1 Power quality and electrical protection

In areas of unreliable power, appropriate surge protectors and or power conditioning equipment should be installed in power supply wiring circuits.

#### Note

The IBC boiler (like any modern appliance that contains electronic equipment) must have a “clean” power supply, and is susceptible to power surges and spikes, lightning strikes and other forms of severe electrical “noise”. Power conditioning equipment (surge protectors, APC or UPS devices) may be required in areas where power quality is suspect.

### 4.10.2 120VAC line-voltage hook-up

Line-voltage wiring is done within the field-wiring box (see [Wiring diagrams on page 129](#)). Connect the boiler to the grid power using a separate, fused circuit and on/off switch within sight of the boiler. Use 14-gauge wire in BX cable or conduit properly anchored to the boiler case for mains supply and pump circuits.

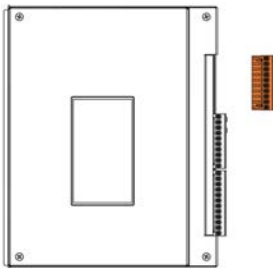


Figure 41 Line voltage load pump terminals



#### Caution

The on-board controller load pump relays are protected with 5 Amp fuses. The maximum recommended load on each fuse is 4 Amps (80% of rating). The maximum combined pump load is 10 Amps. Isolation relays or contactors **must** be used if the loads exceed these maximums.

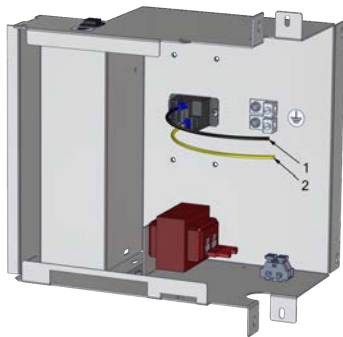
Connect a 120VAC / 15 amp supply to the "AC IN" tagged leads in the wiring box.

### 4.10.2.1 Load pumps

The 120VAC power supply to the load pumps (P/V1, P/V2, P/V3, and P/V4) is factory installed and connected to P/V-L and P/V-N for your convenience. If you use the P/V relay connections for zone valves, you need to remove and cap off the 120VAC connections at P/V-L and P/V-N. The 24VAC can then be applied using an external transformer to supply power to zone valves. The upper 4 pairs of contacts on the connector strip are then powered to manage up to 4 load pumps – the top pair for Load 1, the second pair for #2 etc. Once the controller is programmed for the respective loads, the boiler manages all the loads without need of further relays (for loads up to  $\frac{1}{3}$  HP; for more – use a protective relay).

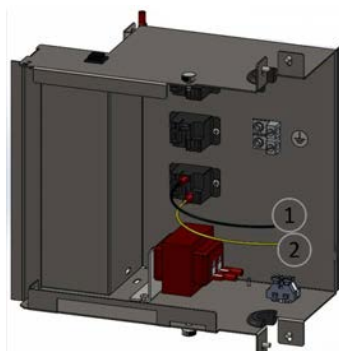
### 4.10.2.2 Boiler pump

The boiler (primary) pump is powered by the yellow wire from the pair labeled "Boiler Pump". Wire the pump's neutral to the white wire labeled "AC In". Do not attempt to connect the boiler pump to the pump/zone valve terminal block along the controller's right edge as this is reserved for the secondary pumps and/or zone valves only.



- ① Power in - black wire.
- ② To boiler - yellow wire.

**Figure 42** Electrical box with boiler pump relay - black and yellow wires - EX 400, EX 500



- ① Power in - black wire.
- ② To boiler - yellow wire.

**Figure 43** Electrical box with boiler pump relay - black and yellow wires - EX 700, EX 850

If the total boiler amperage drawn is less than 12 amps and the boiler pump is 120V, you can connect the black wire from the relay to the line voltage mains supplied to the boiler. For 120 volt boiler pumps, the black wire can be connected to the line voltage mains and the yellow wire connected to boiler pump. For 208/240 volt boiler pumps, the black wire can be one leg of the 208/240 voltage mains and the yellow wire connected to the boiler pump.

The boiler pump relay may require connection to a second electrical circuit (amperage greater than 4 amps). The boiler pump relay is rated for a maximum amperage load of  $\frac{3}{4}$  horsepower. A

disconnect switch should be installed to isolate the boiler pump and the boiler pump relay power supply.

Pumps can be switched on/off using the touchscreen controller, so there is no need for temporary pump wiring during system filling / air purging.

- » After defining loads, go to > *System Settings* > *Site Settings*. In the *Manual Pump Purge* field, set to "On". The manual pump purge runs until it is turned off, or when there is a call for heat.
- » To shut off the manual pump purge, tap "On" to toggle to "Off"

In a new construction application, use a construction thermostat, or jumper with an in-line on/off switch – for on/off management of the boiler. Do not just turn off power from the appliance, or its moisture management routine will be interrupted (fan turns at ultra low rpm for 90 minutes after burner shutdown). Treat it like a computer, where you do not just pull the plug when done. If a "low airflow / check vent" error signal shows, check for (and remove) any water in the clear vinyl air reference tubes. This has been seen occasionally at construction sites where the boiler has been repeatedly de-powered wet.

The combined current of all load pumps connected through the on-board pump relays should not exceed 10 amps. The control circuit board is protected using on-board field replaceable fuses. Each pump is fused with a separate 5 Amp fuse. The Alarm contact is fused with a 5 Amp fuse and the 24VAC boiler control circuit is protected with a 2 Amp fuse.

#### 4.10.2.3 Variable speed boiler pumps

Variable speed boiler pumps are for connecting and managing speed in pumps that accept 0-10VDC on 4-20 mA input signal.

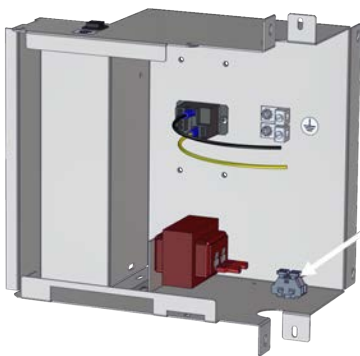


Figure 44 Electrical box with new variable speed connection - EX 400, EX 500

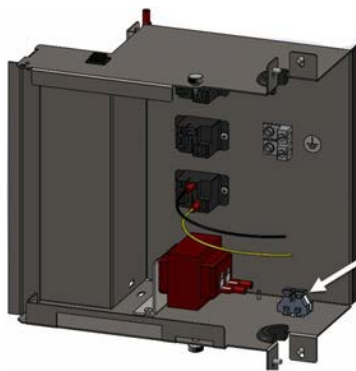


Figure 45 Electrical box with new variable speed connection - EX 700, EX 850



### 4.10.3 Thermostat wiring

Each of the four loads has dry contacts for thermostats as marked on the lower connector strip (e.g., "Therm 1"). Gang lines from a multiple-zoned load (e.g., off the end-switches for each radiant floor zone) present a common thermostat signal to the controller. Ensure that there are no disturbing influences on the call-for-heat lines - for example, from being run in the same conduit as line voltage wires. Most power stealing thermostats can be connected directly to the Therm terminals. Consult the *Controller* manual for more detailed instructions.

#### 4.10.3.1 Thermostat heat anticipator

IBC "Therm" contacts draw no power, so an anticipator setting for the thermostat is not applicable with the EX modulating series boilers. For a heat load where zone valves are used to manage thermostatically controlled zones, each room's thermostat heat anticipator should be adjusted to the current draw of its associated zone valve.

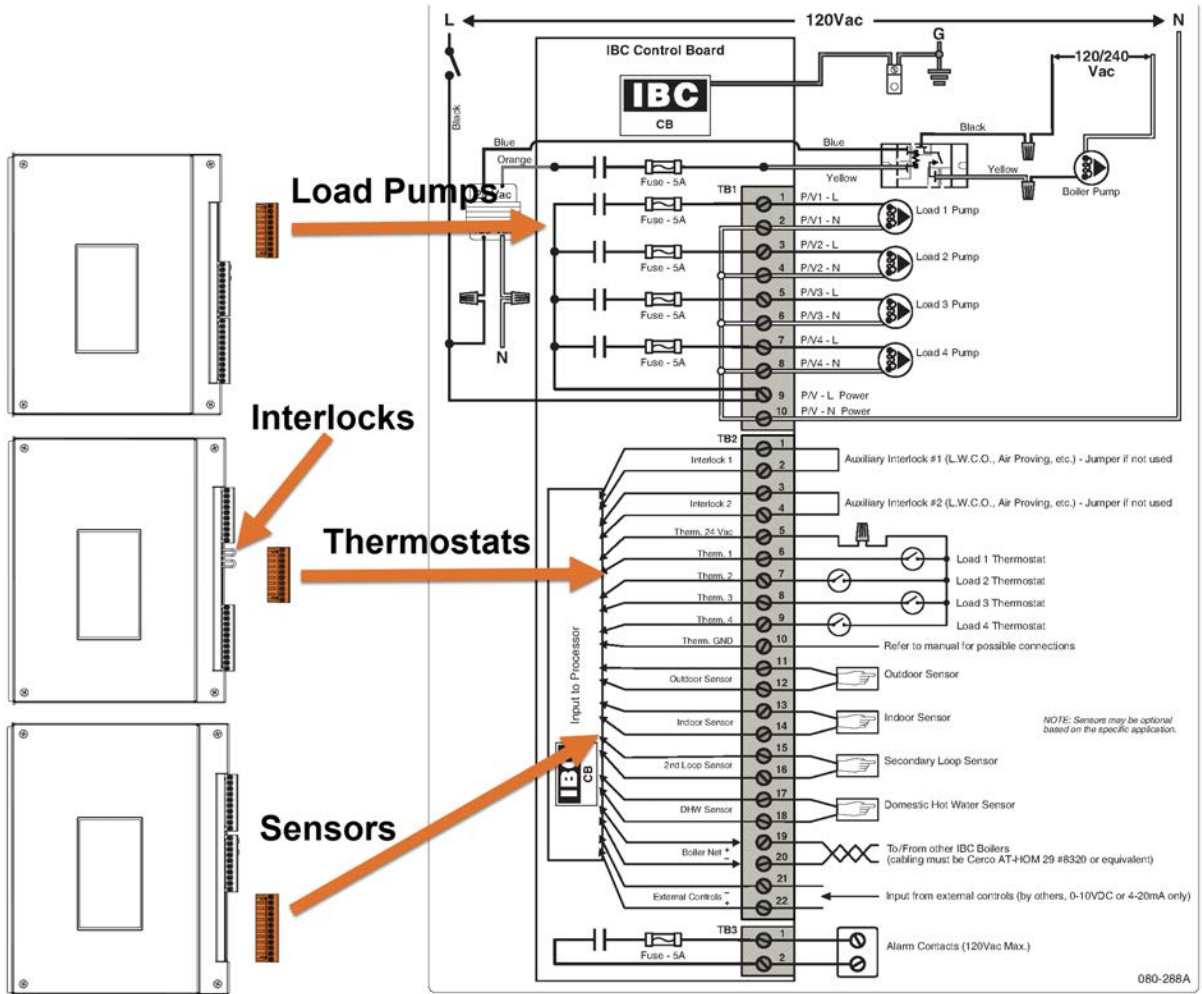


Figure 46 Electrical wiring connections

#### 4.10.4 Sensor and other wiring



#### **Danger**

Do not connect sensors to "Therm" terminals. Overheating components can result in serious personal injury and/or property damage.

Other optional low voltage connections to the control board include:

- » Two auxiliary Interlocks - for external safety devices as may be required by some jurisdictions, such as an external low-water cutoff.
- » Contacts for indoor and outdoor temperatures sensors associated with reset heating. A 10K ohm thermister (resistor dependent on temperature) for outdoor

reset sensing is supplied with the boiler for improved comfort and combustion efficiency.

- » One pair for a DHW tank sensor. Connect to "DHW S" (not the respective Therm. 1,2,3,4 location) and the boiler automatically detects and calls a smart DHW routine.
- » One pair of contacts for remote secondary loop temperature control.
- » One pair (marked BoilerNet) for network connection – this is used for connecting multiple IBC modulating appliances for autonomous staging.
- » The bottom pair of contacts (labeled 'External Control') receives a 0-10VDC (default) or 4-20 mA signal from an external boiler controller for direct throttle control. The boiler's own sensors act as high limits only. The user must enter maximum and minimum boiler supply temperatures.

**Note**

Sensors connected to any sensor input contacts must be of the NTC Thermister type with a resistance of 10,000 ohms at 77°F (25°C) and  $\beta = 3892$ . We do not recommend using 3rd party supplied sensors. Compatible water temperature sensors and outdoor sensors can be supplied by your IBC distributor.

Intentionally left empty

## 5.0 About the boiler controller

---

This boiler is equipped with a touchscreen controller for programming the boiler. For detailed instructions on using the controller, see the *Touchscreen Controller* manual.

### Note

Use only a stylus or a clean finger to interact with the touchscreen. Using sharp or metallic objects will cause damage.

The controller is equipped to provide:

- » Control of up to 5 pumps – 1 boiler pump + 4 separate load pumps
- » Outdoor Reset control
- » Set Point temperature regulation
- » Domestic Hot Water (DHW)
- » External control via 0-10VDC or 4-20mA signaling
- » Manual control of firing rate for gas valve calibration
- » Alarm dry contacts
- » Zoning - simultaneous operation of up to four pumps
- » Load Combining – simultaneous operation of two similar water temperature loads
- » Programmable setback / override schedule
- » The control can manage or operate in a network of up to 24 IBC boilers without additional controller.
- » Some of the new features available in the touchscreen control include:
  - » Express Setup Menu for simple, quick programming
  - » Portal connectivity for remote monitoring and programming
  - » Superior warning messages while setting up the control
  - » Advanced Error messages with visual display on the Home Screen
  - » Internet/LAN connectivity
  - » BACnet (with activation)

## 5.1 Controller

When the boiler is first energized, the controller will go through a power up sequence that will take approximately 90 seconds. During this time the controller is completing a self- diagnostic and loading all previous settings. In the event of a power interruption the boiler will automatically resume operation when power is restored with all the previously stored values.

The controller provides overall management of the boiler operations including:

- » Power-up, self-diagnostics, easy Load parameter adjustments
- » The boiler status bar indicates if the boiler is in a normal, warning or alarm state. When no warning or alarm state is present, the bar will be green and the time will be displayed inside the green area. The bar can also be yellow or red corresponding a warning or alarm state. Text inside the bar will indicate the specific warning or alarm present. If more than one alarm is present the text display will slowly change, rotating through whatever alarms that are present.
- » Burner operation, safety management systems, Call for Heat management and Load Priority
- » Real time boiler data
- » Temperature and throttle operation
- » Maintenance of operational and error service logs
- » 2-way communication between other IBC boilers and controls
- » Internet connection and communication



Operational and historical data may be accessed at any time using the System Status and Load Profiles sections of the control. Error logs are available in the Diagnostics section and the controller is capable of recording any or all errors since original power-up complete with the date and time of the error.

## 5.2 Controller interface

The control interface is provided through a 2¼ x 4 inch, color touchscreen display. The touchscreen responds to a light finger touch on the screen. You can also use a stylus, pencil, or similar device to operate the touch controls. Do not use a sharp or metallic object such as a screw driver to operate the control as it could damage the touchscreen.

Prior to any interaction with the touchscreen, the display shows the Home screen details of the current boiler status. If the controller has been left on the Home screen long enough (user adjustable, 10 minutes by default) the display will be dimmed to save power.

The control will automatically return to the home screen if left unattended. The screens will step back one screen at a time in 10 minute increments if the touchscreen has not been touched. The pop-up windows will also step back automatically in 2 minute intervals.

## 6.0 Before operating the boiler



### **Danger**

Do not store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance. If you smell gas vapors, do not try to operate any appliance - do not touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a phone located remotely. Follow the gas supplier's instructions, or if the supplier is unavailable, contact the fire department.

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

Should overheating occur or the gas supply fails to shut off, do not turn off or disconnect the electrical supply to the pump. Instead shut off the gas supply at a location external to the appliance.

## 6.1 Important pre-ignition checks

Once installation of the appliance is completed, and before operating the appliance, it is important to review the following checklist of precautions:

### 6.1.1 Checklist for electrical conditions, ducting and water connections

Checking electrical conditions	Check
Check all line voltage electrical connections to ensure all connections are correct and tight.	<input type="checkbox"/>
Check thermostat connections.	<input type="checkbox"/>
Thermostat in a suitable location.	<input type="checkbox"/>
Checking piping connections	Check
Ensure venting system is complete and seal tested.	<input type="checkbox"/>
Confirm any common venting system at the installation site is isolated and independent of the EX boiler.	<input type="checkbox"/>
Confirm that any holes left from the removal of a previous boiler have been sealed, and that any resizing of the old flue has been done.	<input type="checkbox"/>

Checking piping connections	Check
Check that the water piping system is fully flushed and charged, and that all air has been discharged through loosened bleed caps.	<input type="checkbox"/>
Note it is possible to switch all pumps on/off from the touchscreen – without a call for heat. This simplifies system filling and air bleeding (go to ●●● > <b>System Settings &gt; Site Settings</b> > In the <b>Manual Pump Purge</b> field, set to "On" . The manual pump purge runs until it is turned off, or when there is a call for heat.). Use a minimum water pressure of 12 psig. And confirm that the pressure relief valve is installed and safely drained.	
Check to see that adequate gas pressure is present at the inlet gas supply test port.	<input type="checkbox"/>
Open the test port by turning its center-screw one full turn counterclockwise, using a small (1/8" or 3 mm) flat screwdriver. Connect a manometer and open the gas control valve. Requirements are minimum 4" w.c and maximum 14" w.c.	
Check that there are no gas leaks.	<input type="checkbox"/>
All connections are pressure tested and leak free.	<input type="checkbox"/>
All piping flushed to ensure all air is removed.	<input type="checkbox"/>
Check valve is installed and the external pump is flowing in the correct direction.	<input type="checkbox"/>

Checking vent connections	Check
All connections are pressure tested and leak free.	<input type="checkbox"/>
All vent pipe is sized correctly and joints are sealed.	<input type="checkbox"/>

Powering on the boiler	Check
The installer must verify that at least one carbon monoxide alarm has been installed within a residential living space or home following the alarm manufacturer's instructions and applicable local codes before putting the appliance into operation.	<input type="checkbox"/>
The boiler door must be in place during normal operation.	<input type="checkbox"/>
Perform a final check of electrical wiring, and provide power to the boiler to initialize operation.	<input type="checkbox"/>



### Warning

Fill the condensate trap with water before you first fire the boiler to prevent exhaust fumes from entering the room. Never operate the boiler unless the trap is filled with water. Failure to comply will result in severe personal injury or death.



## 7.0 Boiler operation

Before operating the appliance, there are some important pre-ignition checks that need to be performed. For more information, see [Before operating the boiler on page 71](#). To understand the boiler start-up process, see [Sequence of Operation on page 132](#).

Start-up Checklist	Check
Followed lighting and shutting down procedure.	<input type="checkbox"/>
Tested the ignition safety shutoff function (see <a href="#">Testing the ignition safety shutoff on page 74</a> ).	<input type="checkbox"/>
Checked the appliance's fuel source, and if necessary, <a href="#">performed a fuel conversion</a> using the appropriate P-kit.	<input type="checkbox"/>
Performed gas pressure test by <a href="#">Measuring the inlet gas pressure on page 81</a> .	<input type="checkbox"/>
Tested efficiency of the appliance and made necessary adjustments by <a href="#">Performing a combustion test and adjustment</a> .	<input type="checkbox"/>

## 7.1 Lighting and shutting down the boiler

**FOR YOUR SAFETY READ BEFORE OPERATING**

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

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

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

**WHAT TO DO IF YOU SMELL GAS**

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.


- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to turn the gas control valve. Never force using tools. If the valve will not turn by hand, don't try to repair it. call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

**OPERATING INSTRUCTIONS**


1. **STOP!** Read the safety information above on this label before doing anything.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance by selecting main power switch to OFF.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Locate manual gas shut-off valve (see pictures below) and turn clockwise to "CLOSE".
6. Wait five (5) minutes to clear out any gas. Then

smell for gas, including near the floor. If you smell gas, **STOP!** Follow step "B" in the safety information above on this label. If you don't smell gas, go to the next step.


7. Turn gas control valve to OPEN.
8. Turn on electric power to appliance by selecting main power switch to ON.
9. Set thermostat to desired setting.
10. If the appliance will not operate, follow the instructions "TO TURN OFF GAS APPLIANCE" and call your service technician or gas supplier.




clockwise  
open  
close



CLOSE  
clockwise



clockwise  
OPEN  
CLOSED




clockwise  
OPEN  
CLOSED

**TO TURN OFF GAS APPLIANCE**

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance by selecting main power switch to OFF.
3. Turn gas control valve to CLOSE.

## 7.2 Testing the ignition safety shutoff

To test the ignition system safety shutoff device:

1. With the boiler in operation, shut off the gas control valve directly outside the boiler case.
2. Ensure that the boiler has purged, attempted to re-light three times, has shut off and the appropriate error information is displayed on the controller.
3. The error is displayed after testing the ignition safety shutoff.
4. To restart the boiler, reset the power or on the touchscreen controller, tap  (Status)>**Clear Errors** > **Yes**.

## 7.3 Commissioning

The EX modulating boilers are factory calibrated to operate with natural gas (or propane if desired) at sea level. The gas-air ratio or zero-offset adjustment screw may need adjusting to attain optimum combustion results. Note that only qualified technicians using properly functioning and calibrated combustion analyzing equipment should perform a mixture adjustment.

### 7.3.1 Checking a boiler's fuel source

This boiler model can burn either natural gas or propane if equipped with the correct fuel-air metering device. Examine the rating plate of the boiler to ensure it is configured for the fuel you are using. If the boiler is configured for natural gas, but needs to be converted to propane, use the conversion kit (sold separately by IBC) to install the appropriate fitting(s) and adjust the gas valve accordingly. See [Table 11](#) for the required conversion kit.

The touchscreen controller will automatically detect the installation's altitude and make the appropriate adjustments to operate the boiler up to 4,500 feet in elevation without de-rating. The boiler will automatically de-rate at altitudes above 4,500 feet.

## 7.3.2 Performing a fuel conversion

These boilers are factory fire-tested to operate with natural gas or propane as ordered. The rating plate will be marked to indicate which fuel the particular boiler has been set up with. Firing a boiler with a fuel other than what is listed on the rating plate is prohibited unless the conversion procedure is completed by a qualified technician.

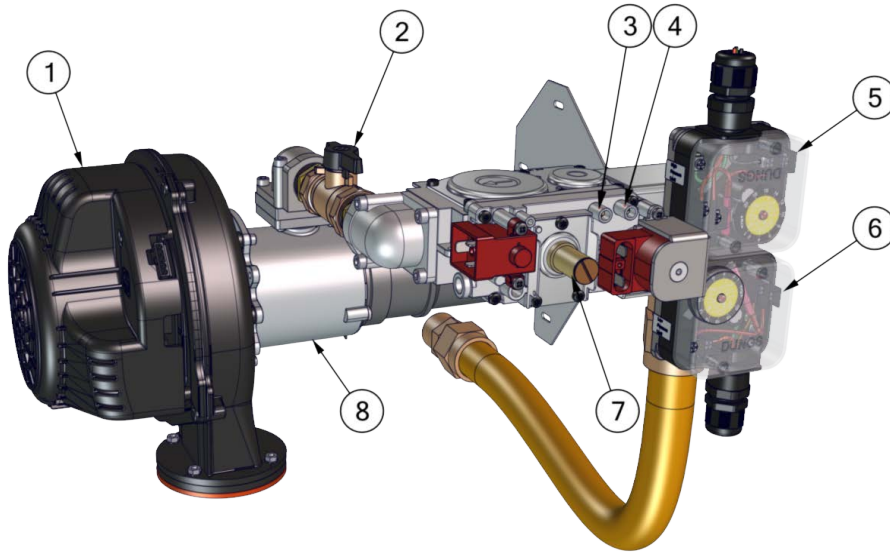


### **Danger**

Operating any IBC boiler using a fuel other than the fuel listed on its rating plate is prohibited. Failure to follow the instructions on converting to alternate fuels can result in a fire or explosion, which may cause property damage, personal injury, or loss of life.

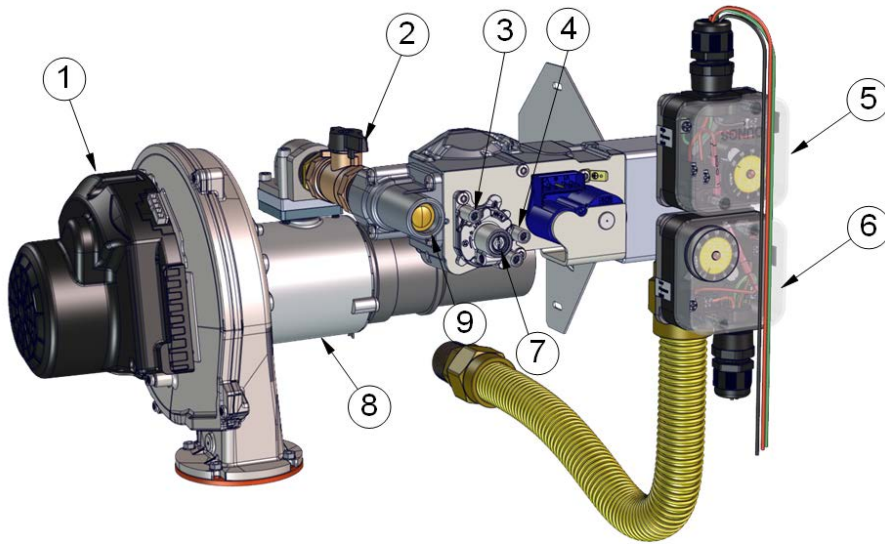
Check the rating plate of the boiler to ensure it is configured for the fuel you are using. If the fuel is incorrect for the appliance, a conversion kit must be ordered from IBC and the gas valve adjusted accordingly. Failure to perform the required fuel conversion can result in an immediate hazard.

Note that for the EX 400 and EX 500 models the gas valve may be manufactured by SIT or by Honeywell (each are illustrated below):



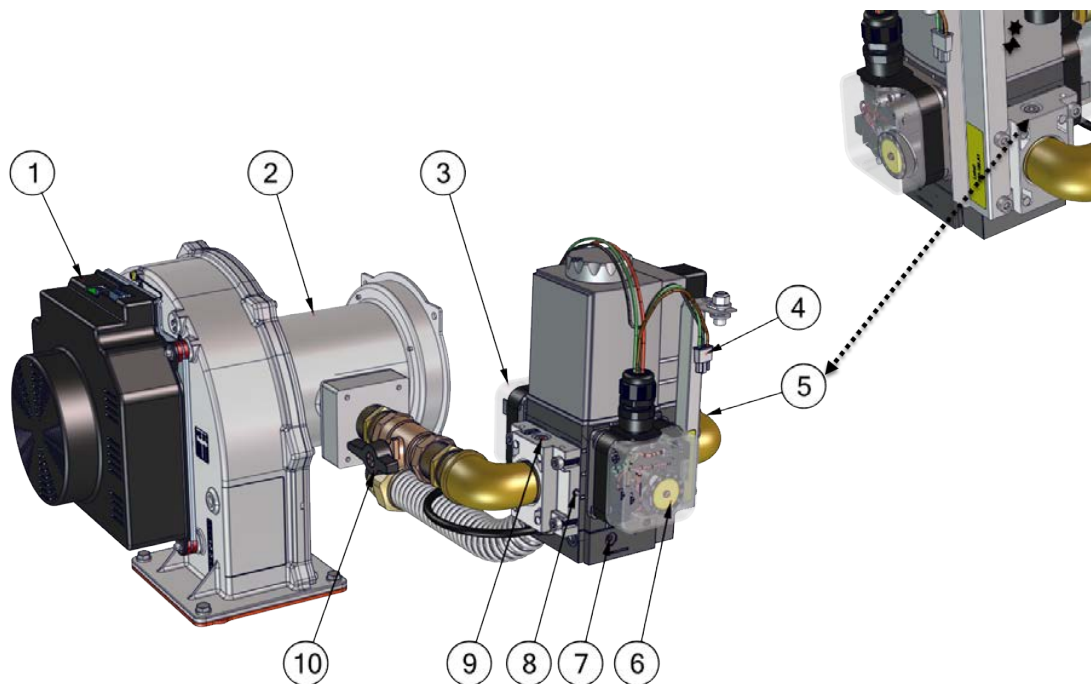
- ① Fan
- ② Shutoff valve
- ③ Manifold gas pressure test port
- ④ Inlet gas pressure test port
- ⑤ High pressure switch
- ⑥ Low pressure switch
- ⑦ Low fire adjustment
- ⑧ Mixing device
- ⑨ High fire adjustment - Honeywell gas valve only

**Figure 47** SIT gas valve and fan components - EX 400, 500



- ① Fan
- ② Shutoff valve
- ③ Manifold gas pressure test port
- ④ Inlet gas pressure test port
- ⑤ High pressure switch
- ⑥ Low pressure switch
- ⑦ Low fire adjustment
- ⑧ Mixing device
- ⑨ High fire adjustment - Honeywell gas valve only

**Figure 48** Honeywell gas valve and fan components - EX 400, 500



- |   |  |
|---|--|
| ① | Fan  |
| ② | Mixing device                              |
| ③ | Gas high pressure switch                   |
| ④ | Three- (3) wire Molex plug                 |
| ⑤ | Inlet gas pressure test port (location of) |
| ⑥ | Gas low pressure switch                    |
| ⑦ | Low fire adjustment (zero-offset)          |
| ⑧ | High fire adjustment (on the side)         |
| ⑨ | Manifold gas pressure test port            |
| ⑩ | Shutoff valve                              |

**Figure 49** Gas valve and fan components - EX 700, 850

The High Fire (gas-air ratio) adjustment screw will have to be adjusted to attain optimum combustion results whenever fuel conversion is undertaken, however, no mixture adjustment shall be performed unless done by a qualified technician using properly functioning and calibrated combustion analyzing equipment.

1. Ensure you are installing the correct fuel conversion kit for your boiler. Compare the boiler model number with the Kit # found in [Table 11](#).
2. Carefully follow the procedures of the fuel conversion instructions on:
  - a. Fuel Conversion
  - b. Combustion Testing and Adjustment
  - c. Placing conversion labels associated with the new fuel onto the boiler.

### Fuel conversion kit part numbers

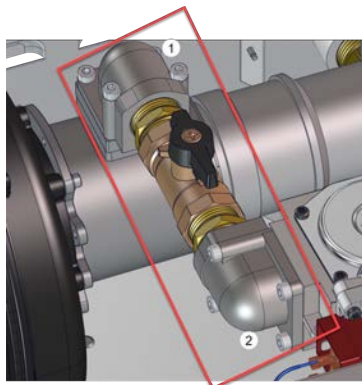
Model Number	Natural Gas to Propane	Propane to Natural Gas
EX 400	P-1236	P-1235
EX 500	P-1238	P-1237
EX 700	P-1201	P-1200
EX 850	P-1203	P-1202

**Table 11** Fuel Conversion Kits

#### 7.3.2.1 Performing a fuel conversion on EX 400 and EX 500 appliances

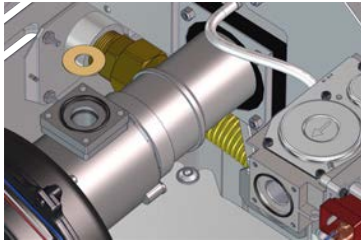
The following steps document replacing the current orifice with the kit-supplied orifice. After replacing the orifice, you will need to tune the gas valve.

1. Disconnect the power to the boiler, and close the gas shut-off valve.
2. Remove the front door and top cover from the boiler.
3. Remove the bolts of the elbow (mixer side) marked ① (see image below).
4. Remove the bolts of the elbow (gas valve side) marked ② (see image below).



**Figure 50** Fuel pipe assembly

5. Carefully lift off the fuel pipe assembly.



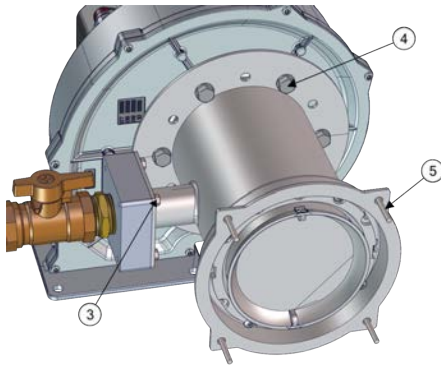
**Figure 51** *Removing the orifice*

6. Remove the orifice.
7. Retain the two O-rings in the elbows for reassembly.
8. Install the kit-supplied orifice.
9. Secure the elbow with bolts on the gas valve side, ensuring that the O-ring is well seated in the groove.
10. Secure the elbow with bolts on the mixer side, ensuring that the O-ring is well seated in the groove.
11. Turn on the electric power and gas supply to the boiler.
12. Reset the gas low pressure switch by pressing the clear plastic cover above the Red button.
13. Tune the gas valve. For instructions, see [Adjusting the gas valve \(EX 400, EX 500\) on page 84](#).
14. Check for gas leaks.

### **7.3.2.2 Performing a fuel conversion on EX 700 and EX 850 appliances**

1. Turn off the power and shut off the gas supply at the external gas shut-off valve.
2. Remove the front door and top cover from the boiler.
3. Remove the four (4) 5/16" hex bolts from the gas inlet to the mixing device. Carefully separate the two parts, remove and retain the O-ring for re-assembly. (See ③ in image below).





**Figure 52** *Disconnecting the mixing device*

4. Remove the four (4)  $\frac{1}{4}$ " hex bolts that connect the mixing device to the air filter box. The gasket should remain attached to the air filter box. (See 5 on image above).
5. Use an Allen key to remove the Six (6) 6 mm screws connecting the mixing device to the fan. (See 4 in image above). Carefully separate the two parts, remove and retain the O-ring for re-assembly.
6. Remove the propane mixing device.
7. When Installing the new natural gas mixing device ensure that the O-ring is properly seated in the groove of the fan.



**Caution**

Failure to position the O-ring as indicated will result in a gas leak, and affect burner operation.

8. Re-assemble in the reverse order of steps provided.
9. Turn on the electric power and gas supply to the boiler.
10. Reset the gas low pressure switch by pressing the clear plastic cover above the Red button.
11. Tune the gas valve. See [Adjusting the gas valve \(EX 700, EX 850\) on page 86](#).
12. Check for gas leaks.

## 7.3.3 Measuring the inlet gas pressure

To locate the inlet gas pressure test port on the EX 400 and the EX 500 models, see [7.0](#) . To locate the inlet gas pressure test port on the EX 700 and the EX 850 models, see [Figure 49](#) .

### 7.3.3.1 Measuring the inlet gas pressure - EX 400 and EX 500

To perform a gas pressure test, you will need to use a flat head screwdriver and a digital manometer. You will be measuring the inlet gas supply from the test port (see 7.0 ). Do not perform a test from the manifold gas pressure test port.

Ensure that you have a load configured (Reset Heating, Set Point, or DHW). This load should be large enough to allow the boiler to operate at high fire for over 10 minutes.

1. Shut off the gas supply.
2. On the gas valve, loosen the inlet gas pressure test port screw counter-clockwise.

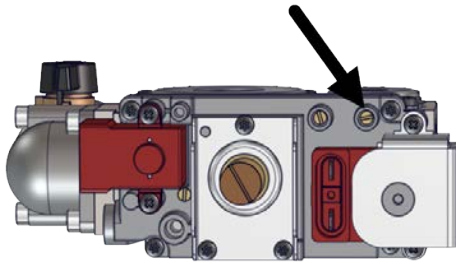


Figure 53 Location of inlet gas pressure test port - SIT valve

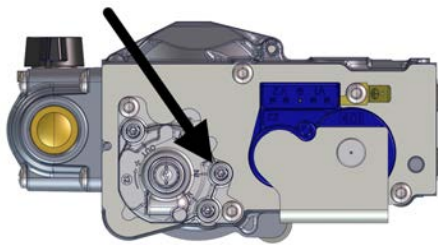


Figure 54 Location of inlet gas pressure test port - Honeywell valve

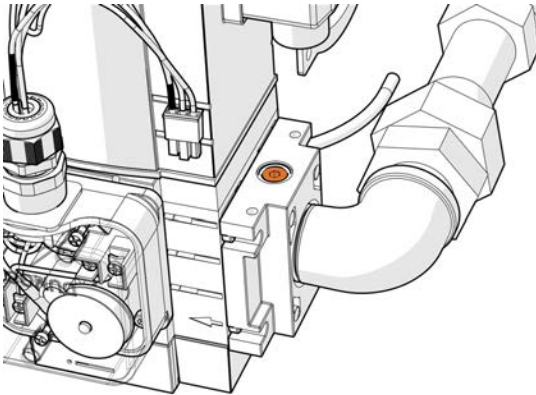
3. Attach the manometer to the inlet gas pressure test port.
4. Switch on the gas supply to measure the inlet gas pressure. The gas pressure for natural gas should be around 7" wc at high fire and 11" wc for propane. If the gas pressure dips below 3½" wc or exceeds 15" wc, the boiler will shut down. If this occurs, you will need to reset the gas high or low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).
5. After completing the inlet gas pressure test, switch off the gas supply.
6. Remove the manometer from the inlet gas pressure test port.
7. Tighten the bolt head using a flat head screwdriver.

### 7.3.3.2 Measuring the inlet gas pressure - EX 700 and EX 850

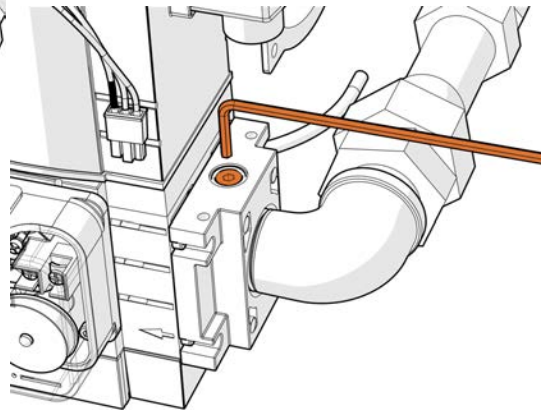
To perform a gas pressure test, you will need to use the inlet gas pressure test fitting (supplied with the boiler to transition from 1/8" BSP to barbed for connection to a manometer), a 3 mm Allen wrench, and a digital manometer. You will be measuring the inlet gas supply from the test port located to the right of the gas valve (see ④ on [Figure 49](#)). Do not perform a test from the manifold gas pressure test port.

Ensure that you have a load configured (Reset Heating, Set Point, or DHW). This load should be large enough to allow the boiler to operate at high fire for over 10 minutes.

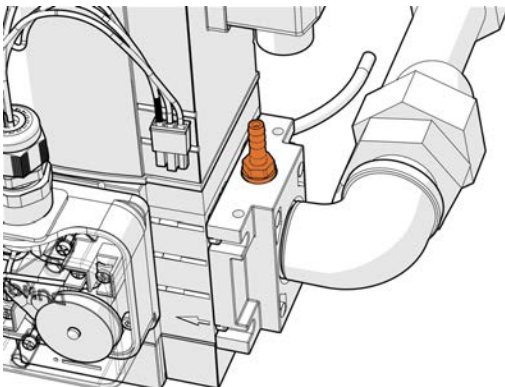
- 1.** Shut off the gas supply.



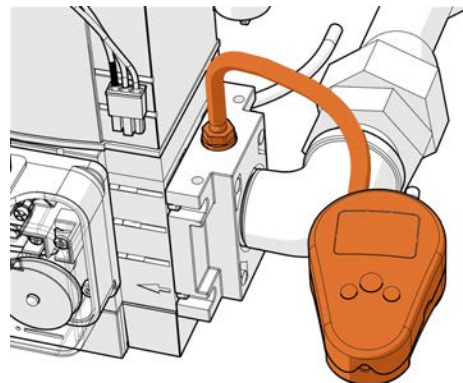
- 2.** Remove the bolt head using a 3mm Allen wrench, and put aside.



- 3.** Screw the inlet gas pressure test fitting into the inlet gas pressure test port.



- 4.** Insert the tubing securely into the inlet gas pressure test fitting.



- 5.** Switch on the gas supply to measure the inlet gas pressure. The gas pressure for natural gas should be around 7" wc at high fire and 11" wc for propane. If the gas

pressure dips below 3½" wc or exceeds 15" wc, the boiler will shut down. If this occurs, you will need to reset the gas high or low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).

6. After completing the inlet gas pressure test, switch off the gas supply.
7. Remove the inlet gas pressure test fitting and manometer from the inlet gas pressure test port.
8. Insert the bolt head and tighten using a 3 mm Allen wrench.

### 7.3.4 Adjusting the gas valve (EX 400, EX 500)



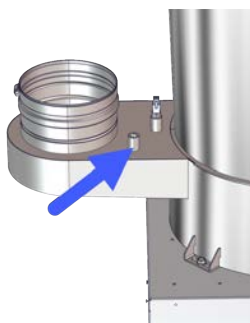
#### **Danger**

Making adjustments to the IBC gas valve without a properly calibrated gas combustion analyzer and by persons who are not trained and experienced in its use is forbidden. Failure to use an analyzer can result in an immediate hazard.

To help with the following procedure, see [7.0](#).

#### **Performing a combustion test**

1. Give the boiler a call for heat.
2. To run the boiler at high fire, you can set the heat-out value in Test Operation mode to the maximum MBH for the boiler. To do this, on the controller, go to ●●● (More) > **Test Operation** > In the **Fan Test: Heat Out** field, tap **0 MBtu**, then enter the maximum MBH (**40** or **50 MBtu**).
3. When the boiler reaches high fire, insert the combustion analyzer test probe into the flue gas test port. Then verify that the CO<sub>2</sub> reading is within the combustion test targets at [Table 12](#) values.



**Figure 55** Flue gas test port

**Note**

If using the SIT gas valve, high fire adjustment is not available on the EX 400 and EX 500. If the combustion analysis shows that the CO<sub>2</sub> value is lower than the minimum indicated for high fire, confirm that the incoming gas pressure is sufficient and the gas is purged of air. If it is, contact IBC Technical Support.

4. If using the Honeywell gas valve, adjust high fire if needed according to Table 11, using a Torx 40 screwdriver. Turn clockwise to raise the CO<sub>2</sub>% (to richen). Turn counter-clockwise to lower CO<sub>2</sub>%. Start with 1/8 of a turn until you see the analyzer measure a change then only make 1/16 adjustments. If changing direction on this adjustment you may notice a significant backlash.
5. Set the heat-out value in manual mode to the minimum MBH for the boiler. To do this:
  - a. Go to ●●● (More)> **Test Operation**.
  - b. In the **Fan Test: Heat Out** field, tap **0 MBtu**, and using the number pad, enter the minimum MBH (**40 or 50 MBtu**)> **OK**. Note that exiting the screen will stop the fan test.
6. Low fire adjustment - adjust the low fire according to see [Table 12](#) using a Phillips screwdriver. Turn clockwise to raise the CO<sub>2</sub>% (to richen). Turn counter-clockwise to lower CO<sub>2</sub>%. Start with 1/8 of a turn until you see the analyzer measure a change then only make 1/16 adjustments. If changing direction on this adjustment you may notice a significant backlash.
7. Check the results and confirm the correct settings when you return the boiler to high fire, and then to low fire.

**Note**

Clock the gas meter to confirm full maximum rating plate input.

8. To exit the Test Operation screen, select **Back**.
9. Remove call for heat.
10. Turn off the gas supply at the external gas shut-off valve.
11. Remove the analyzer probe, and install the test port plug.
12. Disconnect the manometer.
13. Tighten the inlet pressure port screw with a flat head screwdriver.
14. Turn on the gas supply shut off valve and test for gas leaks.

Fuel	High fire CO <sub>2</sub>		Low fire CO <sub>2</sub>		CO max PPM
	Range %	Target %	Range %	Target %	
Natural Gas	8.9 - 10.0	9.5	8.2 - 9.2	8.7	<150

Fuel	High fire CO <sub>2</sub>		Low fire CO <sub>2</sub>		CO max PPM
	Range %	Target %	Range %	Target %	
Propane	10.3 - 11.3	10.8	9.3 - 10.3	9.8	< 250

**Table 12** Combustion test target ranges - CO<sub>2</sub> / Maximum CO

### 7.3.5 Adjusting the gas valve (EX 700, EX 850)



#### **Danger**

Making adjustments to the IBC gas valve without a properly calibrated gas combustion analyzer and by persons who are not trained and experienced in its use is forbidden. Failure to use an analyzer can result in an immediate hazard.

To help with the following procedure, see [Figure 49](#).

#### **Performing a combustion test**

1. Give the boiler a call for heat.
2. To run the boiler at high fire, you can set the heat-out value in Test Operation mode to the maximum MBH for the boiler. To do this, on the controller, go to ●●● (More) > **Test Operation** > In the **Fan Test: Heat Out** field, tap **0 MBtu**, then enter the maximum MBH.
3. When the boiler reaches high fire, insert the combustion analyzer test probe into the flue gas test port (see [Figure 55](#)).
4. Adjust the high fire (gas-air ratio) adjustment with a small slot screwdriver according to [Table 12](#) values. Do not over-adjust. Turn counter-clockwise (in the direction of the '+' sign) to raise the CO<sub>2</sub>% (to richen). Turn clockwise to lower CO<sub>2</sub>%.
5. Set the heat-out value in manual mode to the minimum MBH for the boiler. To do this:
  - a. Go to ●●● (More)> **Test Operation**.
  - b. In the **Fan Test: Heat Out** field, tap **0 MBtu**, and using the number pad, enter the minimum MBH > **OK**. Note that exiting the screen will stop the fan test.
6. Adjust the low fire according to see [Table 12](#). Use a 2.5 mm Allen key. Turn counter-clockwise (in the direction of the '+' sign) to raise to raise the CO<sub>2</sub>% (to richen). Turn clockwise to lower CO<sub>2</sub>%. Start with 1/8 of a turn until you see the analyzer measure a change then only make 1/16 adjustments. If changing direction on this adjustment you will notice a significant backlash.
7. Return the boiler to high fire, and check the results to confirm the correct settings. Then return the boiler to low fire to confirm the correct settings.

**Note**

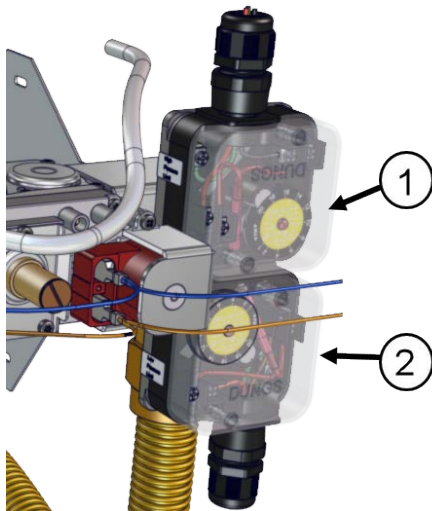
Clock the gas meter to confirm full maximum rating plate input.

8. To exit the Test Operation screen, select Back.
9. Turn off the gas supply at the external gas shut-off valve.
10. Remove the analyzer probe and install the test port plug.
11. Disconnect the manometer.
12. Remove the adapter fitting and reinstall the inlet test port plug, tightening with a 3mm Allen wrench. **Keep the fitting with the boiler for future use.**
13. Turn on the gas supply shut off valve and test for gas leaks.

### 7.3.6 Resetting the gas high / low pressure switches

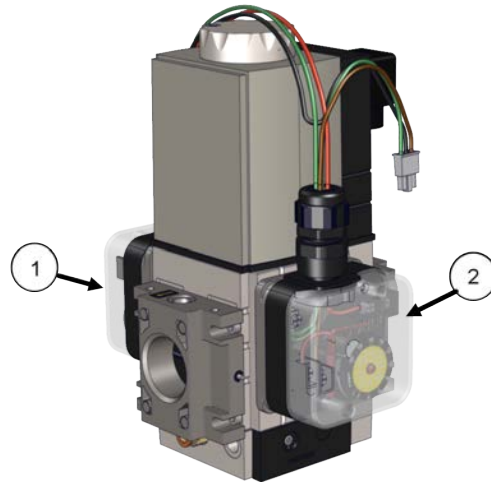
The gas high and low pressure switches are used to verify that the gas pressure is within the operating range (see images below). The gas low pressure switch responds to a drop in gas supply, and will shut down the boiler at 3½" wc (factory set). Located at the back of the gas valve, the gas high pressure switch is set to shut down the boiler at 15" wc.

After the gas to the boiler is connected and turned on, you must reset the gas low pressure switch.



① High pressure switch

**Figure 56** Gas low/high pressure switches - EX 400 and EX 500



② Low pressure switch

**Figure 57** Gas low/high pressure switches - EX 700 and EX 850

If the gas high or low pressure switch trips, the boiler controller will show a Red bar at the bottom of the controller screen. The white mark on the dial indicates when the gas pressure switch is set to trip.


To "reset" either the gas low or high pressure switch, press on the clear plastic cover above the Red button.



**Warning**

Do not attempt to adjust the gas high or low pressure switch in the field.

The low water cutoff (LWCO) function provides continuous protection against low water in the boiler. If the SIM detects low water, the boiler enters a lockout state. Perform the test to ensure that the LWCO sensor is functioning.

1. Go to Status  > **SIM Menu** > **LWCO Test** > Read the instructions.
2. After the test, on the touchscreen controller, select the **Reset** button.

The message: "The SIM Module has been reset" is displayed.

3. Tap **Close** > **Back** to exit the test.



## 8.0 Service and maintenance

Inspection of the boiler is to be performed annually by a qualified service technician.



### Caution

The owner is responsible for general care of the boiler. Improper maintenance of the boiler may result in a hazardous condition.

Managers of EX series boilers should arrange follow-up inspections and simple maintenance procedures according to IBC's suggested servicing guidelines below.

Maintenance Required for Venting	Frequency	Check
Check and replace filter as needed. Site conditions will determine how often the filter will need to be replaced. For replacement instructions, see <a href="#">Replacing the air filter on page 114</a>	As needed	<input type="checkbox"/>
Inspect system for unusual noises. Call your local heating contractor for service if needed	As needed	<input type="checkbox"/>
Keep vent terminals clear of obstructions (snow, dirt, etc.).	As needed	<input type="checkbox"/>
Check for signs of corrosion, such as noisy or smellable ignitions, deposits at venting transitions, or the appearance of soot at the vent termination: any such signs should be brought to the immediate attention of a qualified service technician.	Monthly	<input type="checkbox"/>
Inspection of the boiler is to be performed annually by a qualified service technician.	Annually	<input type="checkbox"/>

## 8.1 Maintenance checklists for heating contractor



### Caution

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

Maintenance Required	Check
Remove any obstructions (e.g. leaves, dust, other debris) from vent terminals	<input type="checkbox"/>
Check and clean or replace intake air filters or screens as required.	<input type="checkbox"/>
Check for holes or leaks in venting. Replace venting as needed.	<input type="checkbox"/>
Examine for any signs of moisture caused by sweating intake air pipes; insulate as required.	<input type="checkbox"/>
Ensure proper resealing or re-installation of venting on each servicing.	<input type="checkbox"/>

### 8.1.1 Venting

Maintenance Required for Venting	Frequency	Check
Check and replace filter as needed. For replacement instructions, see <a href="#">Replacing the air filter on page 114</a>	Monthly	<input type="checkbox"/>
Have your local heating contractor inspect the appliance annually.	Annually	<input type="checkbox"/>
Inspect system for unusual noises. Call your local heating contractor for service if needed	As needed	<input type="checkbox"/>
Keep vent terminals clear of obstructions (snow, dirt, etc.).	As needed	<input type="checkbox"/>
Inspection of the boiler is to be performed annually by a qualified service technician.	Annually	<input type="checkbox"/>

### 8.1.2 Condensate trap

Maintenance Required for Condensate Trap	Frequency	Check
Examine to see if cleaning is necessary (see <a href="#">Cleaning a condensate trap on page 115</a> ).	Annually	<input type="checkbox"/>
Ensure that the trap has been re-filled completely before firing boiler.		
If condensate neutralization is used, check the pH level of condensate discharge.	Annually	<input type="checkbox"/>

### 8.1.3 Burner

Maintenance Required for Burner	Frequency	Check
Remove the burner to inspect for extent of fouling (see <a href="#">Replacing the burner in the EX 400 and 500 models on page 101</a> or <a href="#">Replacing the burner in the EX 700 and EX 850 models on page 112</a> ).	Annually	<input type="checkbox"/>
<ol style="list-style-type: none"> <li>1. Wash the burner from outside with a domestic water pressure, and dry using compressed air.</li> <li>2. Evaluate and establish a reasonable burner inspection and cleaning schedule. Some boiler / locations may call for annual service, others with clean burners needing attention every 2 – 5 years.</li> <li>3. Reassemble. Visually inspect the burner through sight glass, ensuring flame is stable, without excessive fluttering. Normal flame pattern is evenly distributed over the burner surface.</li> </ol>		

Maintenance Required for Burner	Frequency	Check
If the burner is operating improperly, remove and clean or replace. Use a CO <sub>2</sub> analyzer to determine proper combustion. See <a href="#">Combustion test target ranges - CO<sub>2</sub> / Maximum CO on page 86</a> for correct values.	Annually	<input type="checkbox"/>

**Warning**

When removing the burner for inspection or boiler servicing, examine the sealing gaskets and replace if damaged. Upon re-assembly, test all sealing areas to ensure there is no leakage of combustible gas/air premix.

## 8.1.4 Heat exchanger

Maintenance Required for Heat Exchanger	Frequency	Check
In areas of poor gas quality, there may be a build-up of black plaque (typically sulfur). Other fouling agents include: airborne dust, debris and volatiles.	Annually	<input type="checkbox"/>

With the burner removed, examine the heat exchanger for signs of contamination and clean if necessary. Refer to instructions in [Replacing the burner in the EX 400 and 500 models on page 101](#) or [Replacing the burner in the EX 700 and EX 850 models on page 112](#) for access to the combustion chamber and heat exchanger.

## 8.1.5 Pump

Maintenance Required for Pump	Frequency	Check
Check that the pump is on in normal operation and that the water $\Delta^{\circ}\text{T}$ is reasonable for a given firing rate.	Annually	<input type="checkbox"/>

## 8.1.6 Gas piping

Maintenance Required for Gas Piping	Frequency	Check
Check for damage or leaks and repair as needed.	Annually	<input type="checkbox"/>

### 8.1.7 Touchscreen boiler controller

Maintenance Required for Boiler Controller	Frequency	Check
Check that boiler operation is consistent with the steps in the Touchscreen Boiler Controller Manual.	Annually	<input type="checkbox"/>
Check that water temperature targets and setpoint is satisfactory and have not been adversely amended.	Annually	<input type="checkbox"/>
Check the operating history using the boilers Logs menu and Error Logs menu. The controller tracks the duty cycle of the boiler in each of the 4 loads separately. This information can be used to adjust the water temperatures of each load. If a problem exists with the controller, see <a href="#">Troubleshooting on page 117</a> .	As needed	<input type="checkbox"/>

### 8.1.8 Water

Checks for Water in the Boiler	Frequency	Check
Check water pressure and temperature. There should be no noticeable change if boiler is functioning normally. Check for any noise in the system.	Annually	<input type="checkbox"/>
Check water piping for damage or leaks and repair as needed.	Annually	<input type="checkbox"/>
Check the water pressure. Pressure should be stable when the boiler is firing and the water temperature is rising. If pressure rises sharply, consider replacement of expansion tank.	Annually	<input type="checkbox"/>
Check also for noise at high fire, which may signal water quality problems.	Annually	<input type="checkbox"/>
Water chemistry shall be of a quality generally accepted as suitable for hydronic applications.	Annually	<input type="checkbox"/>
Test Low-water cut-off (LWCO) safety operation on each servicing: see <a href="#">Testing LWCO function</a> .	Annually	<input type="checkbox"/>
Ensure any direct "city fill" water connections are left in the closed position to minimize exposure to leaks and flooding.	Annually	<input type="checkbox"/>



#### Caution

Installers should inquire of local water purveyors as to the suitability of their supply for use in hydronic heating systems.

If water quality is questionable, a local water treatment expert must be consulted for testing, assessment and, if required, treatment.

Alternatively, water or hydronic fluid of known quality can be brought to the site.

## 8.1.9 Freeze protection

Maintenance to prevent freezing	Frequency	Check
Check the freeze protection. Use only antifreeze made specifically for hydronic systems. Inhibited propylene glycol is recommended. Antifreeze volume must be between 25% and 50% of the total volume of water in the system.	Annually	<input type="checkbox"/>



### Warning

Do not use automotive-type ethylene or other types of automotive glycol antifreeze, or undiluted antifreeze of any kind. This may result in severe boiler damage. It is the responsibility of the Installer to ensure that glycol solutions are formulated to inhibit corrosion in hydronic heating systems of mixed materials. Improper mixtures and chemical additives may cause damage to ferrous and non-ferrous components as well as non-metallic, wet components, normally found in hydronic systems. Ethylene glycol is toxic, and may be prohibited for use by codes applicable to your installation location. For environmental and toxicity reasons, IBC recommends only using non-toxic propylene glycol.

## 8.1.10 Boiler treatment

Maintenance for Boiler Treatment	Frequency	Check
Check consistency of any boiler treatment used, for appropriate mixture. Chemical inhibitors are consumed over time, lowering their density.	Annually	<input type="checkbox"/>
Verify proper operation after servicing.	Annually	<input type="checkbox"/>



### Caution

Installers should inquire of local water purveyors as to the suitability of their supply for use in hydronic heating systems.

If water quality is questionable, a local water treatment expert must be consulted for testing, assessment and, if required, treatment.

Alternatively, water or hydronic fluid of known quality can be brought to the site.

## 8.1.11 Relief valve - maintenance and testing

The relief valve manufacturer requires that under normal operating conditions a “try lever test” must be performed every two months.

Under severe service conditions, or if corrosion and/or deposits are noticed within the valve body, testing must be performed more often. A “try lever test” must also be performed at the end of any non-service period.

Maintenance for Relief valve	Frequency	Check
------------------------------	-----------	-------

Test at or near the maximum operating pressure by holding the test lever fully open for at least 5 seconds to flush the valve seat free of sediment and debris. Then release the lever and allow the valve to snap shut.

Annually

☐

If the lever does not activate, or if there is no sign of discharge, discontinue use of equipment immediately and contact a licensed contractor or qualified service personnel.

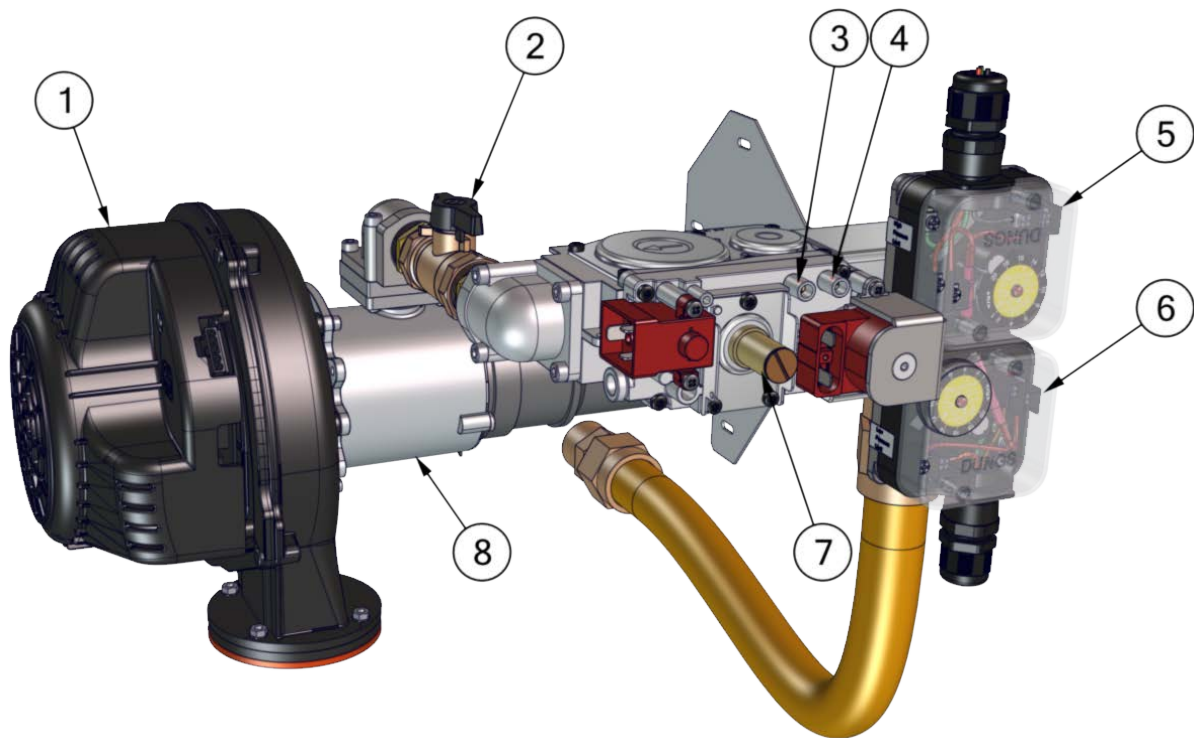
If the relief valve does not completely seal, and fluid continues to leak from the discharge pipe - perform the test again to try and flush any debris that may be lodged in the valve. If repeated tries fail to stop the leakage, contact a licensed contractor or qualified service personnel to replace the valve.

While performing a "try lever test", a quantity of heat transfer fluid will be discharged from the piping system and the system pressure will drop. This fluid must be replaced. To refill and pressurize your system, we recommend using a system pressurization appliance such as an Axiom Industries model SF100 series. Capture the discharged fluid in a container and recycle it by returning it to the system feeder appliance. This is particularly important when your system contains treatment chemicals or glycol solutions. If the system employs plain water, the boiler auto fill valve must be turned on in order to recharge the lost fluid.

## 8.2 Replacing the fan, gas valve, and burner in EX 400 and EX 500 models

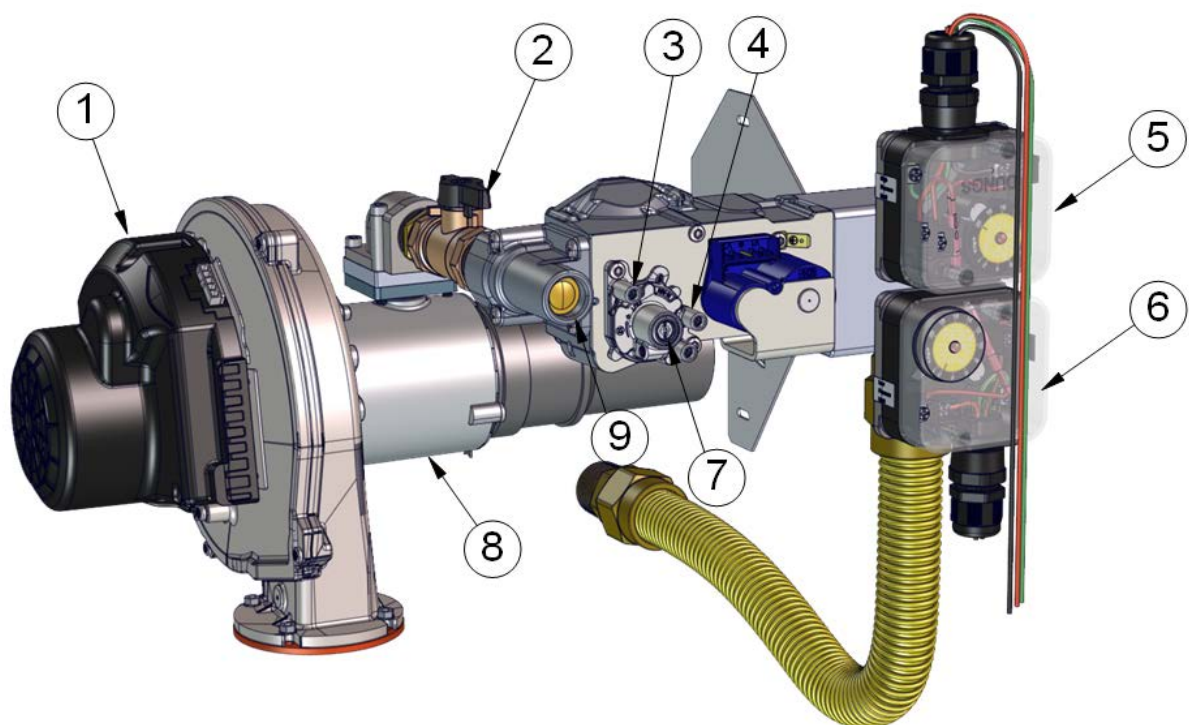
This section documents the following maintenance procedures for EX 400 and EX 500 models. Note that the gas valve may be manufactured by SIT or by Honeywell (each are illustrated below):

- » Replacing the fan
- » Replacing the gas valve
- » Replacing the burner.



- |   |  |
|---|--|
| ① | Fan  |
| ② | Shutoff valve  |
| ③ | Manifold gas pressure test port (generally not used)         |
| ④ | Inlet gas pressure test port                                 |
| ⑤ | High pressure switch   |
| ⑥ | Low pressure switch  |
| ⑦ | Low fire adjustment  |
| ⑧ | Mixing device  |
| ⑨ | High-fire adjustment (available on Honeywell gas valve only) |

Figure 58 SIT gas valve and fan components - EX 400, 500



- ① Fan
- ② Shutoff valve
- ③ Manifold gas pressure test port (generally not used)
- ④ Inlet gas pressure test port
- ⑤ High pressure switch
- ⑥ Low pressure switch
- ⑦ Low fire adjustment
- ⑧ Mixing device
- ⑨ High-fire adjustment (available on Honeywell gas valve only)

Figure 59 Honeywell gas valve and fan components - EX 400, 500

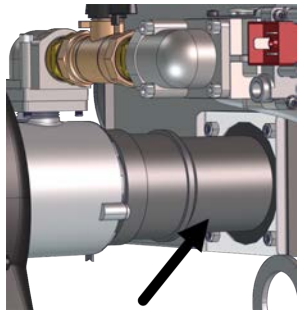


## 8.2.1 Replacing the fan on the EX 400 and EX 500 models

1. Turn off the electric power and gas supply to the boiler.
2. Ensure the boiler cools down to the surrounding temperature. Do not drain the boiler unless freezing conditions are expected during this procedure.
3. Remove the front cover, and then remove the boiler's top panel by removing the Torx screws on the top panel of the boiler.

A ladder or step may be required to have a clear vertical view of the work area. Do not attempt to reach from the front without a clear view, as damage to connectors, screws or refractory may occur.

4. Unplug the electrical connectors on the front and back of the fan.
5. Position the harnesses out of the way of the heat exchanger lid.
6. Pull away the air intake tube (can slide into the filter box) from the fuel mixer (see [Figure 60](#) ).



[Figure 60](#) Air intake tube

7. Use a 3mm Allen key to remove the three (3) screws connecting the mixing device to the fan. (See [Figure 61](#) ). Ensure that the fan O-ring stays seated in the fan groove during reassembly.



[Figure 61](#) Location of screws securing mixing device to fan

8. Use a 7mm wrench to remove the four screws at the base of the fan (attaching the fan to the heat exchanger lid). It may help to unplug the ignitor for easier access.
9. Lift off the fan, and replace with the new fan. Ensure that the fan O-ring stays seated in the fan groove during reassembly.
10. Reinstall the components in reverse order. Upon reassembly, ensure that all O-rings and gaskets are correctly positioned.

**Warning**

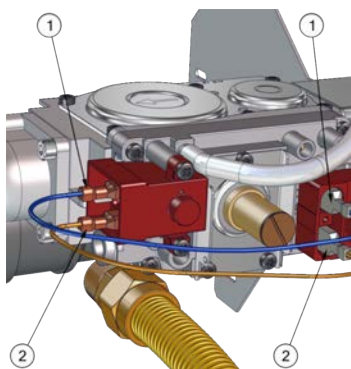
Ensure that the fan O-ring is seated in the groove of the fan when reassembling.

## 8.2.2 Replacing the gas valve in the EX 400 and EX 500 models

1. Turn off the electric power and gas supply to the boiler.
2. Ensure that the boiler cools down.
3. Remove the front cover, and then remove the four Torx 20 head screws on the top panel of the boiler.

A ladder or step may be required to have a clear vertical view of the work area. Do not attempt to reach from the front without a clear view, as damage to the connectors or screws may occur.

4. Disconnect the gas valve wiring, and pull out the connectors by gripping the plastic tip, rather than the wire, to avoid breaking the connector (see ① and ② in [Figure 62](#)). Note the position of the colored wires; do not cross the colored wires upon reconnection (i.e., blue on top).



**Figure 62** Connector wires

5. Gently remove the silicone air pressure tube from the gas valve by gripping near its base, and put aside.

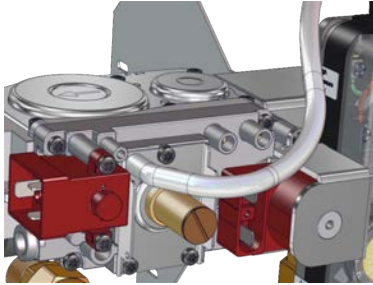


Figure 63 *Silicone air pressure tube*

6. From the inlet side of the gas valve (see ⑨ on 8.0 ), remove the four (4) screws using a 4mm Allen key, and put aside.

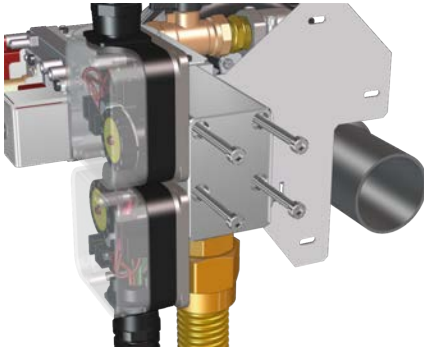
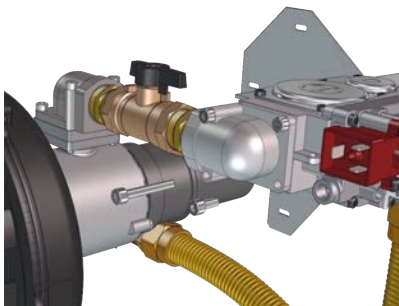


Figure 64 *Screws on gas valve inlet*

7. Remove the screws from the outlet side of the gas valve (see ⑩ on 8.0 ) to separate the gas valve from the appliance. To do this, ensure that you support the bottom of the gas valve when you remove the bottom two (2) screws (see Figure 65 ) and then the top two (2) screws.



**Figure 65** *Gas valve outlet screws*

8. Replace with the new gas valve following the steps in reverse order. Upon reassembly, ensure that all O-rings are well seated in their grooves.

**Tip:** Lightly hand-tighten each screw before tightening all four screws fully on both the outlet and inlet sides of the gas valve. To prevent gas leaks, ensure that the O-rings on the outlet side and inlet side are well seated in their grooves.

9. Tune the gas valve. For instructions, see [Adjusting the gas valve \(EX 400, EX 500\) on page 84](#).
10. Turn on the electric power and gas supply to the boiler.
11. Reset the low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).

## 8.2.3 Replacing the burner in the EX 400 and 500 models



### Warning

The IBC heat exchanger has a small amount of combustion chamber insulation (refractory), which contains ceramic fibers.

When exposed to extremely high temperatures, the ceramic fibers that contain crystalline silica can be converted into cristobalite, classified as a possible human carcinogen.

Avoid disturbing or damaging the refractory. If damage occurs, contact the factory for directions.

Avoid breathing and contact with skin and eyes and follow these precautions:

1. For conditions of frequent use or heavy exposure, respirator protection is required. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

For the most current information, NIOSH can be contacted at 1-800-356-4676 or on the web at [www.cdc.gov/niosh](http://www.cdc.gov/niosh).

2. Wear long sleeved, loose fitting clothing, gloves and eyes protection.
3. Assure adequate ventilation.
4. Wash with soap and water after contact.
5. Wash potentially contaminated clothes separately from other laundry and rinse washing machine thoroughly.
6. Discard used insulation in an air tight plastic bag.

NIOSH stated first aid:

- » Eye contact - Irrigate and wash immediately.
- » Breathing - Provide fresh air.

### To remove the burner:

1. Turn off the electric power and gas supply to the boiler.
2. Remove the front cover, and then remove the boiler's top panel by removing the Torx head screws.
3. Unplug the two electrical connectors from the front and back of the fan (see [Figure 66](#) ).

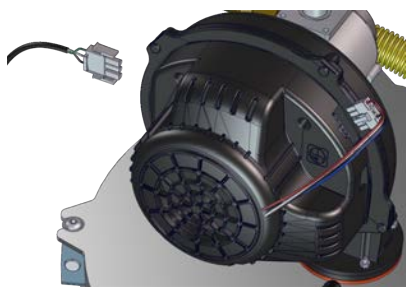


Figure 66 *Fan connectors*

4. Remove the Nylok nuts from the air intake clamp and gasket assembly.

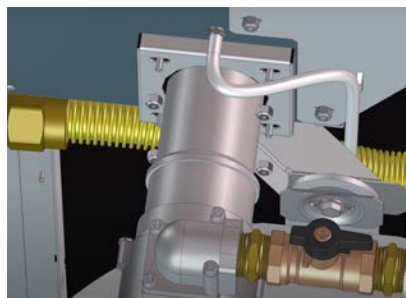


Figure 67 *Air intake clamp and gasket assembly*

5. When loose, slide off the clamp and gasket assembly, and put aside with screws and Nylok nuts for reassembly.

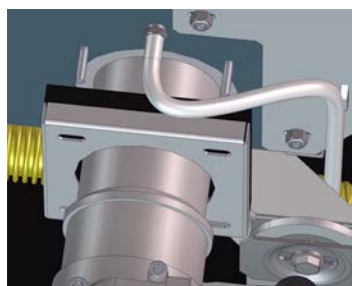


Figure 68 *Removal of clamp and gasket assembly*

6. Push the air intake tube into the filter box.

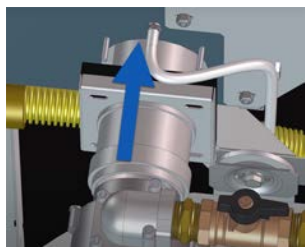


Figure 69 Removal of clamp and gasket assembly

7. Remove the silicone tube.

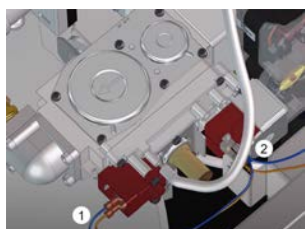


Figure 70 Removal of silicone tube

8. Disconnect the electrical connectors (see ① and ② on above image).
9. Remove the four (4) bolts from the right side of the gas valve.
10. Remove the four (4) bolts that attach the mixing device to the fan.



Figure 71 Removing bolts securing mixer to fan

11. Remove the mixer assembly, gas line and gas valve by pulling straight up.



Figure 72 Removing mixer assembly, gas line and gas valve

12. Remove the air intake tube.



Figure 73 Removing air intake tube

13. Disconnect the ignitor electrical cable and green grounding wire.
14. Remove the nuts securing the fan to the lid.
15. Remove the fan.

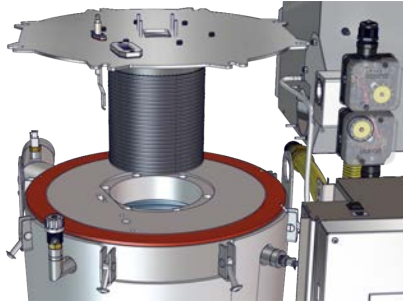


**Warning**

Wear a suitable protective mask to avoid ingesting particles from the refractory.

16. Loosen the eight (8) bolts securing the lid to the heat exchanger using a 5 mm Allen key.
17. To confirm correct lid orientation upon reassembly, draw a vertical line from the front of the lid down to the heat exchanger.
18. Carefully lift (straight up) the heat exchanger lid, and place in a clean dry area. The refractory might be left behind in the heat exchanger (as shown) or might come out with the lid. Take care to avoid damaging the refractory.





**Figure 74** *Lifting heat exchanger lid with burner on underside*

19. If the refractory is held to the lid with four bolts and washers, use a 7/32" socket to remove them, set them aside, and carefully lift the refractory off the burner.
20. Carefully remove the 6 M8 bolts securing the burner to the heat exchanger lid.  
  
Tip: to gain better access to the burner, carefully unscrew the ignitor from the lid and place in a safe place.
21. Remove the burner and gasket. The burner gasket may be brittle and break in the process. Replace if necessary.



**Figure 75** *Removing bolts securing burner to heat exchanger lid*

**To reinstall:**

1. Install the new burner.
2. Ensure that you tighten each screw evenly by following the order indicated in the pattern below.

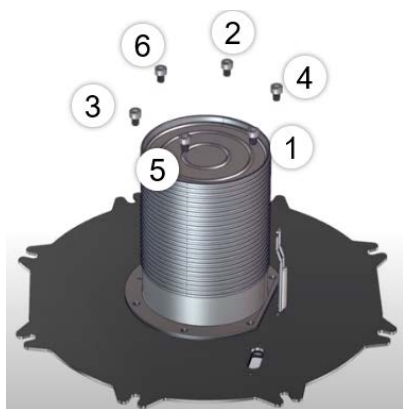


Figure 76 Example of cross-tightening of screws



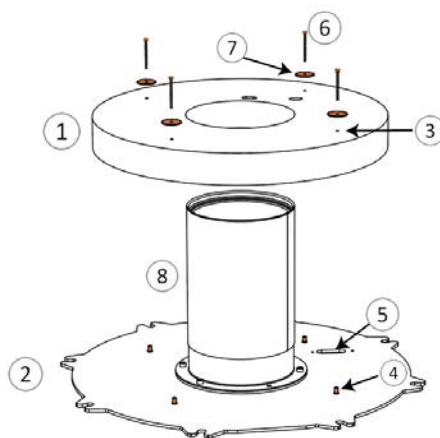
#### Caution

The refractory is to be secured to the heat exchanger lid using the supplied specialty high-acidity / temperature resistance bolts and washers. **Do not substitute with non-OEM parts.**

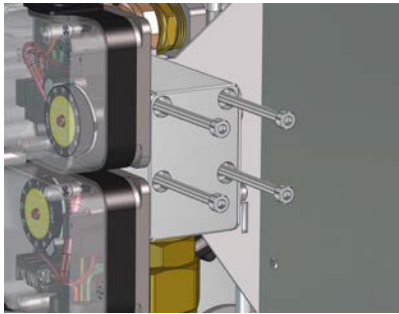
Extreme care must be taken when aligning the bolts through the refractory to the lid.

Gaps are to be avoided between the refractory and the lid in order to prevent overheating, hotspots and distortion of the heat exchanger lid.

- a. Place the supplied refractory (1) onto the supplied lid (2), over the burner (8), aligning the bolt holes (3) through the refractory to the indexed holes in the lid (4). Ensure that the ignitor position (5) is also aligned with the refractory.
  - b. Carefully secure the refractory to the lid using the 4 supplied bolts (6) and washers (7) (see Caution above).
  - c. Align the heat exchanger lid gasket onto the heat exchanger, ensure the gasket is flat.
- 3.
  4. Reinstall the lid bolts.
  5. Reinstall the fan gasket and fan. Replace gasket if necessary.
  6. Reconnect the ignitor electrical cable and green grounding wire.



7. Insert the air intake tube into the air filter box.
8. Reinstall the mixer, gas line and gas valve assembly, ensuring that the mixer gasket is in place.
9. Attach the mixing device to the fan with the bolts.
10. Replace the bolts on the right side of the gas valve.



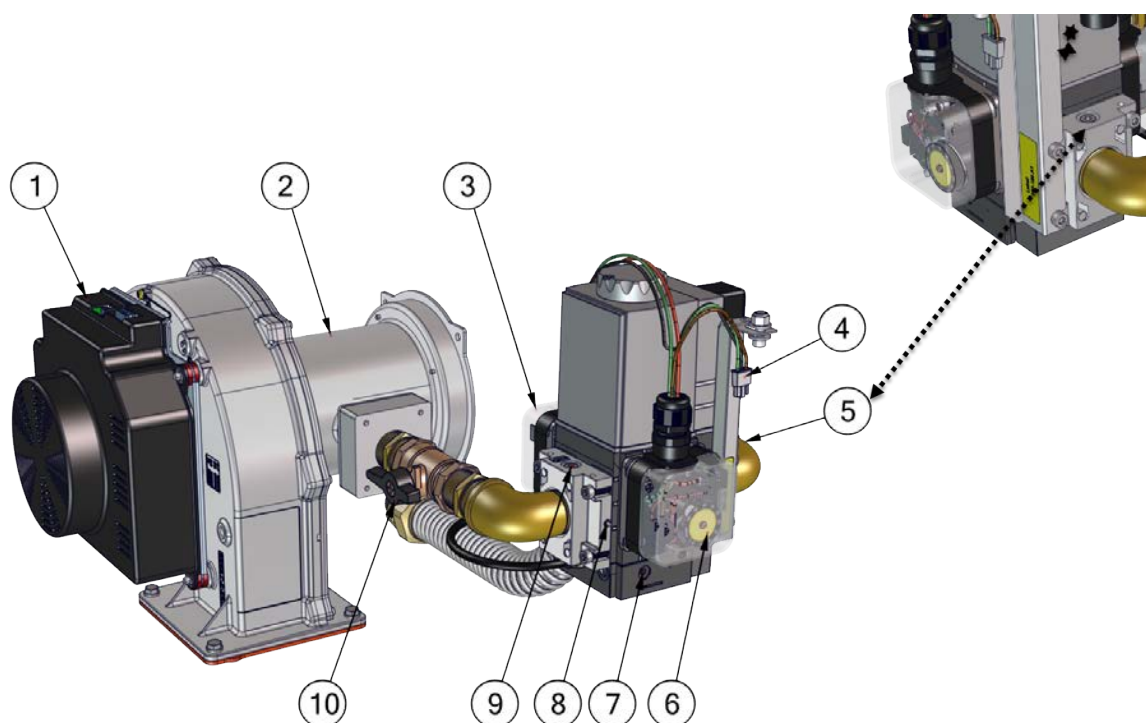
*Figure 77 Bolts on right side of gas valve*

11. Reattach the electrical connectors to the gas valve.
12. Reattach the silicone tube.
13. Fit the air intake tube onto the mixing device.
14. Secure the air intake gasket and clamp components to the filter box.
15. Reattach the two electrical connectors to the front and back of the fan.
16. Reinstall the boiler's top panel and then the front cover.
17. Turn on the electric power and gas supply to the boiler.
18. Reset the low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).
19. Tune the gas valve. For instructions, see [Adjusting the gas valve \(EX 400, EX 500\) on page 84](#).

## 8.3 Replacing the fan, gas valve, and burner in EX 750 and EX 800 models

This section documents the following maintenance procedures for EX 700 and EX 850 models:

- » Replacing the fan
- » Replacing the gas valve
- » Replacing the burner.



- |   |                                    |
|---|------------------------------------|
| ① | Fan                                |
| ② | Mixing device                      |
| ③ | High pressure switch               |
| ④ | Three- (3) wire Molex plug         |
| ⑤ | Inlet gas pressure test port       |
| ⑥ | Low pressure switch                |
| ⑦ | Low fire adjustment (zero-offset)  |
| ⑧ | High fire adjustment (on the side) |
| ⑨ | Manifold gas pressure test port    |
| ⑩ | Shutoff valve                      |

Figure 78 Gas valve and fan components - EX 700, 850

## 8.3.1 Replacing the fan on the EX 700 and EX 850 models

1. Turn off the electric power and gas supply to the boiler.
2. Ensure the boiler cools down. Do not drain the boiler unless freezing conditions are expected during this procedure.
3. Remove the front cover, and then remove the boiler's top panel by removing the Torx screws on the top panel of the boiler.

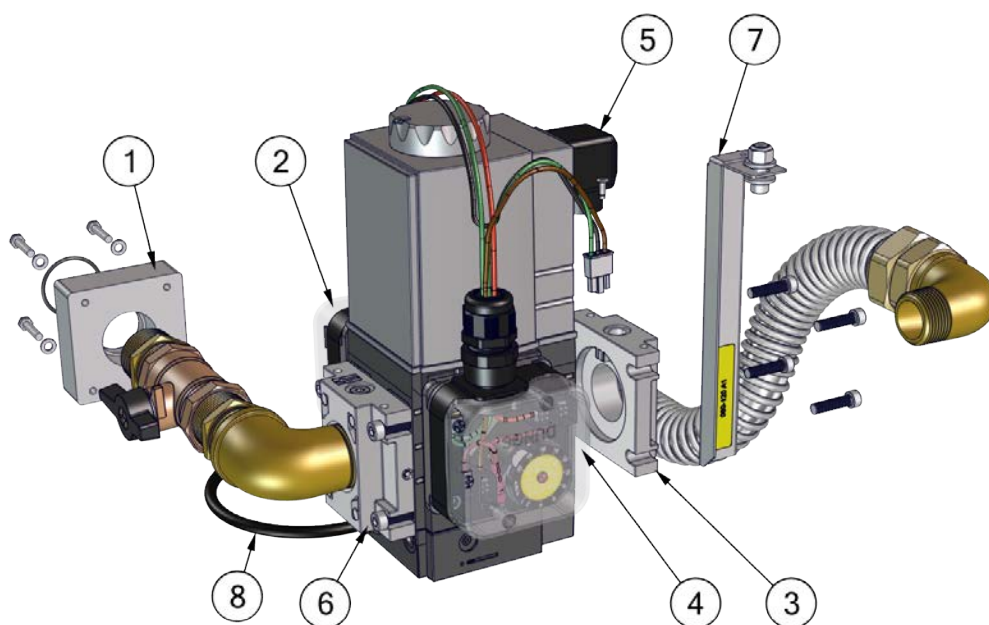
A ladder or step may be required to have a clear vertical view of the work area. Do not attempt to reach from the front without a clear view, as damage to connectors, screws or refractory may occur.

4. Unplug both the front and back electrical connectors from the fan, and position them out of the way of the fan.
5. To separate the mixing device from the fan, remove the 6 x 6mm bolts. Note how the mixing device is positioned on the fan before separating it from the fan.

**Note:** When you disconnect the mixer from the fan, it is still attached to the filter box and gas valve. This puts pressure on the fan, filter box and gas valve assembly, which have limited support. When you swap out the fan, place some sort of support underneath the mixer.

6. Remove the four (4) bolts at the base of the fan, connecting the fan to the heat exchanger lid.
7. Carefully lift off the fan, by pulling straight up and ensuring that no wires are caught, and that the gas line remains in place. Place the removed components in a clean, dry area.
8. Attach the new fan.
9. Ensure that the O-ring is in place on the fan before reattaching the mixer.
10. Re-install the components in reverse order. Upon reassembly, ensure that all gaskets are included and correctly positioned.

### 8.3.2 Replacing the gas valve in EX 700 and EX 850 models



- ① Four (4) bolts connecting gas valve and mixing device. Keep gasket and bolts for re-assembly.
- ② Location of high gas pressure switch.
- ③ Gas valve inlet: Four (4) bolts of the flange. Keep gasket and bolts for re-assembly.
- ④ Low gas pressure switch.
- ⑤ Gas valve electrical connector
- ⑥ Gas valve outlet: Four (4) bolts of the flange. Keep gasket and bolts for re-assembly.
- ⑦ Supporting bracket for gas valve
- ⑧ Black tubing

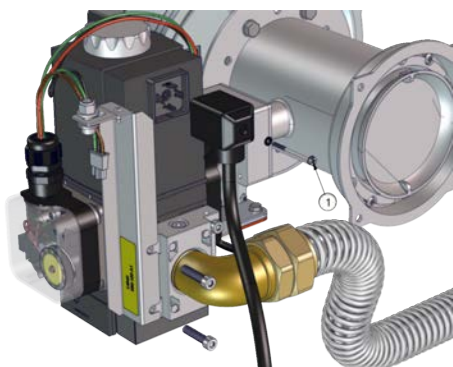
Figure 79 Accessing the gas valve - EX 700, 850

1. Turn off the electric power and gas supply to the boiler.
2. Ensure that the boiler cools down to the surrounding temperature. Do not drain the boiler unless freezing conditions are expected during this procedure.

3. Remove the front cover, and then remove the boiler's top panel by removing the four Torx head screws on the top panel of the boiler.

A ladder or step may be required to have a clear vertical view of the work area. Do not attempt to reach from the front without a clear view, as damage to connectors, screws or refractory may occur.

4. Remove the bolt and nut securing the gas valve bracket to the frame.
5. Remove the Phillips head screw (see ① on [Figure 80](#)) from the power connector plug, and pull off the electrical connector from the gas valve.
6. Remove the two screws of the bracket supporting the gas valve on the inlet side (see [Figure 80](#)).



[Figure 80](#) Removing two screws of bracket and Phillips head screw on gas valve inlet side

7. Pull the black tubing (see ⑧ on [Figure 79](#)) from the push-to-connect fitting on the gas valve outlet side.
8. Disconnect the three- (3) wire Molex plug from the gas pressure switches.
9. Unscrew the two (2) bolts of the flange to separate the gas valve inlet from the gas line. Keep gasket and bolts for re-assembly. (See ③ on [Figure 79](#).)
10. Unscrew the four (4) bolts of the flange to separate the gas valve outlet from the gas line. Keep gasket and bolts for re-assembly. (See ⑥ on [Figure 79](#).)
11. Remove the gas valve and install the new gas valve.
12. Re-install the components in reverse order of the steps above.
13. Turn on the electric power and gas supply to the boiler.
14. Reset the low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).
15. Tune the gas valve. For instructions, see [Adjusting the gas valve \(EX 700, EX 850\) on page 86](#).

### 8.3.3 Replacing the burner in the EX 700 and EX 850 models



#### Warning

The IBC heat exchanger has a small amount of combustion chamber insulation (refractory), which contains ceramic fibers.

When exposed to extremely high temperatures, the ceramic fibers that contain crystalline silica can be converted into cristobalite, classified as a possible human carcinogen.

Avoid disturbing or damaging the refractory. If damage occurs, contact the factory for directions.

Avoid breathing and contact with skin and eyes and follow these precautions:

1. For conditions of frequent use or heavy exposure, respirator protection is required. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

For the most current information, NIOSH can be contacted at 1-800-356-4676 or on the web at [www.cdc.gov/niosh](http://www.cdc.gov/niosh).

2. Wear long sleeved, loose fitting clothing, gloves and eyes protection.
3. Assure adequate ventilation.
4. Wash with soap and water after contact.
5. Wash potentially contaminated clothes separately from other laundry and rinse washing machine thoroughly.
6. Discard used insulation in an air tight plastic bag.

NIOSH stated first aid:

- » Eye contact - Irrigate and wash immediately.
- » Breathing - Provide fresh air.

1. Turn off the electric power and gas supply to the boiler.
2. Ensure that the boiler cools down to the surrounding temperature. Do not drain the boiler unless freezing conditions are expected during this procedure.
3. Remove the front cover, and then remove the boiler's top panel by removing the four Torx head screws on the top panel of the boiler.

A ladder or step may be required to have a clear vertical view of the work area. Do not attempt to reach from the front without a clear view, as damage to connectors, screws or refractory may occur.



4. Remove the two screws of the bracket supporting the gas valve on the inlet side (see [Figure 80](#)).
5. Remove the Phillips head screw (see ① on [Figure 80](#)) from the power connector plug, and pull off the electrical connector from the gas valve.
6. Pull the black tubing (see ⑧ on [Figure 79](#)) from the push-to-connect fitting on the gas valve outlet side.
7. Disconnect the three- (3) wire Molex plug from the gas pressure switches.
8. Unscrew the two (2) bolts of the flange to separate the gas valve inlet from the gas line. Keep gasket and bolts for re-assembly. (See ③ on [Figure 79](#).)
9. Remove the four 5/16" hex head bolts that attach the gas valve assembly to the mixing device. (See ① on [Figure 79](#).) These bolts should be first loosened slightly in a cross sequence to prevent deformation of the mating parts.
10. Carefully move aside the gas valve assembly, and retain the O-ring for re-installing.
11. Remove the four (4) 1/4" hex bolts that connect the mixing device to the air filter box. The gasket should remain attached to the air filter box.
12. Remove the four (4) 10mm hex bolts that attach the fan to the heat exchanger lid. An open-ended wrench or socket is required.
13. With the mixing device still attached, remove the fan by pulling straight up ensuring that no wires are caught and that the gas line remains in place. Place the removed components in a clean, dry area
14. Unplug the ignitor from the lid and place in a safe place.
15. Loosen the eight (8) 5mm Allen lid fasteners securing the lid to the heat exchanger. Mark the orientation of the lid onto the heat exchanger with a marker.
16. Carefully lift up on the lid and remove. Be careful not to damage the refractory insulation. Place the lid and burner assembly in a clean dry area.
17. Carefully loosen the burner cap screws and remove. Keep the cap screws for re-installation.
18. Separate the burner from lid. Replace the burner gasket upon re-installation.
19. Re-install the components in reverse order of the steps above.

**Warning**

After removing a burner, it is imperative that you perform a gap analysis on the ignitor.

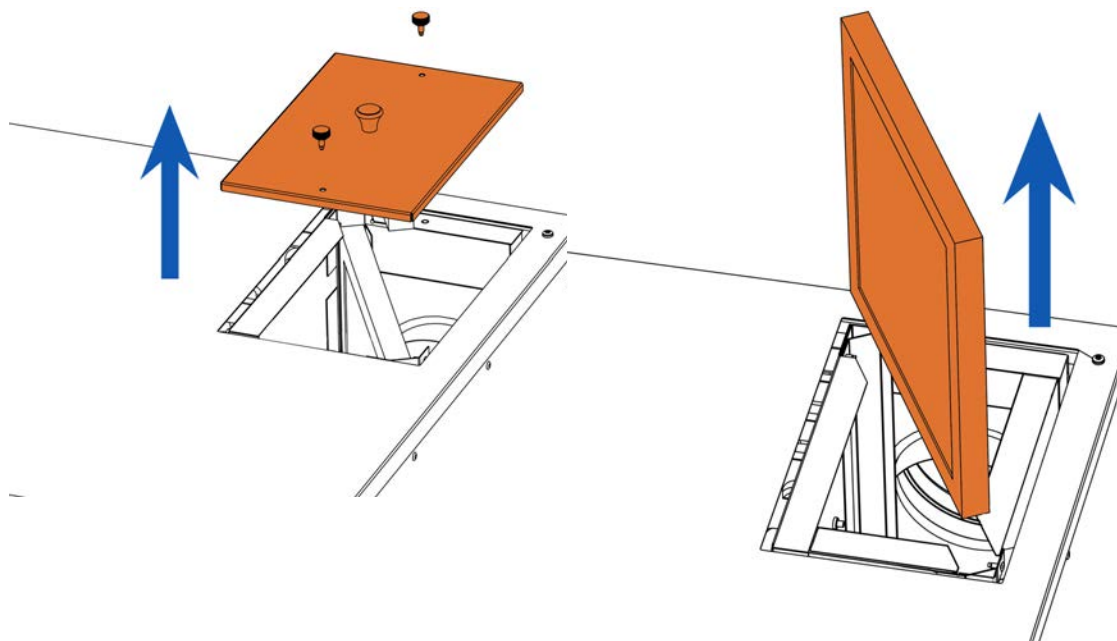
20. Turn on the electric power and gas supply to the boiler.
21. Reset the low pressure switch. For instructions, see [Resetting the gas high / low pressure switches on page 87](#).

## 8.4 Replacing the air filter

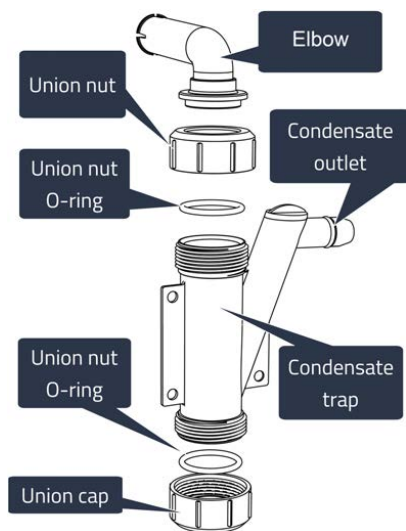
Two replacement filters are shipped with each boiler. The air filter should be inspected and/or replaced monthly. When replacing the air filter in the appliance, use a MERV 8 filter sized at 10" x 10" x 1".

- 1.** Remove the two screws of the air filter lid, and set aside.

- 2.** Remove the air filter, and replace with a new one.



## 8.5 Cleaning a condensate trap



Condensate traps should be checked annually, cleaned and refilled as necessary. Before cleaning the condensate trap, you must turn off the power to the boiler, and allow it to cool down.

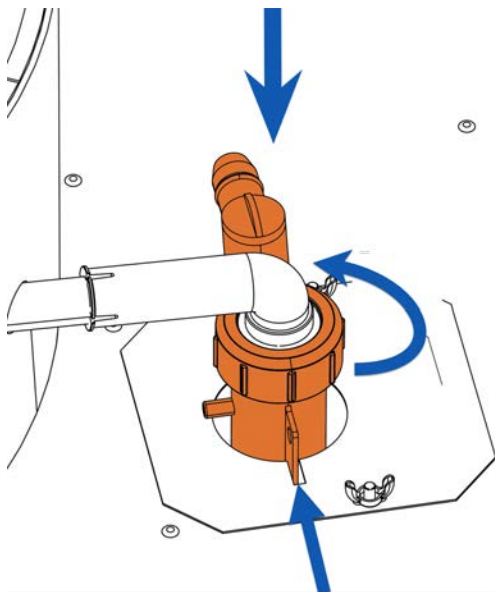
**Important:** Installers or service contractors should ensure that the end user is instructed on cleaning and refilling the trap.



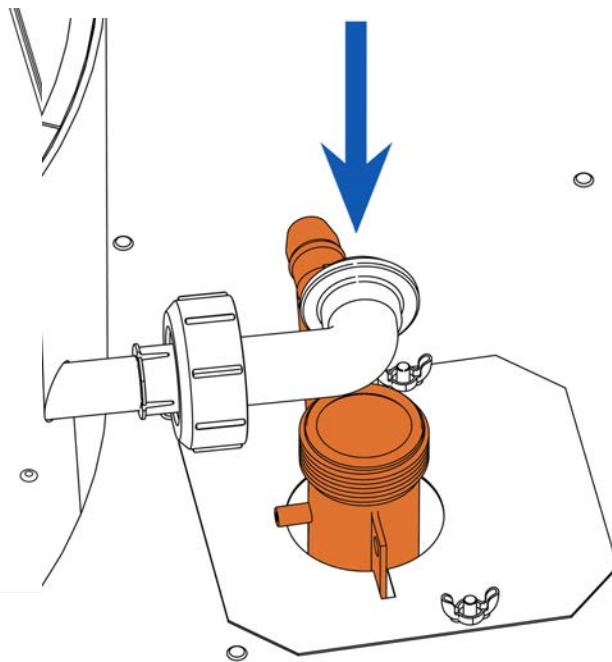
### Warning

If condensate neutralization is used, check the pH level of condensate before and after neutralization to verify effectiveness and ensure that the discharge has neutral pH levels. Never operate the boiler unless the trap is filled with water. Failure to comply will result in severe personal injury or death.

**1.** Unscrew the union nut.

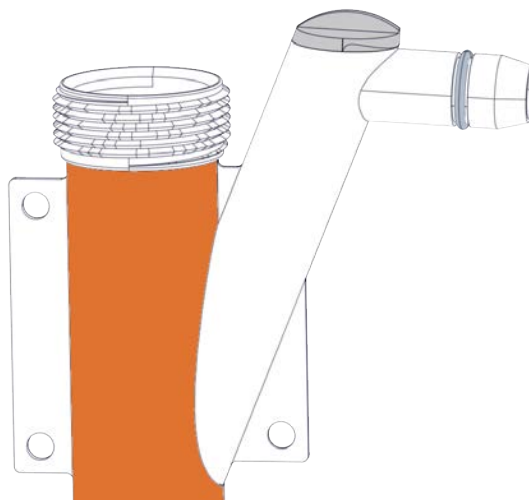


**2.** Rotate the elbow sideways, so that you can remove the condensate trap base.



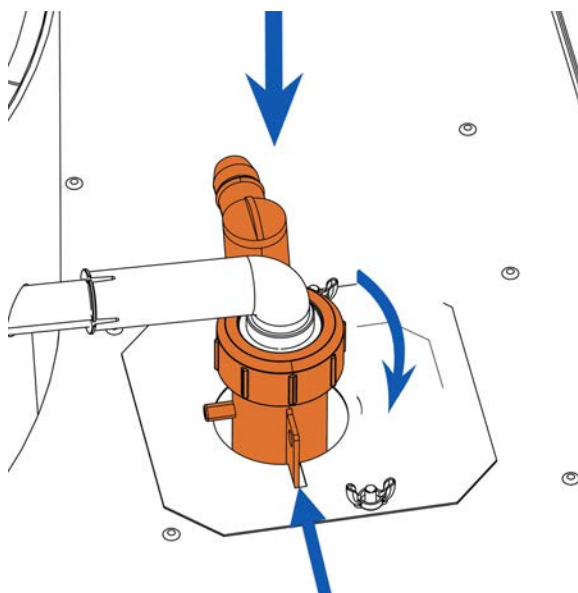
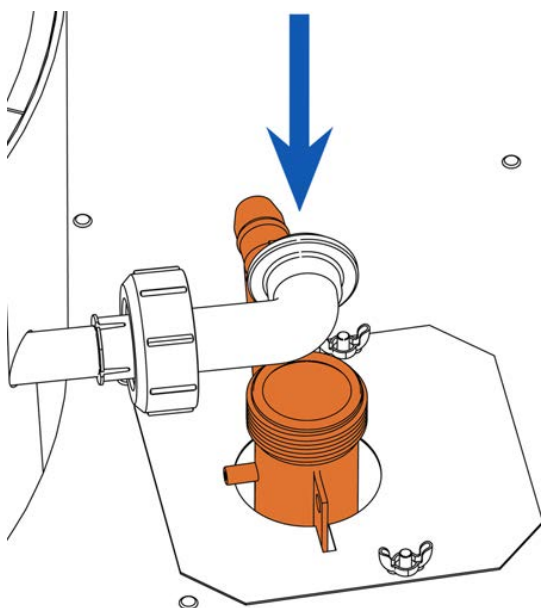
- 3.** Clean and flush out the debris in the condensate trap base.

- 4.** Fill the condensate trap to the top with water.



- 5.** Reinsert the condensate trap through the metal plate.

- 6.** Rotate the elbow, and tighten the union nut, so that elbow and condensate trap are secured. Ensure the union nut O-ring is included. Check for leaks.



## 9.0 Troubleshooting

Often, you can identify a problem and solve it through basic checks: confirming the electrical power supply, gas flow and resetting the thermostat control.

### Note

The boilers are equipped with a blocked vent shutoff system, which closes the gas supply upon detection of an irregular venting condition. In such an event, the electronic controller automatically carries out a reset/ retry every 5 minutes.

The troubleshooting section is divided into 3 sections:

- » Preliminary checks
- » Electronic components
- » Troubleshooting error messages

## 9.1 Preliminary checks

The first step in troubleshooting this system should be a review of the touchscreen controller. There are a number of diagnostic features incorporated in the software that evaluate system integrity, display error conditions and provide initial remedial actions.

In addition to checking the display, the following list is a guideline for troubleshooting:

Preliminary Troubleshooting Checks	Check
Confirm power to the boiler: check that the touchscreen controller display is on (e.g., display is lit. The touchscreen controller's display will be fully functional in 90 seconds after power is restored to the boiler.)	<input type="checkbox"/>
Check that the boiler is not in a safety lockout.	<input type="checkbox"/>
Ensure wiring is clean and secure.	<input type="checkbox"/>
Check that gas is reaching the appliance.	<input type="checkbox"/>
Check the gas pressure switches.	<input type="checkbox"/>
Confirm that the water system is properly charged within specifications, and that the pump is serviceable.	<input type="checkbox"/>

## 9.2 Electronic components

This section details the method for troubleshooting the non-standard electronic components on the boiler.

### 9.2.1 Temperature sensors

The resistance of the temperature sensors varies inversely with temperature. To test, measure the temperature of the sensed environment and compare with the value derived from the measurement of the resistance (obtained by connecting a good quality test meter capable of measuring up to 5,000 k $\Omega$  (5,000,000 $\Omega$ ) at the controller end of the sensor lead).

To obtain a resistance reading, remove power to the boiler. For the supply water, return water, and vent temperature sensors, remove the wire leads by disconnecting their respective Molex connectors. Place multi-meter probes into the sensor's female Molex connector socket. Do not apply voltage to the sensor as damage may result.

The supply water and vent temperature sensors each contain two separate circuits. Test each pair. The two circuits must deliver nearly identical readings. Note that failures may occur only within certain temperature ranges.

Temp. °F/°C	Resist. $\Omega$ – Ohm	Temp. °F/°C	Resist. $\Omega$ – Ohm
0 / -18	85,362	100 / 38	5,828
5 / -15	72,918	105 / 41	5,210
10 / -12	62,465	110 / 43	4,665
15 / -9	53,658	115 / 46	4,184
20 / -7	42,218	120 / 49	3,760
25 / -4	39,913	125 / 52	3,383
30 / -1	34,558	130 / 54	3,050
35 / 2	29,996	135 / 57	2,754
40 / 4	26,099	140 / 60	2,490
45 / 7	22,763	145 / 63	2,255
50 / 10	19,900	150 / 66	2,045
55 / 13	17,436	155 / 68	1,857
60 / 16	15,311	160 / 71	1,689
65 / 18	13,474	165 / 74	1,538
70 / 21	11,883	170 / 77	1,403
75 / 24	10,501	175 / 79	1,281
80 / 27	9,299	180 / 82	1,172
85 / 29	8,250	185 / 85	1,073
90 / 35	7,334	190 / 88	983
95 / 35	6,532	195 / 91	903

**Table 13** Temperature sensor resistance values - 10K ohms

## 9.2.2 Fan

Operating power is provided by means of a separate 120 VAC connector (white/black/green). Control of the fan is provided via a four-lead connector. This connector feeds a PWM control signal (black wire) from the controller and provides a tachometer signal (white wire) back from the fan. Unplugging the control connector will cause the fan to go to high speed and trigger a “Blocked Vent Error” within 6 seconds if the boiler is operating.

## 9.2.3 Air pressure sensor

The air pressure sensor monitors air flow in the venting system. If airflow through the combustion air intake or the exhaust vent becomes too restricted for safe operation, the boiler will stop firing, and display a "Fan Pressure Error". Also, to prevent avoidable Fan Pressure Errors, the system decreases the fan speed if the reading from the sensor nears the error threshold.

## 9.2.4 Water pressure sensor

The water pressure sensor ensures that there is adequate pressure in the heating system for safe operation. The pressure is displayed in PSI as the default. If the system pressure should drop below 8PSI the firing rate of the boiler is reduced. If the pressure drops to 4PSI or lower, the boiler will not fire.

Check the operation of the sensor by isolating the boiler from its system piping, and close the system fill valve, and then crack the pressure relief valve. The pressure displayed should reflect declining pressure. If it remains “fixed”, drain the boiler and replace the sensor, or dislodge any blocking debris from the sensor inlet channel and reinsert.

## 9.2.5 Gas pressure switches

The high and low gas pressure switches help protect the boiler from gas pressures outside of the acceptable range of operation. To view the location of the pressure switches on the EX series boilers, see [7.0](#) or [Figure 49](#).

- » The low gas pressure switch is pre-calibrated, and will trip when the inlet gas pressure falls below 3.5" w.c.
- » The high gas pressure switch is pre-calibrated and will trip when the inlet gas pressure rises above 15" w.c.

You must **reset** the low gas pressure switch after the gas to the boiler is connected and turned on. To "reset" either the low or high gas pressure switch, press on the clear plastic cover above the Red button.



### Warning

Do not attempt to adjust the High or Low pressure switch.

If either the high or low gas pressure switch trips, the boiler controller will show a Red bar at the bottom of the screen and indicate "Low/High Gas Pressure".

## 9.2.6 Safety and Ignition Module (SIM)

The SIM is a safety control used in the EX series of boilers. It is certified to conform to the UL 60730-5-5 and ANSI Z21.20-2014 • CAN/CSA-C22.2 No. 60730-2-5-14 standards.

The module controls the boiler's gas valve, including:

- » Direct spark automatic ignition
- » Flame detection and current measurement
- » Supply water temperature sensing
- » Flue gas temperature sensing
- » Supply water maximum temperature shutdown
- » Flue gas maximum temperature shutdown
- » Low water cut-off.

The SIM continuously communicates with the boiler's main controller reporting sensor readings and status. The sensor readings and error status, if any are displayed on the boiler controller's screen.



### 9.2.6.1 Table showing LED operating status

Its two status LEDs indicate the operating status as shown in the table below.

SIM Status Indicators			
LED 1	LED 2	State	Description, LED status indication
Rapid flash		Power up or resetting	startup checks and initialization
Off	Off	Standby	LED 1 Off=flame or sparking LED 2 = Burner-on call state
Off	On	Pre-purge or inter-purge	LED 1 Off=no flame or sparking LED 2 = Burner-on call state
On	On	Heating	LED 1 On = Flame detected LED 2 = Burner-on call state
Rapid flash	On	Igniting	LED 1 Flashing - Electrode sparking LED 2 = Burner-on call state
Off	Flashing	Lockout	Possible errors: <ul style="list-style-type: none"> <li>» An operating limit was exceeded</li> <li>» A sequence failed</li> <li>» An external sensor fault was detected.</li> </ul>
Flash alternately with LED 2	Flash alternately with LED 1	Fail-safe	An error was detected - the boiler requires a power cycle

**Table 14** SIM LED status Indicators

## 9.3 Touchscreen error messages

Errors shown on the touchscreen controller are described below as well as diagnoses and fixes.



### Warning

Never attempt to repair the control module (circuit board). If the control module is defective, replace it immediately.

The bottom line of the touchscreen displays the boiler's error status. The following colors represent the boiler's operating status:

- » Green – Normal
- » Yellow – Warning
- » Red – Alarm

The text inside the bar will indicate the specific warning or alarm. If there is more than one alarm present the text will scroll slowly through all current alarm conditions. Besides the errors listed below, see also [Miscellaneous touchscreen controller errors on page 124](#).

### 9.3.1 Maximum ignition trials error

Maximum Ignition Trials Error		
Issue	Diagnosis	Fix
Error – Ignition Failure after 3 tries boiler has failed to ignite on 3 successive attempts. Boiler is in lockout for 1 hour, then repeats 3-try sequence. Consult service technician if error recurs.	No spark when igniting. Ignition probe/flame sensor disconnected.	Check that ignition lead is secure at the control module and at the probe.
	Manual gas shutoff is closed or gas line not fully purged.	Check for gas flow. Open manual gas shutoff and reset boiler.
	Gap between ignition probe rods is too large or too small.	Adjust ignition probe rod gap between $\frac{1}{8}$ and $\frac{3}{16}$ th (3.2-4.7 mm).
	Spark, but no ignition.	Check spark module is sending power to gas valve – close gas supply, then disconnect (black) electric housing from face of gas valve, gently spread plastic tabs to open, and look for 24vac voltage during an ignition cycle. Replace module if no current detected
	Boiler ignites, but shuts off at the end of the ignition trial. Improperly grounded pressure vessel/burner or unserviceable ignition lead or spark module.	Ensure the pressure vessel is grounded. Check the ignition probe/flame sensor is electrically isolated from the vessel, and its ceramic insulator is intact. Replace ignition lead Replace spark module.

### 9.3.2 Low Water Cut-off error

Low Water Cut-off		
Issue	Diagnosis	Fix
Error - Low Water Cutoff	The Safety and Ignition module has detected a low water condition.	Confirm water at the high point of the boiler. On V10 Reset module and Clear Error. Refer to the <i>V10 Touchscreen Controller</i> manual for more information on resetting a boiler after a LWCO lockout.

### 9.3.3 Hi Limit cut-off temperature error

Hi Limit cutoff temperature Error		
Issue	Diagnosis	Fix
Error – Water High-Limit Exceeded	Water temperature exceeds hi-limit. Boiler is in hard lockout mode.	Refer to the <i>V10 Touchscreen Controller</i> manual for information on resetting a boiler after a hi-limit temperature lockout.

### 9.3.4 Hi/Low gas pressure switch error

High/Low Gas Press Error		
Issue	Diagnosis	Fix
Error – High/Low Gas Press	Inlet gas pressure has risen above 15" w.c. or has fallen below 3.5" w.c.	Measure the inlet gas pressure. Then reset the switch.

### 9.3.5 Interlock 1 or 2

Interlock 1 or 2		
Issue	Diagnosis	Fix
Interlock 1 or 2 terminals are open.	Jumper lead is loose or compromised.	Replace the jumper lead.
	External safety is in an alarm state.	Inspect the external safety devices.

## 9.4 Miscellaneous touchscreen controller errors

Miscellaneous errors		
Issue	Diagnosis	Fix
“ Loop/Indoor Sensor”	The sensor plug is not engaged.	Check the P501 plug is fully engaged in the back of the controller board.
“Insufficient Air Flow”		
“Insufficient Water Pressure”		
“Unknown Error”	The sensor plug is not engaged.	Check the P501 plug is fully engaged in the back of the controller board.
	Temperature sensor input problem.	Test each temperature sensor for appropriate readings and Replace defective temperature sensor.
Error - Max. Inlet/Outlet Sensor Temp. Exceeded. - > Check water flow Water temperature signal not within acceptable range. Potential flow or sensor failure. Consult service technician.	Current outlet temperature exceeds operating limit.	Check water flow.
	Defective or disconnected temperature sensor.	Check wiring to temperature sensor and control module.  Check temperature sensor.
Blank – screen dark, but fan running Indicative of power-surge damage to appliance		Check transformer; replace if damaged. Check circuit board for visible damage.
Controller is stuck in "service" mode after software update.	If update fails or no updates applied.	Restarting returns the boiler to normal operation.

## 9.4.1 Ignition issues

Ignition issues		
Issue	Diagnosis	Fix
Noisy spark when igniting	Ignition lead is not firmly connected.	Reconnect ignition lead.
	Contaminants/moisture on igniter probe/flame sensor.	Ensure probe is dry by re-running post-purge; otherwise, clean or replace igniter probe.
Boiler rumbles when igniting.	Fluctuating gas pressure/ gas pressure too high/too low.	Check CO <sub>2</sub> level via analyzer.
	Check for proper gas piping	Check pressure with manometer during ignition.
Boiler will not attempt to ignite. Fan and pump are operating normally.	No power to ignition control module.	Check system wiring.
		Check air reference tubing.
	Igniter probe/flame sensor disconnected.	Reconnect probe.
	Defective Control Module.	Check for sign of spark voltage; if none, replace ignition control module.
Boiler will not attempt to ignite. Fan and / or pump are off Display not illuminated	No power to boiler.	Check line voltage.
	Defective transformer.	Check transformer. Reconnect or replace as needed.

## 9.4.2 Temperature issues

Temperature issues		
Issue	Diagnosis	Fix
Low heat	Operating temperature too low. Increase temperature target.	Increase temperature target.
	Priority parameters or load configuration improperly set up.	Review load configuration parameters.
	appliance undersized.	Refer to Load Calculation vs. Boiler Output.
	Air trapped within system.	Bleed system as required.
	Improper system piping.	Refer to recommended piping guidelines for the respective boiler model.
	System pump undersized.	Check pump manufacturer's data/check temp differential across heat exchanger.
	Poor gas:air mixing.	Check CO <sub>2</sub> level.
	Defective thermostat.	Refer to manufacturer's instructions.
	Obstruction in condensate drain.	Inspect and clean condensate drain.
	appliance cycling on operating/ safety controls.	Check operation with Ohmmeter/Voltmeter.
	System radiation undersized.	Check manufacturer's rating tables for capacity per foot.
Temperature exceeds thermostat setting	Incorrect anticipator setting.	Set to zero.
	Mercury thermostat not level.	Check level.
One or more zones do not heat properly	Air trapped within zone(s) piping	Vent system/zone as required.
	Low radiation/ excessive heat loss.	Check actual length of pipe using radiation / heat loss calculation.
	Low flow rate to zone(s).	Check temperature drop across zone.
	Defective zone valve/ zone circulator.	Check operation. Refer to manufacturer's instructions. Check with ammeter.

## 9.4.3 Miscellaneous issues

Miscellaneous issues		
Issue	Diagnosis	Fix
Fumes and High Humidity	Improperly installed condensate trap	Refer to installation/operation instructions.
	Leak in vent piping	Inspect using soap solution.
	Flue gas leak within boiler	Visually inspect all mechanical connections.
Boiler stuck on Initialize	Fan board failure	Replace fan.
'Ghost' call for heat.	Triac or 'Power-robbing' thermostat sending current to boiler.	Remove Therm. connections from boiler to confirm that stray voltage, or current induced in thermostat wiring, is source of nuisance signal. Replace the Power Robbing thermostat, isolate the thermostat with a relay or install a properly sized resistor (consult the thermostat manufacturer first then IBC for instructions).
Error: Water High Limit / Low Water Cutoff won't clear.	Boiler is in 1 hour safety lockout.	Reset safety device and cycle boiler power off and on to reset error.
DHW taking too long to heat.	Sensor may be under-reading actual water temp.	Check sensor engagement; note well is 15cm / almost 6 inches deep and sensor must be fully set to back. Check programmed settings boiler temp set too close to the required DHW temperature.
Boiler output not modulating up to maximum despite target not being reached.	Possible flow issue: check for 35 or 40 °F temperature difference between boiler supply and return water temperatures (evokes electronic fence).	Confirm that primary pump is able to overcome head loss of boiler and primary loop piping at the required flow rate.
Primary Pump runs but load pumps do not.	Wiring not complete.	Supply power to the PV/L and PV/N terminals from the incoming power supply to the boiler. (Factory wired on boilers with a factory installed touchscreen controller)

## 9.4.4 Cycling issues

Cycling issues		
Issue	Diagnosis	Fix
Rapid Cycling	Improper values entered via keypad.	Check load maximum temps are above target temps, by ½ of the selected boiler differential. Ensure boiler differential is OK (16 - 30 °F is generally adequate)
	Excess condensate in venting.	Check venting slopes on horizontal runs. Look for sags.
	Obstruction in condensate trap.	Inspect and clean condensate trap.
	Improper vent length or improper slope to vent.	Check venting. Compare vent length and diameter.
	Incorrect settings or defective thermostat.	Check operation. Refer to manufacturer's instructions. Check setting with ammeter.
	Air in system or marginal water flow.	Bleed/purge system as required. Confirm adequate pump size and temp rise in the heat exchanger.
	Boiler relighting due to low flame current.	Check that CO <sub>2</sub> level is within specification.
	Dirty burner/heat exchanger.	Clean burner / heat exchanger.
	Low water flow due to improper piping.	Refer to recommended piping for the respective boiler model.
	Low water flow due to undersized pump.	Check manufacturer's rating charts/check temperature differential across heat exchanger.
	Low water flow due to restrictions in water pipe.	Check temperature differential across zone/heat exchanger.
	Low radiation.	Check actual amount of radiation per zone and refer to manufacturer's rating tables.
	Appliance over-fired.	Clock gas meter/check gas pressure with manometer/ check CO <sub>2</sub> level.
	Appliance Oversized.	Check load calculation vs. minimum boiler output.
	Improperly set or defective operating/safety controls.	Check operation with ohmmeter/voltmeter.



# Appendices

## Wiring diagrams

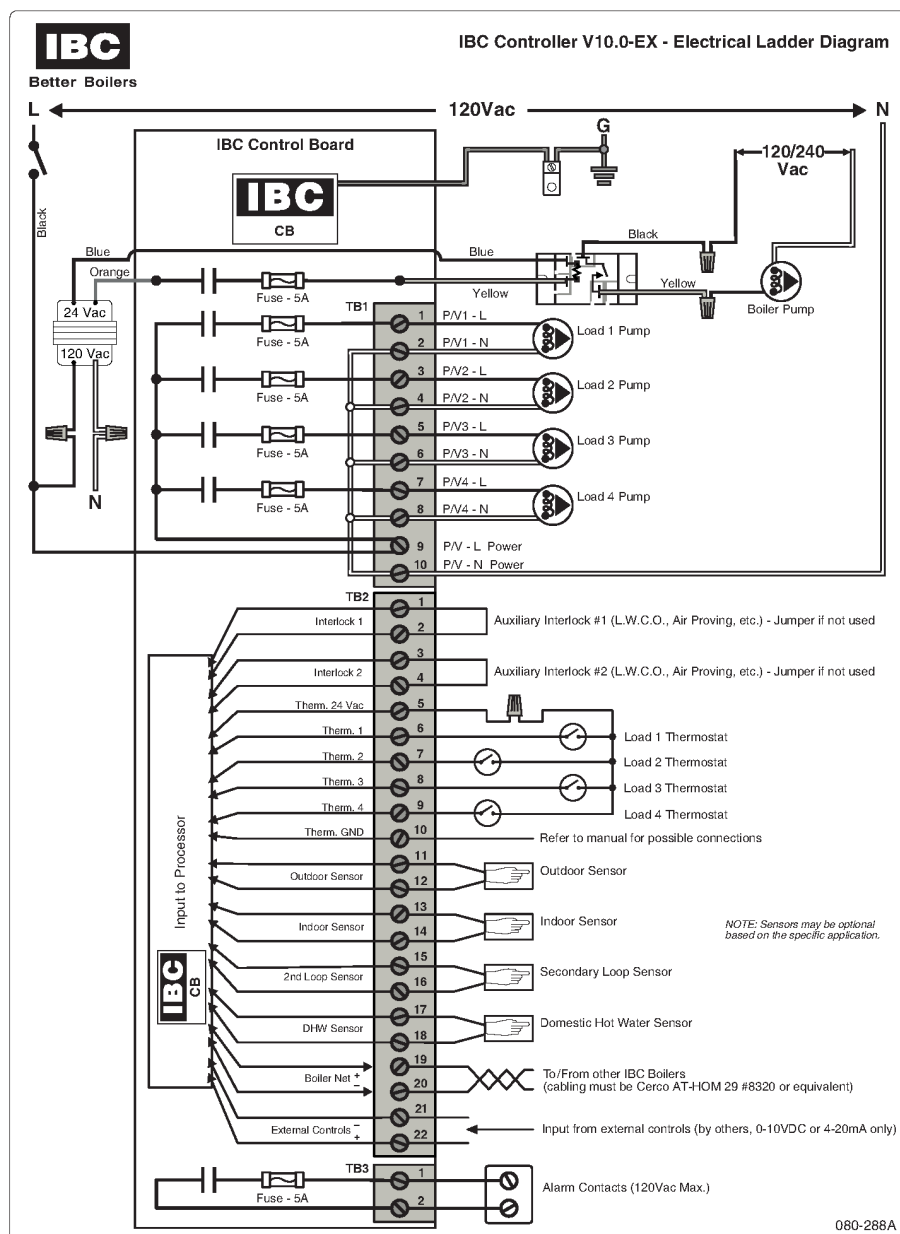


Figure 81 Controller electrical diagram

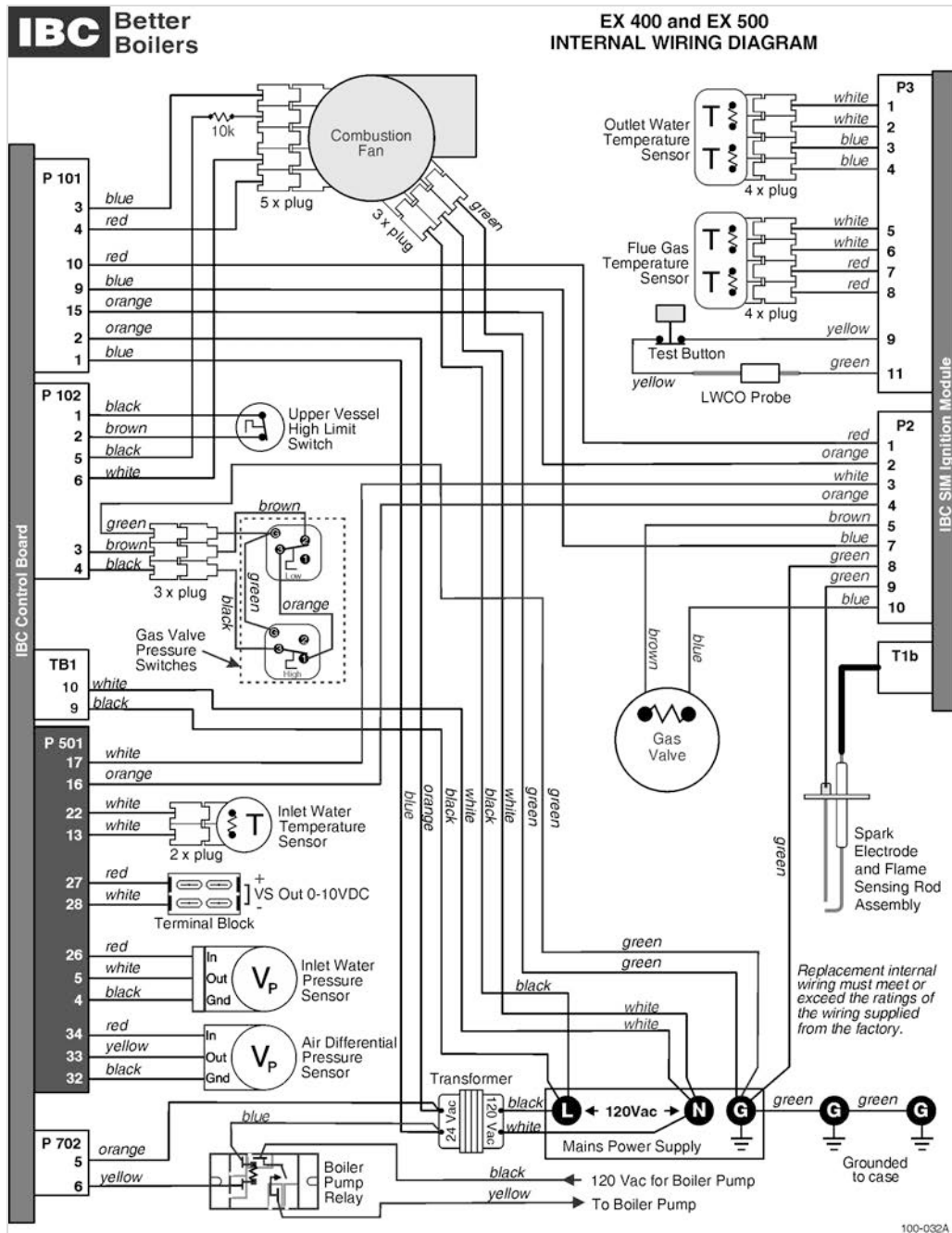


Figure 82 Internal wiring diagram - EX 400 and EX 500 models

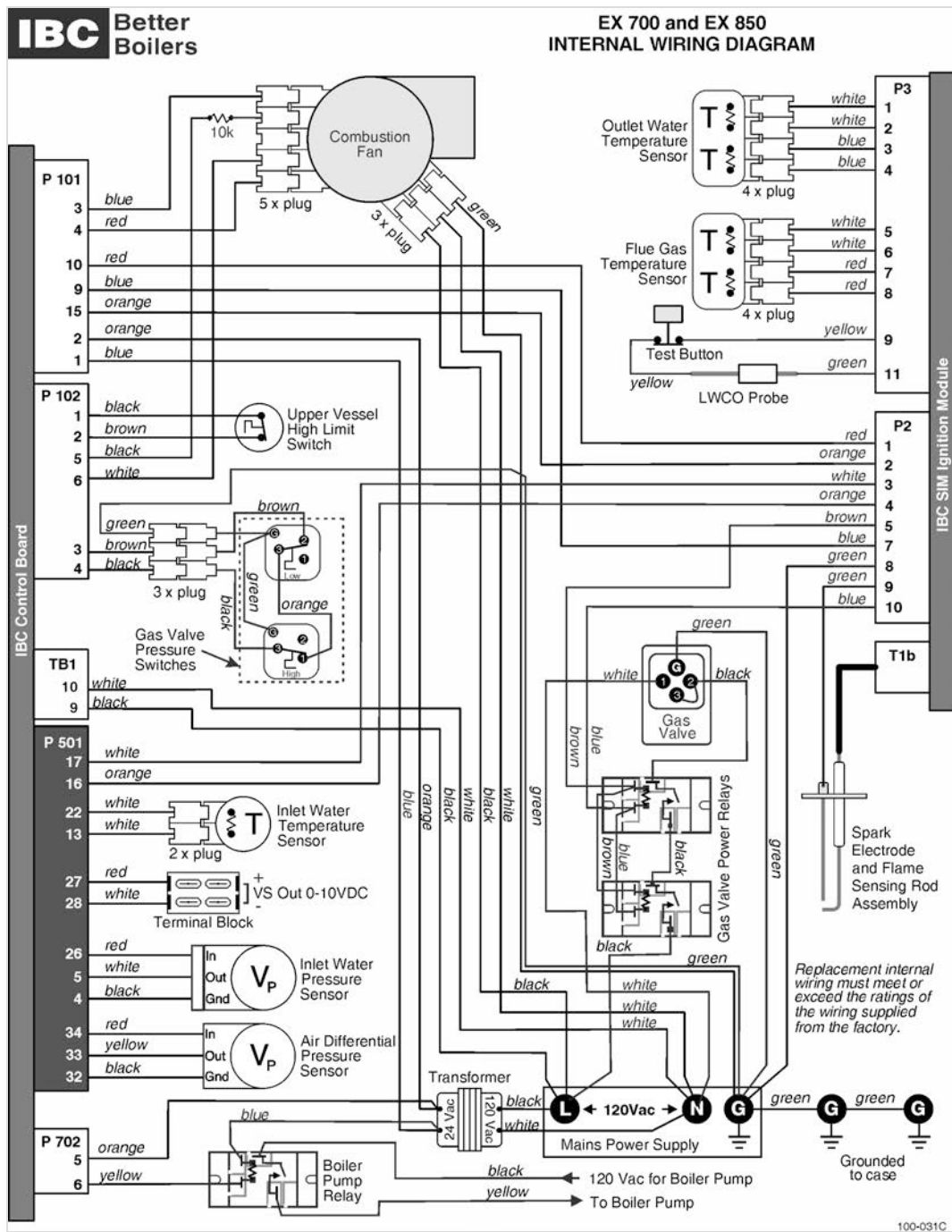


Figure 83 Internal wiring diagram - EX 700 and EX 850 models

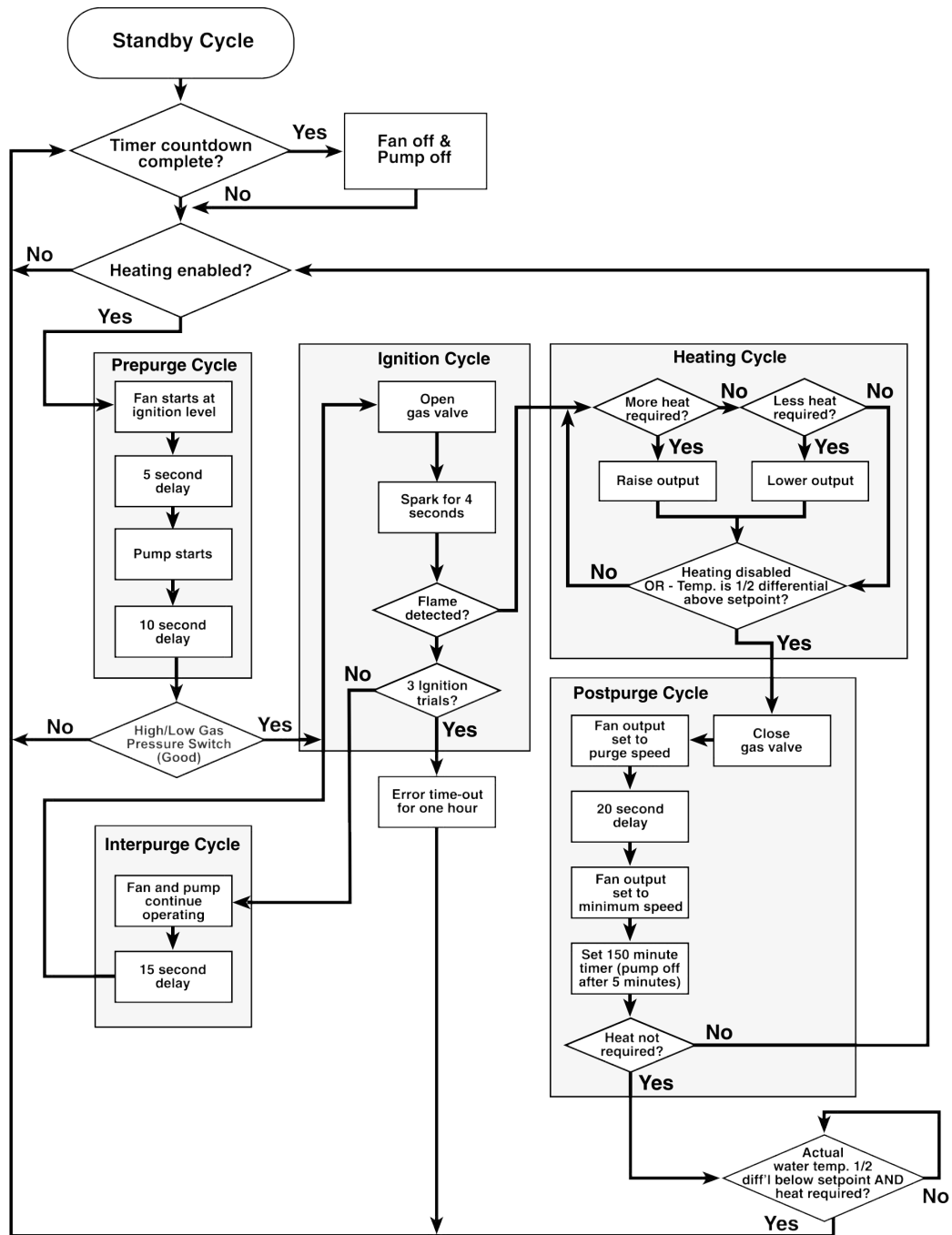


Figure 84 Sequence of Operation

## Installation & Commissioning Report

### Boiler Details:

Model Number \_\_\_\_\_ Serial Number \_\_\_\_\_

Date of Installation \_\_\_\_\_ Address of installation \_\_\_\_\_

User contact information \_\_\_\_\_

Installer Information (Company & Address) \_\_\_\_\_

Phone/Fax/E-mail \_\_\_\_\_

Fuel: ☐ Natural Gas ☐ Propane

Gas Supply Pressure (high fire) \_\_\_\_\_ Inches w.c. Measured Rate of Input (high fire) \_\_\_\_\_ Btu/hr

☐ Leak testing completed ☐ Gas piping ☐ Venting system ☐ Fan ☐ Combustion components

☐ System Cleaned and Flushed (type of cleaner used) \_\_\_\_\_

☐ System Filled (type/concentration of any glycol/chemicals used) \_\_\_\_\_

☐ Air purge completed

☐ Relief Valve correctly installed and piped Relief valve "try lever" test performed

☐ Condensate trap filled Condensate drain clear and free flowing Condensate Neutralization.

☐ Ignition Safety Shutoff test completed. Flame current reading - High fire \_\_\_\_\_  $\mu$ A - Low fire \_\_\_\_\_  $\mu$ A

☐ Owner advised and instructed in the safe operation and maintenance of the boiler and system.

☐ Information regarding the appliance and installation received and left with owner

### Combustion Readings:

High-Fire: CO<sub>2</sub> \_\_\_\_\_ % O<sub>2</sub> \_\_\_\_\_ % CO \_\_\_\_\_ ppm

Low-Fire: CO<sub>2</sub> \_\_\_\_\_ % O<sub>2</sub> \_\_\_\_\_ % CO \_\_\_\_\_ ppm

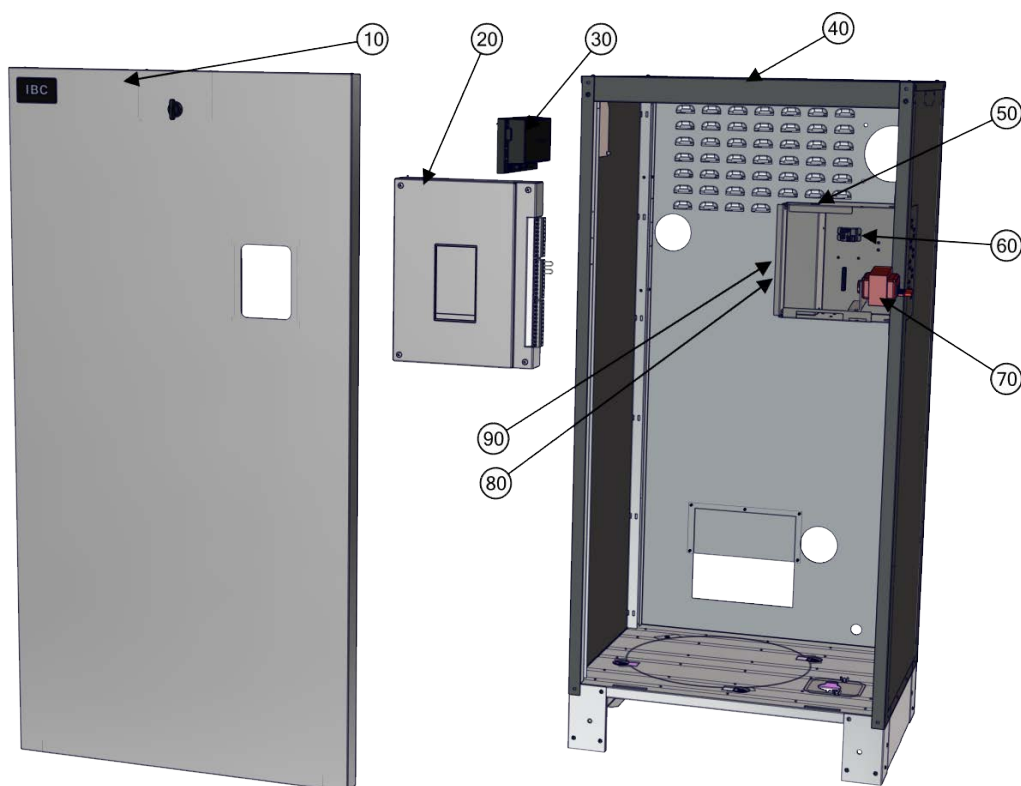
Flue temperature \_\_\_\_\_ Return water temperature (measure simultaneously with flue temp.) \_\_\_\_\_

Commissioning has been completed as listed on this report - Installer Signature \_\_\_\_\_

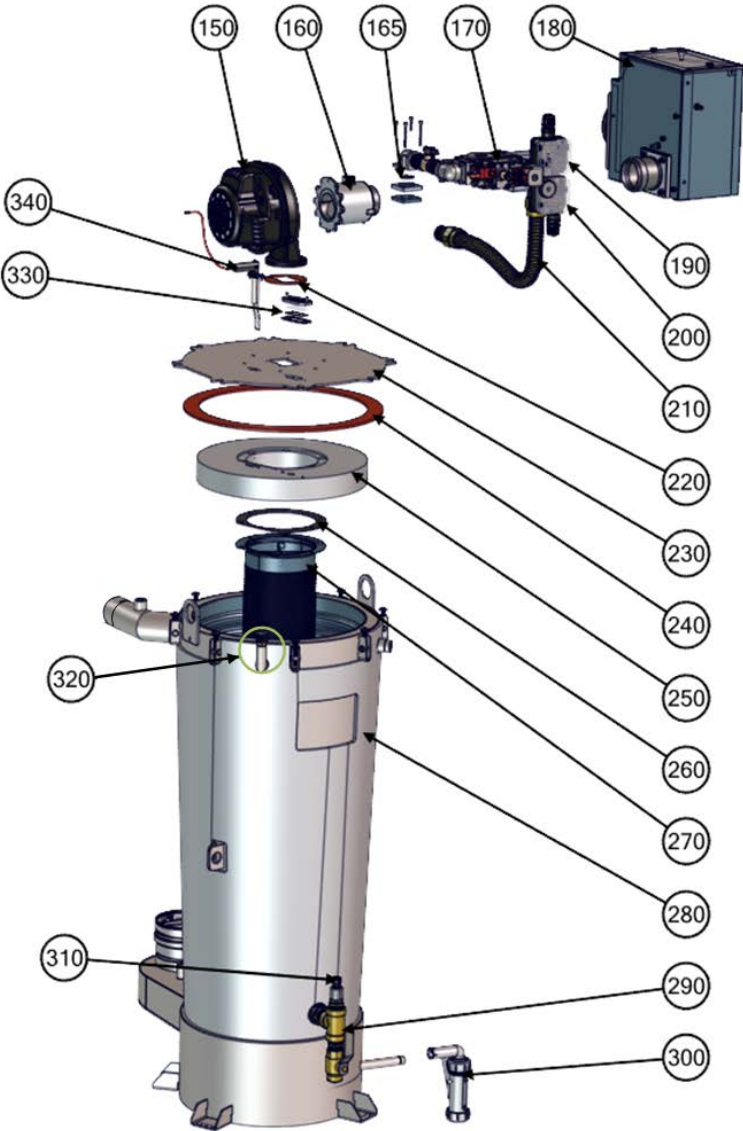
Installers: send this completed sheet - Fax to 604 877 0295 - or - scan and Email to  
info@ibcboiler.com.

Intentionally left empty

## Boiler parts diagram - EX 400 and EX 500



Item Number	Description	Part ID	Replacement Kit Numbers
10	Door	500-134	<a href="#">P-1209</a>
20	Controller	500-044	<a href="#">P-242</a>
30	Safety Ignition Module	500-105	<a href="#">P-270B</a>
40	Top panel	251-030	<a href="#">P-1227</a>
50	Controller module chassis	251-042	<a href="#">P-1248</a>
60	Boiler pump relay	240-165	<a href="#">P-1233</a>
70	Transformer	240-008	<a href="#">P-9059</a>
80	Air pressure sensor (behind controller)	240-162	<a href="#">P-1210</a>
90	Vessel high limit switch (behind controller)	240-030	<a href="#">P-9070</a>
	Wiring harness (not shown)	200-179	<a href="#">P-1256</a>



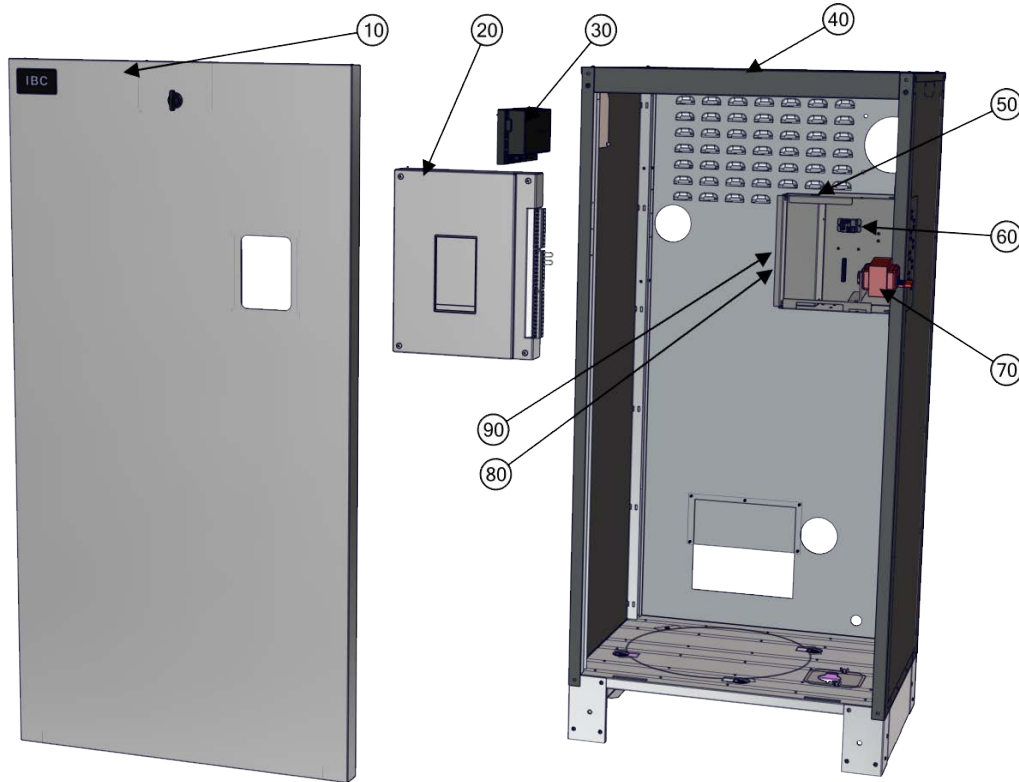


Item Number	Description	Part ID	Replacement Kit Number
150	Fan	240-113	
	Alternative fan (EX 500 only)	240-172	<a href="#">P-311B</a>
160	Fuel mixer EX 400 NG	180-164	<a href="#">P-1235</a>
	Fuel mixer EX 400 LP	180-163	<a href="#">P-1236</a>
	Fuel mixer EX 500 NG	180-252	<a href="#">P-1237</a>
	Fuel mixer EX 500 LP	180-253	<a href="#">P-1238</a>
165	Fuel orifice NG EX 400	251-112	<a href="#">P-1235</a>
	Fuel orifice LP EX 400	251-113	<a href="#">P-1236</a>
	Fuel orifice NG EX 500	251-110	<a href="#">P-1237</a>
	Fuel orifice LP EX 500	251-111	<a href="#">P-1238</a>
170	Gas valve	180-288	<a href="#">P-1241</a>
180	Air filter compartment	500-172	
	Replacement air filters	180-126	<a href="#">P-381</a>
190	High pressure switch	180-276	<a href="#">P-1250</a>
200	Low pressure switch	180-277	<a href="#">P-1249</a>
210	Gas line	190-208	<a href="#">P-1242</a>
220	Fan gasket	250-322	
230	Heat exchanger lid	170-055	<a href="#">P-1247C</a>
240	Heat exchanger gasket	255-136	<a href="#">P-1252B</a>
250	Refractory	255-135	<a href="#">P-1247C</a>
260	Burner gasket	255-128	<a href="#">P-1252B</a>
270	Burner	180-284	<a href="#">P-1243</a>
280	Heat exchanger - 400	170-054	<a href="#">P-1245B</a>
	Heat exchanger - 500	170-045	
290	Boiler drain with cap	500-144	<a href="#">P-1220</a>
300	Condensate trap	180-268	<a href="#">P-1221</a>
310	Water pressure sensor	240-167	<a href="#">P-1231</a>
320	Manual air vent	180-258	<a href="#">P-1219</a>
330	Sight glass kit	500-117	<a href="#">P-107A</a>
340	Ignitor	240-153	<a href="#">P-1213</a>
	Ignitor cable	200-154	<a href="#">P-358</a>

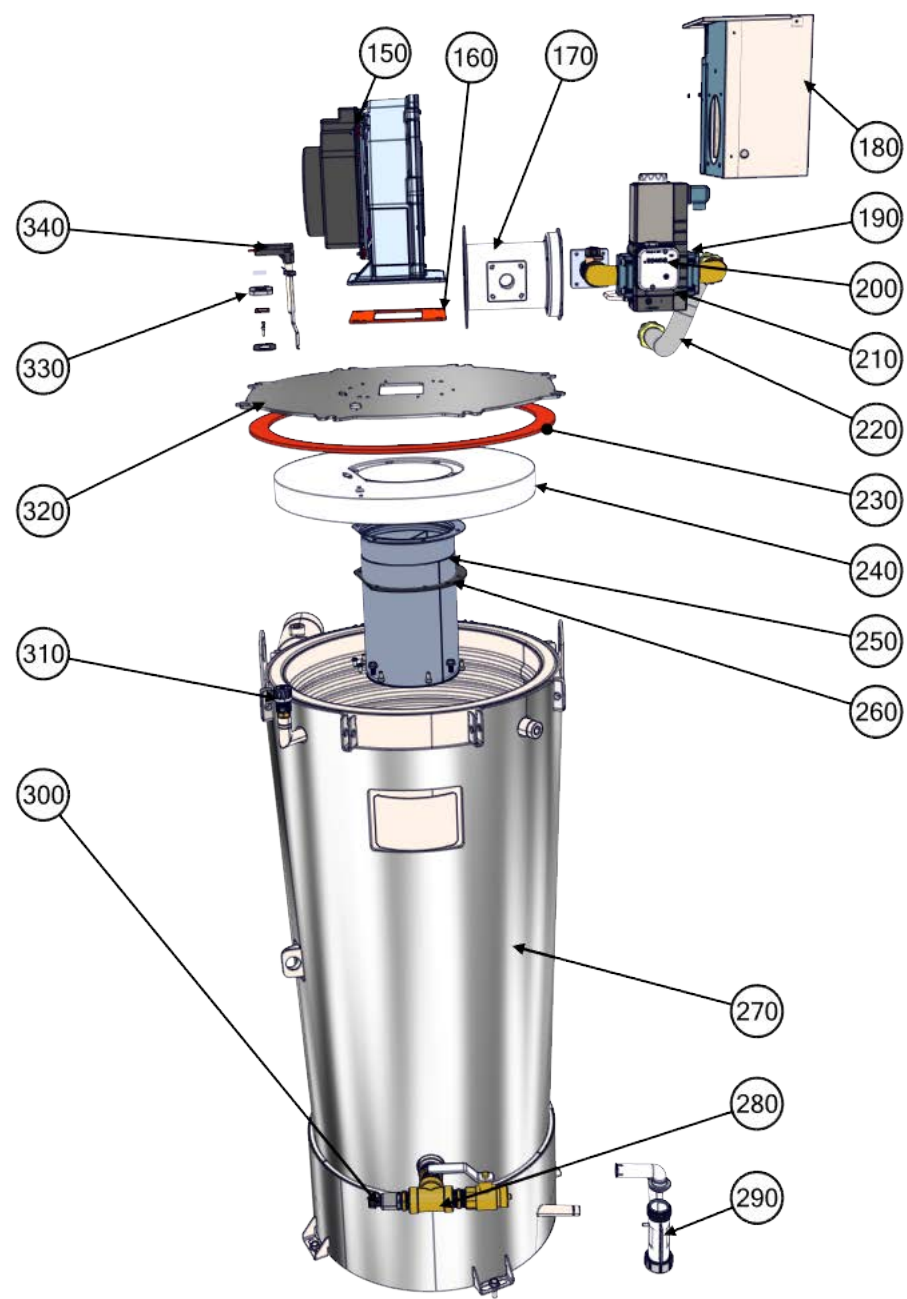


Item Number	Description	Part ID	Replacement Part Number
350	Low water cut-off probe	240-143	<a href="#">P-9078</a>
360	Supply Water temperature sensor	240-159	<a href="#">P-1225</a>
370	Tridicator - field installed	180-283	<a href="#">P-1234</a>
380	Relief valve - field installed	180-279	<a href="#">P-1205</a>
390	Vent stack temperature sensor	240-132	<a href="#">P-361</a>
400	Return water temperature	240-160	<a href="#">P-1226</a>

## Boiler parts diagram - EX 700 and EX 850



Item Number	Description	Part Number	Replacement Kit Numbers
10	Door	500-134	<a href="#">P-1209</a>
20	Controller	500-044	<a href="#">P-242</a>
30	Safety Ignition Module	500-105	<a href="#">P-270B</a>
40	Top panel	251-030	<a href="#">P-1227</a>
50	Controller module chassis	251-042	<a href="#">P-1228</a>
60	Boiler pump relay	240-165	<a href="#">P-1233</a>
70	Transformer	240-008	<a href="#">P-9059</a>
80	Air pressure sensor (behind controller)	240-162	<a href="#">P-1210</a>
90	Vessel high limit switch (behind controller)	240-030	<a href="#">P-9070</a>
	Wiring harness (not shown)		<a href="#">P-1232</a>



Item Number	Description	Part Number	Replacement Kit Number
150	Fan	240-156	<a href="#">P-1212</a>
160	Fan gasket	255-126	
170	Fuel mixer	180-254	<a href="#">P-1200</a> EX 700 NG
		180-255	<a href="#">P-1201</a> EX 700 LP
		180-256	<a href="#">P-1202</a> EX 850 NG
		180-257	<a href="#">P-1203</a> EX 850 LP
180	Air filter compartment	500-136	<a href="#">P-1211</a>
	Replacement air filters	180-126	<a href="#">P-381</a>
190	High pressure switch (behind gas valve)	180-276	<a href="#">P-1250</a>
200	Low pressure switch	180-277	<a href="#">P-1249</a>
210	Gas valve	500-147	<a href="#">P-1215B</a>
220	Gas line	190-201	<a href="#">P-1216</a>
230	Heat exchanger lid gasket	255-125	<a href="#">P-1222B</a>
240	Refractory	255-123	<a href="#">P-1214</a>
250	Burner	180-270	<a href="#">P-1224</a>
260	Burner gasket	255-128	<a href="#">P-1222B</a>
270	Heat exchanger - 700	170-046	<a href="#">P-1230</a>
	Heat exchanger - 850	170-047	<a href="#">P-1229</a>
280	Boiler drain with cap	500-144	<a href="#">P-1220</a>
290	Condensate trap	180-268	<a href="#">P-1221</a>
300	Water pressure sensor	240-167	<a href="#">P-1231</a>
310	Manual air vent	180-258	<a href="#">P-1219</a>
320	Heat exchanger lid	170-049	<a href="#">P-1214C</a>
330	Sight glass kit	500-117	<a href="#">P-107A</a>
340	Ignitor	240-153	<a href="#">P-1213</a>
	Ignitor cable	200-154	<a href="#">P-358</a>



Item Number	Description	Part Number	Replacement Part Number
350	Low water cut-off probe	240-143	<a href="#">P-9078</a>
360	Supply Water temperature sensor	240-159	<a href="#">P-1225</a>
370	Tridicator - field installed	180-283	<a href="#">P-1234</a>
380	Relief valve - field installed	180-279	<a href="#">P-1205</a>
390	Vent stack temperature sensor	240-132	<a href="#">P-361</a>
400	Return water temperature	240-160	<a href="#">P-1226</a>



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