



Better Boilers

SL 80-399

MODULATING GAS BOILER

(Natural Gas or Propane)



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 vapours and liquids or other combustible materials in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

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

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

This Manual is also available in French - contact IBC or visit our web site www.ibcboiler.com



SAFETY CONSIDERATIONS

⚠ 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.

Installation, start-up and servicing of IBC boilers must be done with due care and attention, and should only 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 which in extreme cases might result in death.

HAZARDS & PRECAUTIONS

⚠ DANGER

Points out an immediately hazardous situation which must be avoided in order to prevent serious injury or death.

⚠ WARNING

Points out a potentially hazardous situation which must be avoided to prevent serious injury or death.

⚠ CAUTION

Points out a potentially hazardous situation which must be avoided to prevent possible moderate injury and/or property damage

⚠ NOTE

Points out installation, maintenance and operation details that will result in enhanced efficiency, longevity and proper operation of your boiler.

SPECIFICATIONS

SPECIFICATION	SL 80-399
CSA Input (Natural Gas or Propane) - MBH	80 - 399
CSA Input (Natural Gas or Propane) - kW	23.4 - 117
CSA Output - MBH	77 - 382
CSA Output - kW	22.6 - 112
Combustion Efficiency (CSA 4.9 - 2010)	95.7%
Minimum gas supply pressure (Natural Gas or Propane) - inch w.c.	5
Maximum gas supply pressure (Natural Gas or Propane) - inch w.c.	14
Power use (120Vac/60Hz) @ full fire - Watts	345 (less pumps)
Weight (empty) - lbs/Kg	240 / 110
Pressure vessel water content - USG/Litres	7 / 26
Maximum boiler flow rate - USgpm	45
Minimum boiler flow rate - USgpm	20
Maximum operating water pressure* - psig	80
Minimum water pressure - psig	8
Approved installation altitude - ASL	0 - 12,000'
Ambient temperature - Low °F / °C High °F / °C	32°F / 0°C 122°F / 50°C
Max. relative humidity (non-condensing)	90%
Minimum water temp.	34°F / 1°C
Maximum water temp. (electronic hi-limit)	185°F / 85°C
Maximum water temp. (mechanical hi-limit)	200°F / 93.3°C
Max. ΔT - supply/return (electronic fence)	40°F
Maximum equivalent vent length - 4" Each side (Vent & Air Intake) (Natural Gas or Propane) Air intake options: either direct vent or indoor supply	200'

* boilers are shipped with 30 psig pressure relief valve.

Supplied with the boiler - The IBC boiler is shipped with an accessory parts kit consisting of the following items:

- 1 x Wall mounting bracket
- 1 x Condensate trap assembly
- 1 x 30 psig pressure relief valve
- 1 x Outdoor temperature sensor
- 6 x 1/4" x 2 1/2" Lag screws/w flat washers

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⚠ DANGER

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

⚠ WARNING

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.

⚠ CAUTION

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.

⚠ WARNING

If the boiler can become 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.

The Installer must carefully read this manual to ensure that all installation details can be adhered to. Special attention is to be paid to clearances and access, vent travel and termination, gas supply, condensate removal and combustion air supply.

The Installer should do a pre-installation check to ensure that the following precautions can be observed:

- The boiler should be installed in areas where the combustion air source is not subject to chemical fouling or agricultural vapours. 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 vapours which 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.
- The boiler should be located where water leakage will not result in damage to the area. If a location such as this cannot be found, a suitable drain pan should be installed under the appliance. The boiler is not to be installed above carpeting.
- 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 - allow for air circulation and ventilation in the immediate area.
- When the boiler is in operation, the impact of the steam plume normally experienced at the exhaust terminal of a condensing boiler should be assessed. 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 neighbouring properties.
- The exhaust outlet should be placed so as to reach 24" minimum above the down-turned intake - to avoid exhaust re-ingestion.
- For sidewall venting options: Both the inlet and exhaust terminations should normally be located on the same plane (side) of the building. 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 the indoor combustion air option is used, ensure combustion air openings to the boiler room remain unblocked and free of obstructions.
- 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.
- Ensure that the pressure relief valve will be installed with no valves or other means of isolation between its inlet and the boiler. Make sure the relief valve outlet will be piped with unobstructed piping (minimum 3/4" diameter) to a safe discharge location.

1.0 INSTALLATION

1.1 GENERAL

SL 80-399 gas-fired modulating boilers are low pressure, fully condensing units having a variable input range from 80 MBH to 399 MBH (0 to 8,000'). The boilers are approved as "Category IV" vented appliances using either Direct Vent (sealed combustion) or indoor combustion air, providing a great degree of installation flexibility.

Figure 1 shows outer case dimensions and piping and electrical holes. Use this diagram to find a suitable location for the boiler. See also **Section 1.3 Location**.

DESCRIPTION		SIZE
A	Flue Outlet	4" O.D. CPVC/PVC Pipe
B	Combustion Air Inlet	4" O.D. PVC/ABS/CPVC Pipe
C	Safety Relief Valve and Air Vent	3/4" NPT - F
D	Touch Screen display	2-1/4" x 4"
E	Water Outlet	1-1/2" NPT - M
F	Water Inlet	1-1/2" NPT - M
G	Knock-outs (8)	1/2"
H	Gas Inlet	3/4" NPT - F
I	Condensate Outlet	3/4" Flexible Hose Barb Fitting

Table 1: Connections

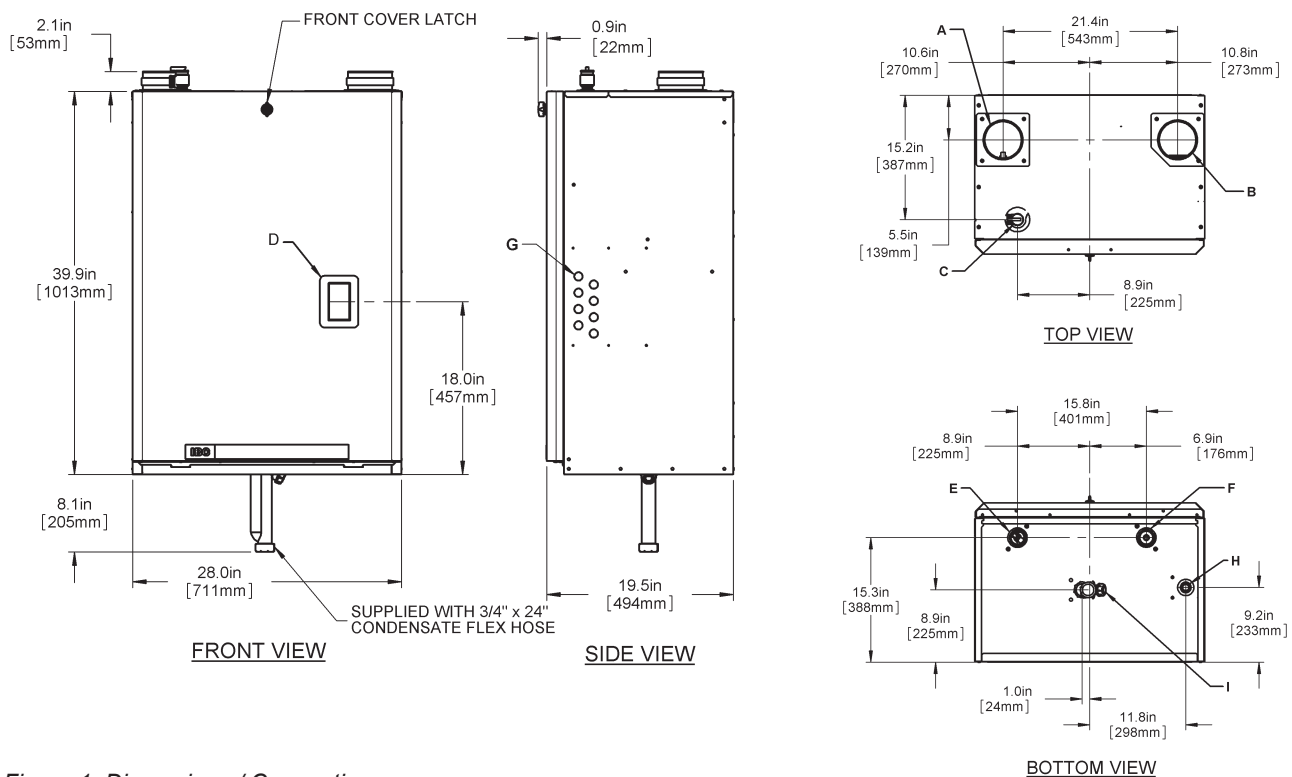


Figure 1: Dimensions / Connections

1.2 CODE REQUIREMENTS

The SL 80-399 boiler was tested to and certified under CSA 4.9-2014 / ANSI Z21.13-2014.

Installation must 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.

In the US, installations must 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. If there is any conflict, then the more stringent requirement will apply.

1.3 LOCATION

WARNING

Keep boiler area free and clear of combustible materials, gasoline, and other flammable vapours and liquids.

WARNING

Combustion air must not be drawn from areas containing corrosive air from swimming pools or spas, including air directly next to outdoor pools and spas.

WARNING

The boiler shall not be exposed to water leaks from piping or components located overhead. This includes condensation dropping from un-insulated cold water lines overhead.

WARNING

Ensure the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and when servicing (pump replacement, condensate trap servicing, control replacement, etc.)

The SL series boilers are designed and approved for indoor installation (wall or rack mounting), with significant flexibility of location provided with the available venting options. The boiler can be placed in an alcove, basement, closet or utility room. Surrounding ambient conditions shall be 0°C to 50°C *and less than 90% relative humidity*.

Install the boiler in areas where the combustion air source is not subject to chemical fouling or agricultural vapours. 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 vapours which 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. For this reason, the indoor air venting option using air surrounding the boiler should not be used in a laundry room. Similarly, ensure any direct vent air source is not adjacent to a clothes dryer exhaust terminal. **Avoid agricultural applications where the boiler and/or the intake air source are affected by ammonia and/or dust.**

Locate the boiler where water leakage will not result in damage to the area. If a location such as this cannot be found, a suitable drain pan should be installed under the appliance. The boiler is not to be installed above carpeting.

Boiler weight – without water and any effect of system piping and components – is approx. 240 lbs/110 kg. For support fasteners, use the supplied 6 x 1/4" x 2 1/2" long lag screws. Installer to supply 1/4" bolts if metal mounting systems are used. Fasteners are to be attached to solid material capable of supporting the combined weight of the boiler and piping assembly components.

Other factors affecting potential mounting sites:

- Ensure minimum clearance requirements for combustible materials (see Table 2) are satisfied.
- Minimum 24" clearance at the front and 12" above is recommended for adequate servicing. Check local codes for additional access and service clearance requirements.
- **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**

⚠ WARNING

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

⚠ WARNING

DO NOT MOUNT THIS BOILER TO HOLLOW WALL STRUCTURES - The weight of the boiler alone is 240 pounds. The combined weight of the boiler, its water contents and associated piping components can exceed 300 pounds. Fasteners must be rated for this strain, and must be firmly anchored into solid material that will support this weight.

Installers are to take all necessary precautions to avoid injury during the installation of this boiler.

(e.g. outdoors) and the boiler should be isolated from interior dust sources. Do not seal boiler case openings directly when firing - allow for air circulation and ventilation in the immediate area.

SURFACE	DISTANCE FROM COMBUSTIBLES	FOR SERVICE
Front	1"	24"
Rear	0"	0"
Left Side	1"	0" - (to non-combustibles)
Right Side	1"	4" for electric and gas if required
Top	12"	12"
Bottom	12"	12" trap service clearance

Table 2 - Clearance from boiler cabinet

A minimum distance below the boiler of 12" is required to provide

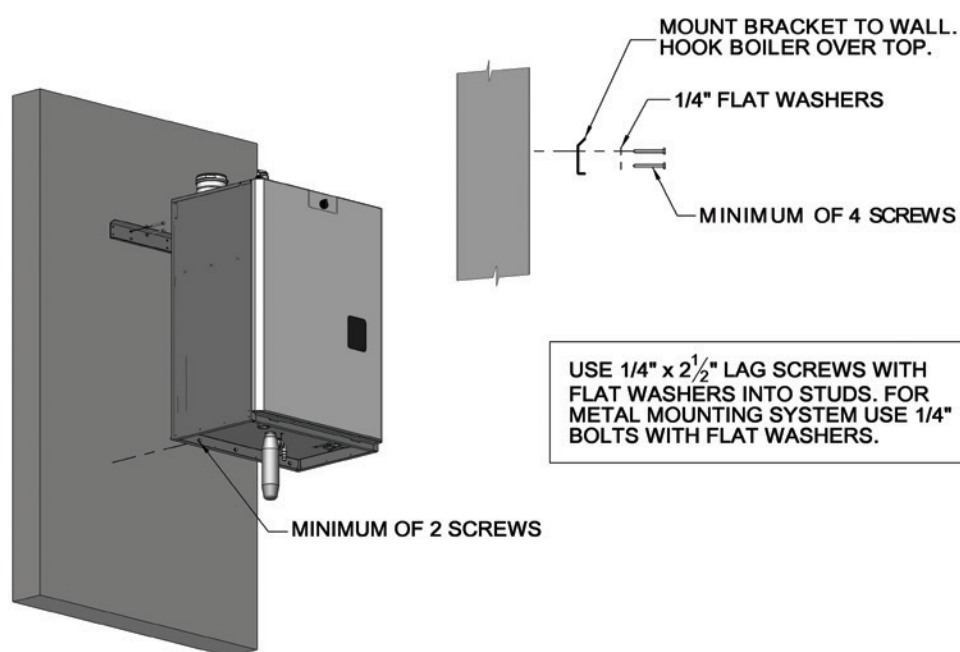


Figure 2: Wall mounting of boiler

clearance for the supplied condensation trap assembly. More clearance will typically be required to accommodate associated water and gas piping.

1.4 EXHAUST VENTING AND AIR INTAKE

⚠ DANGER

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

It is important to carefully plan the installation to ensure the appropriate vent materials, travel and termination decisions are incorporated. Specific attention is warranted to manage the impact of the steam plume normally experienced 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 neighbouring properties.

⚠ WARNING

Venting, condensate drainage, and combustion air systems for all IBC boilers must be installed in compliance with all applicable codes and the instructions of their respective Installation Manuals.

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

Failure to comply will result in severe personal injury or death.

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 below, and the code requirements, the more stringent shall apply.

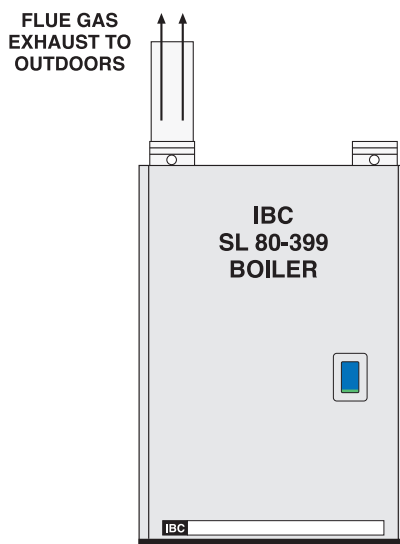


Figure 3: Flue gas venting

IMPORTANT

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

When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in 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 and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.

- 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.

1.4.1 Applications

All SL series boilers are approved with alternative venting options: either 2-pipe Direct Vent or single pipe /Indoor Air venting can be used offering flexibility to meet the specific requirements of the installation. With the Direct Vent case, combustion air is piped directly to the boiler's air intake from outdoors (see *Section 1.4.7 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 installer may choose to vent the boiler through the wall, directly through the roof or upward using an existing - but otherwise unused - chimney as a vent raceway.



WARNING

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

1.4.2 Exhaust Vent Material

EXHAUST VENT MATERIAL – CANADA

Use CPVC or Polypropylene (PPs) vent component systems approved under *ULC-S636 Standard for Type BH Gas Venting Systems*, or stainless steel Type BH venting systems*. Permitted PPs materials comprise *Single Wall Rigid* pipe and fittings and *Flexible*. Ensure compliance with exhaust temperature limitations for the respective materials, which typically are:

- ULC-S636 CPVC: 90°C (194°F)
- ULC-S636 PPs:- 110°C (230°F)

In the standard configuration, SL series boilers can supply water temperatures up to 185°F, leaving stack temperatures above the 65°C (149°F) limit for ULC-S636 approved PVC.

For long vent runs with higher initial exhaust temperature, some jurisdictions may allow the use of mixed materials for economy: CPVC for the initial run followed by ULC-S636 approved PVC to the termination (*It is the responsibility of the Installer to confirm that local codes will allow this option*). Ensure appropriate transition glue is used. The installer is responsible to ensure that sufficient temperature loss is allowed for in the CPVC section to fall below the 65°C (149°F) upper limit for PVC, taking into account the highest possible ambient temperature in the area of vent travel (e.g. boiler room, attic and/or chase).

EXHAUST VENT MATERIAL – USA

IBC strongly recommends that only CPVC or PPs vent component systems approved under *UL1738 (Standard for Venting Systems for Gas Burning Appliances, Categories II, III and IV)*, *ULC-S636 Standard for Type BH Gas Venting Systems*, or stainless steel Type BH venting systems* are to be used, but many local jurisdictions in the USA still allow the use of PVC (Sch. 40 ASTM D1785 or D2665 and fittings) or CPVC (Sch. 40/ASTM F441 with Sch. 80 fittings).

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

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

The boiler offers 4" venting connections. Fittings are to be used to adapt to the appropriate diameter – see Vent Travel below. Exhaust venting is to be inserted directly into the 4" female stainless steel fitting on the top, left side of the boiler (see *Figure 3*).

⚠ WARNING

Do not mix PPs 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.

For PPs material, use the 4" transition/ adaptor fitting (Sch 40 to PPs) offered by the respective PPs manufacturers Centrotherm / *Innoflue*™ (their part # ISAA0404) or M&G Dura Vent / *PolyPro*™ (#4PPs-AD). For PPs material exposed to outdoor weather: follow the venting supplier's recommendations on UV protection.

Combustion air piping - if used - is inserted directly into the 4" female stainless steel fitting on the top, right side of the boiler (see Section 1.4.7).

Venting shall be supported in accordance with applicable code.

***Manufacturers of stainless steel Type BH venting systems must submit their approved transition fitting to IBC for evaluation and written approval.**

1.4.3 Vent Travel

4" PPs (Rigid Single Wall) or CPVC ULC-S636 approved piping is the standard venting option; with this, the SL 80-399 boiler can be sited up to 200 equivalent feet from the vent termination. The actual vent travel allowance is reduced for fittings in accordance with Table 3. – e.g. for a SL 80-399 using 6 x 90° CPVC vent elbows, the maximum lineal measure of pipe allowed is 152 feet (200' – (6 x 8' = 48) = 152').

For Flexible PPs, up to 160 actual lineal feet are allowed in a nominally vertical orientation (>45°). The equivalent length of 4" Flex PPs shall be computed using a multiple of 1.2:1, e.g. 80' x 1.2 = 96' equivalent (with such use of 80' of 4" Flex, up to 104' equivalent of 4" Rigid PPs would still be allowed). PPs 87-90° elbows are considered to be 8' equivalent.

EXHAUST PIPE SIZE	MAXIMUM EQUIVALENT LENGTH
4" CPVC / Rigid PPs	200' (each side)
90° vent elbow	allow 8' equivalent
90° long sweep elbow	allow 5' equivalent
45° elbow	allow 3' equivalent
PPs 87-90° elbows	use 8' equivalent
4" PPs Flexible	160' max, using 1.2 x for equivalent length

Table 3: Maximum exhaust venting length

NOTE: Unused intake travel cannot be added to the exhaust. Unequal intake and exhaust piping is allowed - see Section 1.4.8.

Exhaust venting must slope down towards the boiler with a pitch of at least 1/4" (PPs vent: follow PPs manufacturer requirements for slope) per foot so condensate runs back towards the trap. Support should be provided for intake and vent piping, particularly so for horizontal runs (follow local code). Insulate exhaust piping where it passes through unheated spaces or underground, with appropriate pipe insulation to prevent freezing of condensates.

Ensure all venting components are clean of burrs/debris prior to assembly. Care is to be taken to avoid ingestion into the fan of plastic debris left in the combustion air piping.

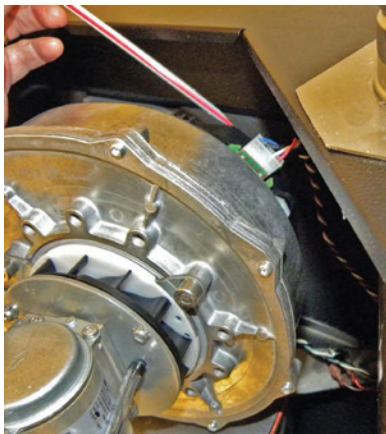
All joints must be secured. For CPVC in Canada, use ULC-S636 approved CPVC solvent cement, following its manufacturer's instructions closely when joining various components. For PPs, connections shall be secured using approved retainer clips supplied by the respective PPs manufacturer.

All vent connections must be 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/water solution. Installer must fill condensate trap prior to test.



⚠ WARNING

Fully insert the approved venting material into the boilers exhaust outlet and tighten clamp to ensure the venting connection is locked in place.



Fan control harness plug



Unplugging fan control harness plug will drive the fan into manual high speed operation for vent leak test

! BEST PRACTICES

To reduce the possibility of expansion noise, allow a 1/4" gap around the exhaust and air intake piping.

! WARNING

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

INSTALLATION

Remove the fan control harness plug as illustrated in the photos, and then block the vent outlet so that the vent run will be under maximum fan pressure. 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. Good practice would suggest that the installer attach a tag on the vent line near the condensate drain tee indicating the type of test, the date and the installer's name.

1.4.4 Venting Passage Through Ceiling and Floor

- Confirm material meets local codes including fire stopping requirements.
- Pipe clearances - no IBC requirements; follow local codes.
- All piping must be liquid and pressure tight.

1.4.5 Rooftop Vent Termination

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.
- If used, the intake air pipe is not typically drained, so it must be terminated with a down-turned elbow (see **Figure 4**). The intake pipe does not need to penetrate the roof at the same elevation as the exhaust (as shown); lower down roof is OK.
- 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.
- For roof top venting of multiple boiler sets, group all intake terminals together

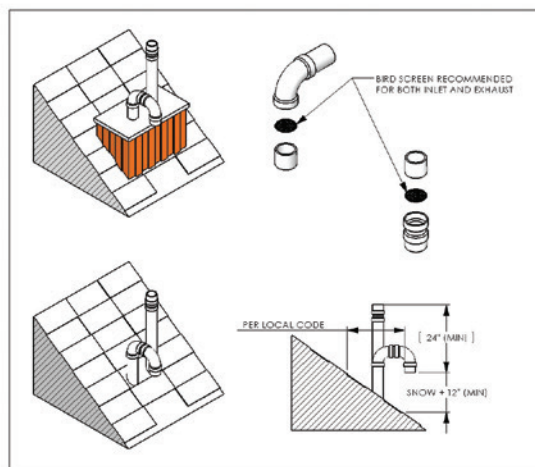


Figure 4: Rooftop vent terminal configurations

for a common penetration through a custom cap. Alternatively, place in the closest proximity achievable using commonly available pipe flashing. Similarly group the exhaust pipes and place the 2 separate groups of pipes at least 3' apart (the closest intake and exhaust pipes shall be 36" - or more - apart). Use the same 24" (minimum) vertical separation for all termination options. For alternate group terminations, contact the IBC Factory for written guidance.

- **DO NOT** exhaust vent into a common venting system.

1.4.6 Sidewall Vent Termination

Sidewall direct vent applications shall be vented as follows:

- Both the inlet and exhaust terminations should normally be located on the same plane (side) of the building.
- The exhaust outlet is to be placed so as to reach 24" minimum above the down-turned intake - to avoid exhaust re-ingestion.
- The elevation of both pipes can be raised in "periscope style" after passing through the wall, then configured as in *Figure 5*, to gain required clearance.
- Use a 45° elbow on the exhaust termination to launch the plume up and off the sidewall, for protection of wall.
- Bird screen of 1/4" stainless steel or plastic mesh (IPEX System 636 drain grate) is useful to guard against foreign objects.

! WARNING

It is extremely important to maintain at least the minimum separation of exhaust vent termination from boiler intake air as illustrated in figures 5, and 9. 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 shall **NOT** be used. Improper installation will void the warranty. Do not use proprietary *InnoFlue* or *PolyPro* PPs terminals available without specific approval from IBC.

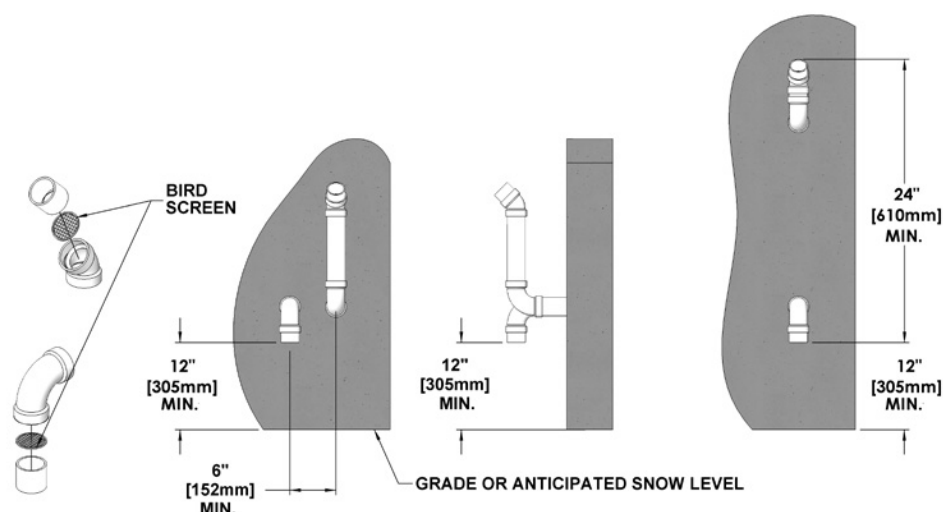


Figure 5: Sidewall vent termination - direct vent applications

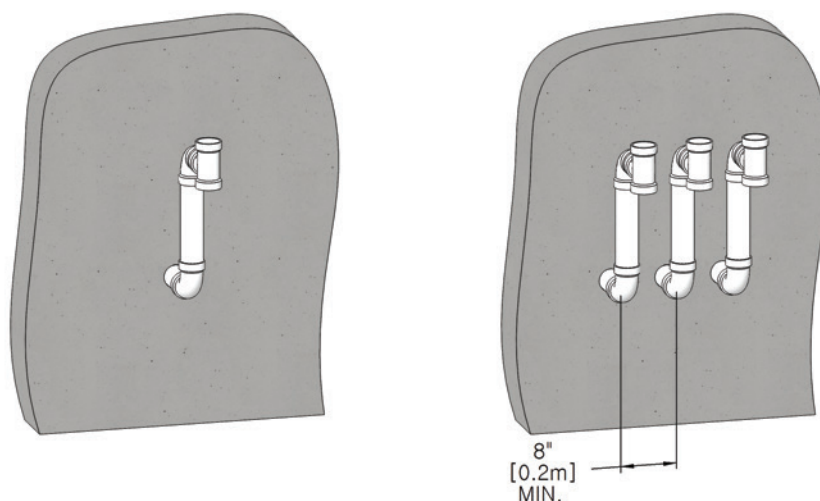


Figure 6: Sidewall vent termination - indoor combustion air applications

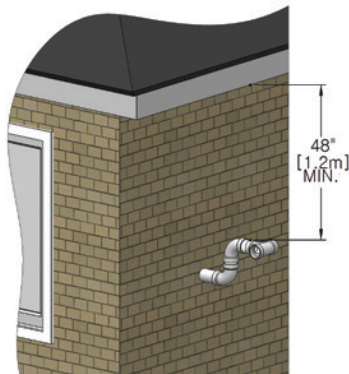


Figure 7: IBC recommended minimum vent terminal clearance under ventilated soffit

Sidewall indoor combustion air applications shall be vented as follows:

- The exhaust outlet is to be placed 18" minimum (12" in USA) above the grade or anticipated snow level.
- The vent shall be terminated with a tee fitting as illustrated - See Figure 6.
- Bird screen, as above, should be installed in both open ends of the tee.

For side venting of multiple boiler sets, group all intake terminals together with 6" to 12" lateral spacing, and similarly group the exhaust pipes. Place the 2 groups on the same plane of the building (e.g. north facing wall). Place the 2 groups of pipes at least 3' apart (the closest intake and exhaust pipes shall be 36" - or more - apart. Use same 24" (minimum) vertical separation. Alternately, as long as the boilers are identical models - intake and exhaust terminals can maintain a minimum of 12" of separation horizontally from any exhaust or inlet termination of an adjacent boiler. For alternate group terminations, contact the IBC Factory for written guidance.

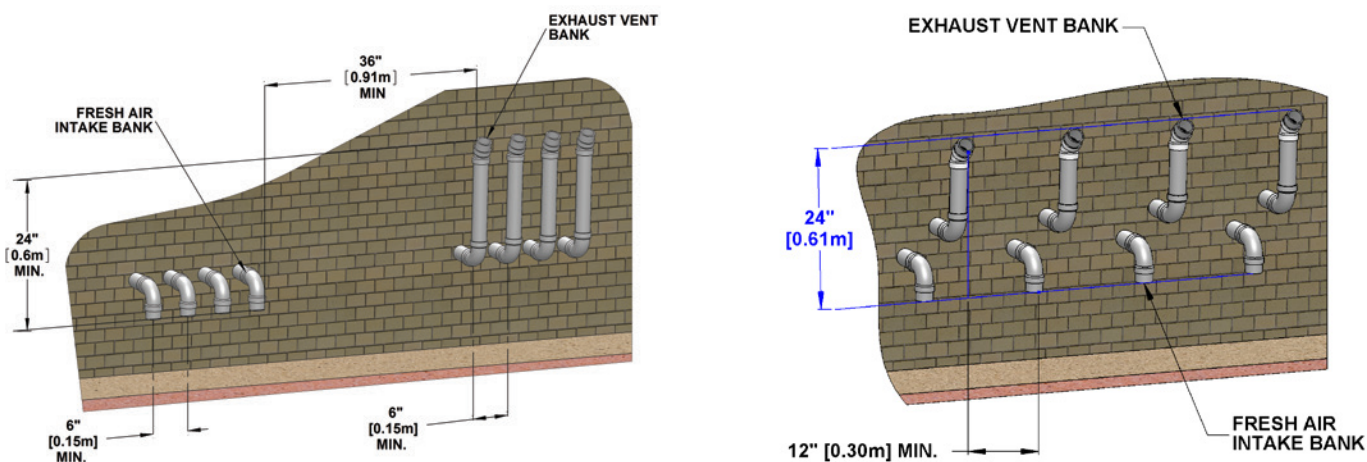


Figure 9: Sidewall vent termination options - multiple vent piping configurations

Vent terminal clearance minimums are as follows:

- Clearance above grade, veranda, porch, deck or balcony - 12" (0.3m), but check local code also (anticipated snow levels may supersede).
- Clearance to openable window or door - 36" (0.91m) (USA - 12")
- Vertical clearance to ventilated soffit located above the terminal - 48" (1.2m) See Caution note in this section.
- Clearance to each side of centre line extended above meter/regulator assembly: - 3' (0.91m) within a height of 15' (4.6m) above the meter/regulator.
- Clearance to service regulator vent outlet: - 3' (0.91m)
- Clearance to non-mechanical air supply inlet to building or the combustion air intake to any other appliance: - 3' (0.91m) (USA - 12" (0.3m))
- Clearance to a mechanical air supply inlet: - 6' (1.82m) (USA - 3' (0.91m) above if within 10' (3.1m) horizontally)
- Clearance above paved sidewalk or paved driveway located on public property: - 7' (2.2m) Note: Cannot terminate directly above a paved sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings
- Clearance under veranda, porch, deck or balcony: - 12" (0.3m) **IBC strongly recommends a minimum of 48" with the SL 80-399 to avoid damage to the structure.** Note: Prohibited unless fully open on a minimum of two sides below the floor.

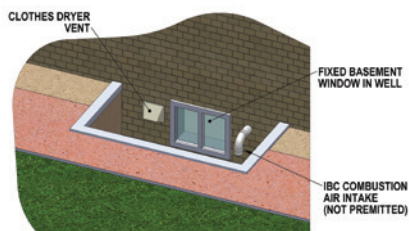


Figure 8: Prohibited installation

⚠ 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.

⚠ 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, and ingress of moisture into building structures is to be avoided. Serious structural damage may occur if adequate precautions and clearances are not allowed for.

These precautions are to be observed for neighbouring structures as well as for the structure the boiler(s) are installed in.

- Vents must be installed such that flue gas does not discharge towards neighbor's windows, or where personal injury or property damage can occur.
- It is important to ensure proper condensate management from vent terminations. Condensate shall not be discharged in a manner that will cause damage to external building finishes or components, or infiltrate building envelopes, including adjacent structures.

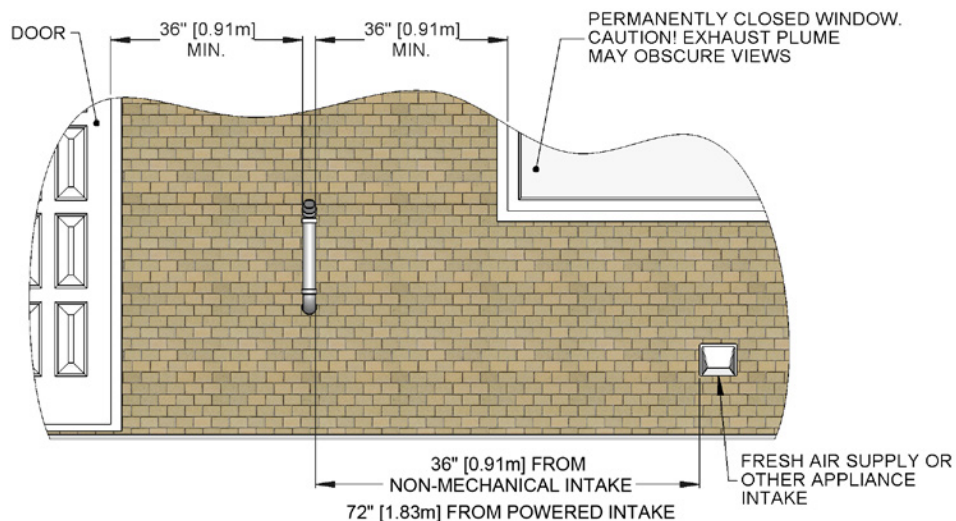


Figure 10: Vent terminal clearances

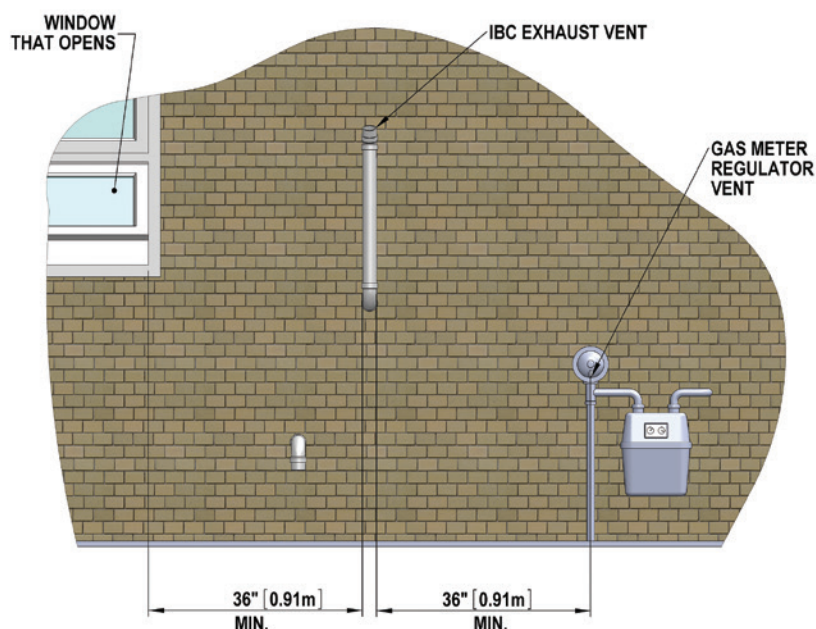


Figure 11: Vent terminal clearances

⚠ WARNING

In addition to preventing ingestion of chemical contaminants, care must be taken to ensure air intake terminals are not installed in locations where contamination might occur due to ingestion of particulate foreign material (dust, dirt and debris).

⚠ WARNING

Intake air openings must be configured such that rain or other forms of moisture cannot enter the air intake piping system. Otherwise serious damage to the boiler may result.

⚠ NOTE

Care must be taken when installing air intake piping to ensure that a “trap” is not formed in the piping so as to allow a build-up of water, and blockage of intake air.

Such blockage will result in a boiler safety shut-down.

⚠ NOTE

Combustion fan blockages can occur when environmental particulate and foreign matter contaminants (leaves, dust, dandelion & cottonwood fluff, etc) are drawn into the air intake. In areas where this problem is suspected to be an issue, intake air filtration should be considered. Contact Factory.

Filters should be checked and cleaned or replaced on a regular schedule based on the severity of the problem.

1.4.7 “Direct Vent” Combustion Air Intake Piping

There are two basic methods of supplying combustion air to an IBC boiler.

The direct vent option uses piping from the outside to supply combustion air directly to the boiler’s combustion air connection.

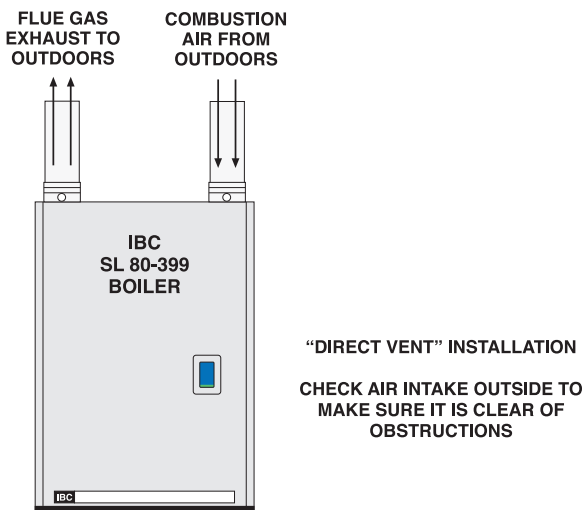


Figure 12: Direct vent combustion air intake

INTAKE PIPE SIZE	MAXIMUM EQUIVALENT LENGTH
4" CPVC / Rigid PPs	200' (each side)
90° vent elbow	allow 8' equivalent
90° long sweep elbow	allow 5' equivalent
45° elbow	allow 3' equivalent
PPs 87-90° elbows	use 8' equivalent
4" PPs Flexible	160' max, using 1.2 x for equivalent length
Air Intake Filter	Contact Factory

Table 4: Maximum intake piping length

For the **inlet** air – 4" Schedule 40 PVC, CPVC, ABS, or PPs piping of any type is permitted.

NOTE: It is not permitted to add to the exhaust length by transfer of unused intake allowance.

Combustion air piping - if used - is inserted directly into the 4" female stainless steel fitting on the top, right side of the boiler and run horizontally or vertically to the outdoors. Screen material can be placed at the inlet as appropriate for the environment (e.g. insects, dust).

Care must be taken to ensure 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.

Support should be provided for intake piping, particularly so for horizontal runs (follow local code).

⚠ WARNING

When using Indoor Air options, adequate combustion air must be supplied to the boiler room according to the requirements of all applicable codes.

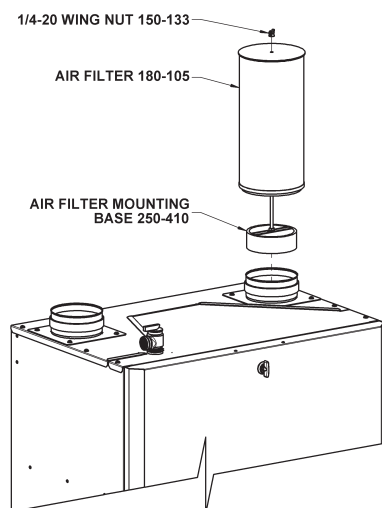


Figure 13: Air Intake Filter Assembly P-172

1.4.8 “Indoor Air” Combustion Air Intake

An “Indoor Combustion Air installation”, as described herein, is one in which air for combustion is taken from the ambient air around the boiler.

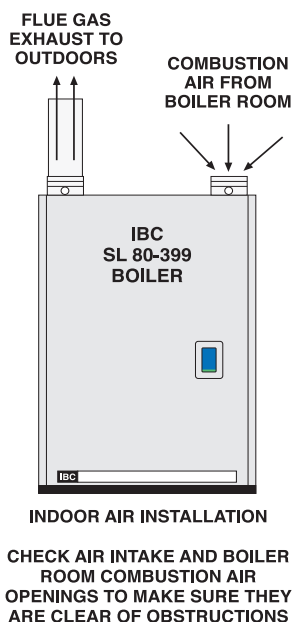


Figure 15: Indoor combustion air intake

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

1.4.9 Combustion Air Filtration

If combustion air contamination from ingested particulate matter may be a concern in any installation, an optional air intake filter may be installed.

IMPORTANT NOTE: Under no circumstances should a third-party air filter be installed on an IBC boiler without proper evaluation and written approval of the IBC Engineering Department.

1.4.10 Closet Installations

For installations in a confined space (such as a closet), ventilation openings may be needed through a door or wall to prevent excessive heat from building up inside the space.

The boiler shall not be exposed to ambient conditions above 122°F (50°C) or below 32°F (0°C).

Figure 14: Reserved

1.5 CONDENSATE REMOVAL

! WARNING

Fill trap with water before boiler is first fired to prevent exhaust fumes from entering room. Never operate the boiler unless the trap is filled with water.

Failure to comply will result in severe personal injury or death.

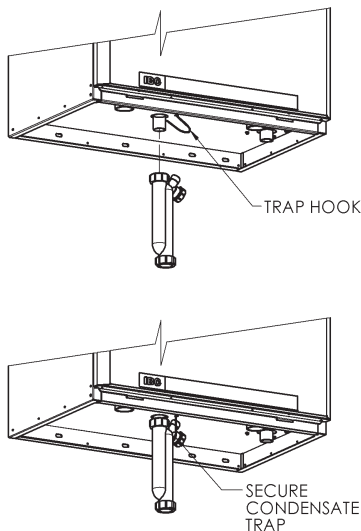


Figure 16: Condensate trap installation

! WARNING

The Trap Hook must be installed as instructed and all trap fittings must be tightened as instructed to prevent leakage of flue gasses.

Failure to comply may result in severe personal injury or death.

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:

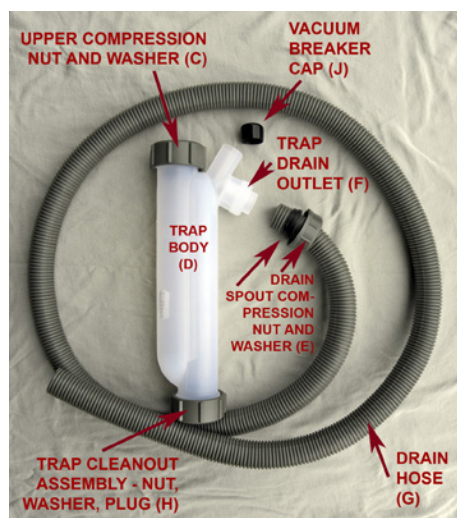
1. Allow for a 1/4" per foot slope back to the vent connection, with appropriate hangers to maintain that gradient.
2. Ensure the supplied trap is correctly installed and filled with water.
3. When required, add (and maintain in good condition) a neutralization tank.

1.5.1 Condensate Trap

A condensate trap must be installed on the drain connection at the base of the boiler as shown in *Figure 16*.

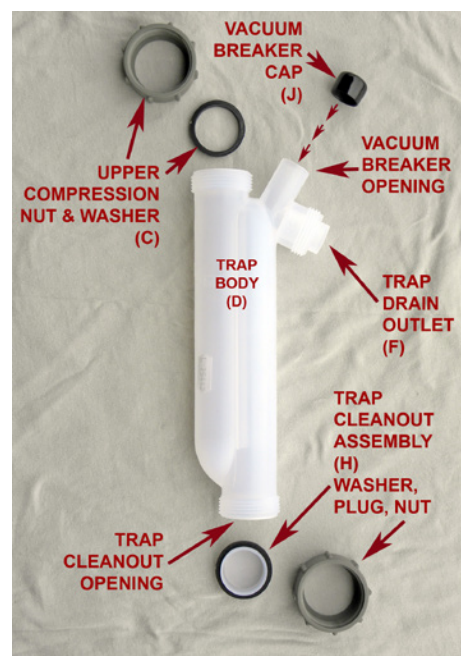
1.5.2 Condensate Trap Assembly - Installation

1. Undo Drain Spout Compression Nut (E), remove Drain Hose (G) from Trap Drain Outlet (F). Place Vacuum breaker cap (J) over the Vacuum breaker opening and push firmly home. Remove Upper Compression Nut and Washer (C) and slide over Boiler Drain Outlet (A). Insert one Trap Hook barb into the back mounting hole.



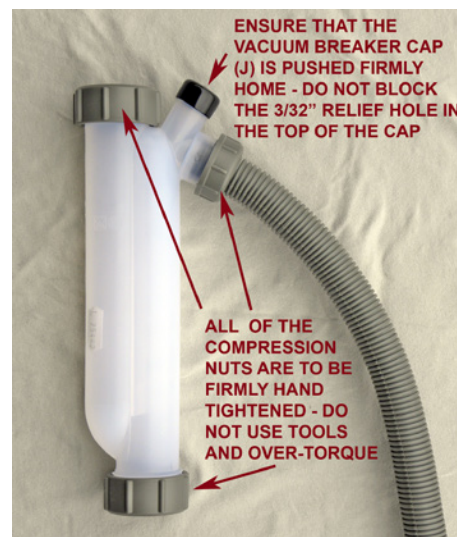
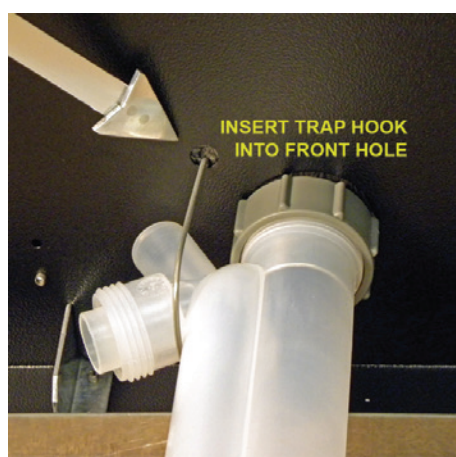
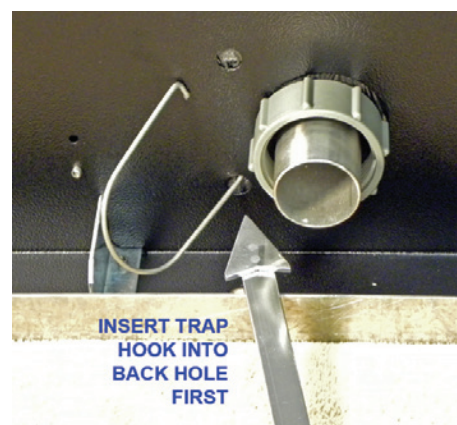
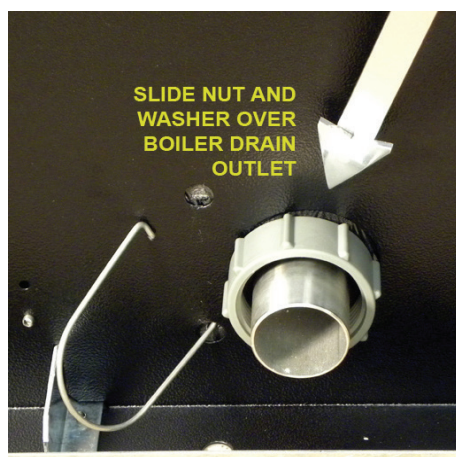
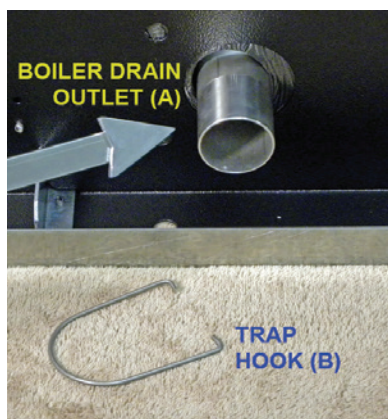
Condensate Trap as shipped

2. **Fill Trap with water**, and slide Trap Body (D) over Boiler Drain Outlet (A). Swing Trap Hook (B) around the Drain Outlet (F) connection threads. Insert remaining Trap Hook barb into the front hole. Pull the trap slightly downward to seat it against the hook and tighten Upper Compression nut (C).



Condensate Trap, disassembled

3. Attach Drain Hose (G) and tighten Drain Spout Compression Nut (E).



NOTE

It is the responsibility of the installing and/or service Contractor to advise and instruct the end User in how to perform the Trap cleaning procedure, and to advise that the Trap be checked at least every two months and cleaned as required.

1.5.3 Condensate Trap Assembly - cleaning procedure

1. Turn off the power to the boiler and allow it to cool down.
2. Remove the trap from the boiler (reverse the installation procedure above).
3. Remove the Trap Cleanout Assembly (H), from the Trap Body and clean and flush the debris out.
4. Re-assemble trap components, re-fill trap, and replace on boiler as described in the installation instructions above.

1.5.4 Further installation details

- Condensate drain must be piped to within 1" of a drain or be connected to a condensate pump.
- Drainage line must slope down to the drain at a pitch of 1/4" per foot so condensate runs towards the drain.
- Condensate traps should be checked every 2 months, and cleaned and refilled as necessary.

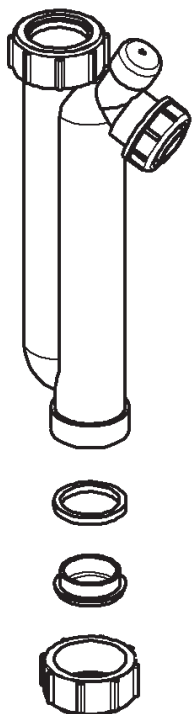


Figure 17: Condensate trap disassembly for cleaning

⚠ WARNING

If condensates are to be discharged into building drain piping materials that are subject to corrosion, a neutralization package must be used.

⚠ CAUTION

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

⚠ DANGER

The water in the condensate neutralizer can cause severe burns to the skin. Use extreme caution when servicing the condensate neutralizer. Wear protective gloves and eyewear.

INSTALLATION

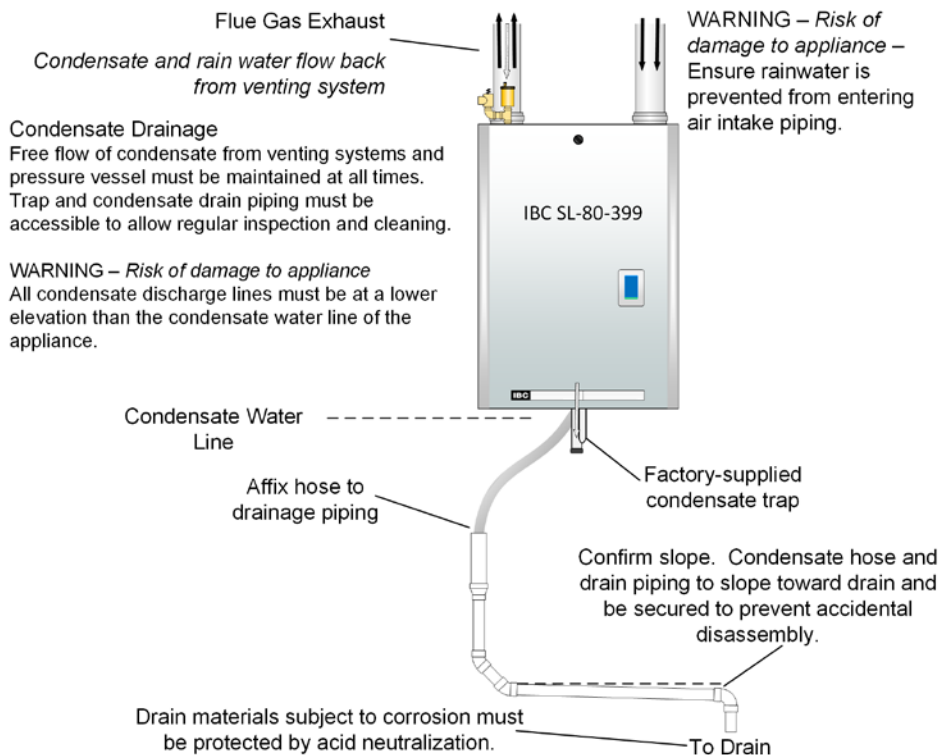


Figure 18: Condensate trap drainage

MAINTENANCE DETAILS FOR NT-25 CONDENSATE NEUTRALIZATION TANK

Refer to manufacturer's maintenance instructions for other makes and models of condensate neutralization tanks.

WARNING – Risk of injury

Tank fluid can be highly acidic. Do not use hands to stir material.

WARNING – Risk of damage to appliance

Neutralization tank inlet and discharge must be at a lower elevation than the condensate water line of the appliance.

NOTE – 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 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.

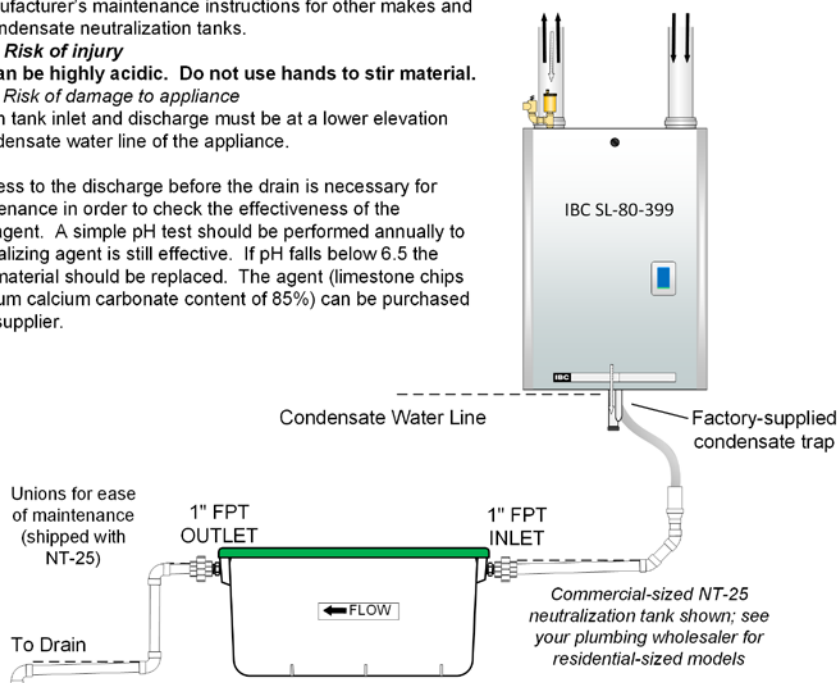


Figure 19: Condensate neutralization tank

1.6 WATER PIPING

⚠ WARNING

During operation, the relief valve may discharge large amounts of steam and/or hot water. Therefore, to reduce the potential for bodily injury and property damage, a discharge line **MUST** be installed that it:

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

DO NOT CAP, PLUG OR OTHERWISE OBSTRUCT THE DISCHARGE PIPE OUTLET!

⚠ 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.

1.6.1 General Piping Issues

The SL modulating series boilers are designed for use within a closed loop, forced circulation, low pressure system. A 30 psi pressure relief valve (3/4" NPT) is supplied for field installation in the relief valve fitting on top of the boiler. An optional 75 Psig relief valve can be used where required on closed loop systems within multi-level buildings. Relief valve discharge piping must terminate between 6" (15cm) and 12" (30cm) above the floor or per local Code.

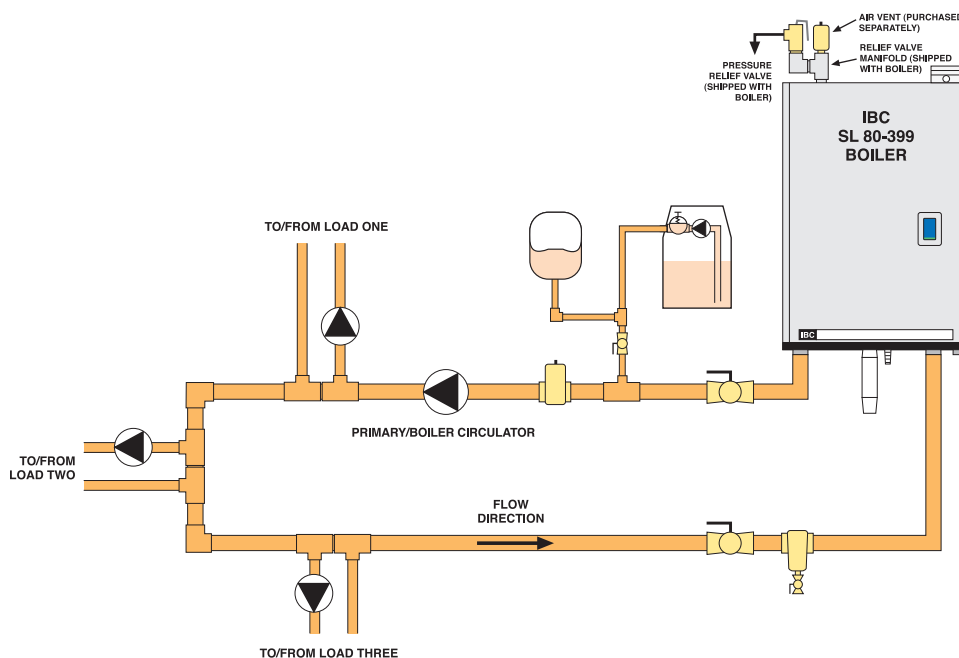


Figure 20: Boiler trim options - Single boiler

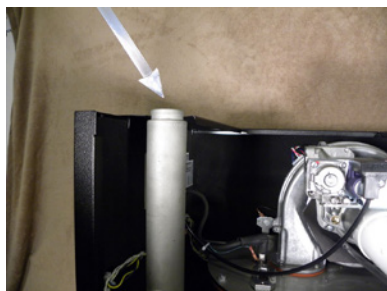
System piping is connected to the boiler using the 1 1/2" NPT-M threaded fittings. Unions and gate or ball valves at the boilers supply and return water connections are recommended to simplify servicing. Un-insulated hot water pipes must be installed with a minimum 1/4" clearance from combustible materials.

Fluid fill is most often accomplished by using a boiler regulator & fill valve set at 12 psig or more, with 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 applicable Codes and good piping practice.

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 unit for recycling of boiler fluid and chemicals back into the system. In buildings that may be unoccupied for long periods of time, pressurization units 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.

⚠ WARNING

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



Supply stack upper tapping - 3/4" FIP to accept relief valve and air vent assembly



Relief valve and air vent assembly (recommended configuration)



Relief valve and air vent assembly (relief valve discharge piping - required by code - piped to back)

⚠ NOTE

Full sized application drawings can be downloaded from our web site.

www.ibcboiler.com

Do not place any water connections overhead the boiler; leaks can damage the fan & 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 2" piping for the SL 80-399. Heat exchanger head is only 2' at 30 gpm and approx. 4' at 40 gpm.

The minimum flow rate required through the heat exchanger is 20 gpm and a maximum of 45 gpm is allowed. Primary/Secondary piping ensures adequate flow and de-couples ΔT issues (boiler vs. distribution). Aim for a 20° to 30° F ΔT across the heat exchanger at high fire (there is a boiler protection throttle fence limiting the ΔT to 40°F).

Table 5: Reserved

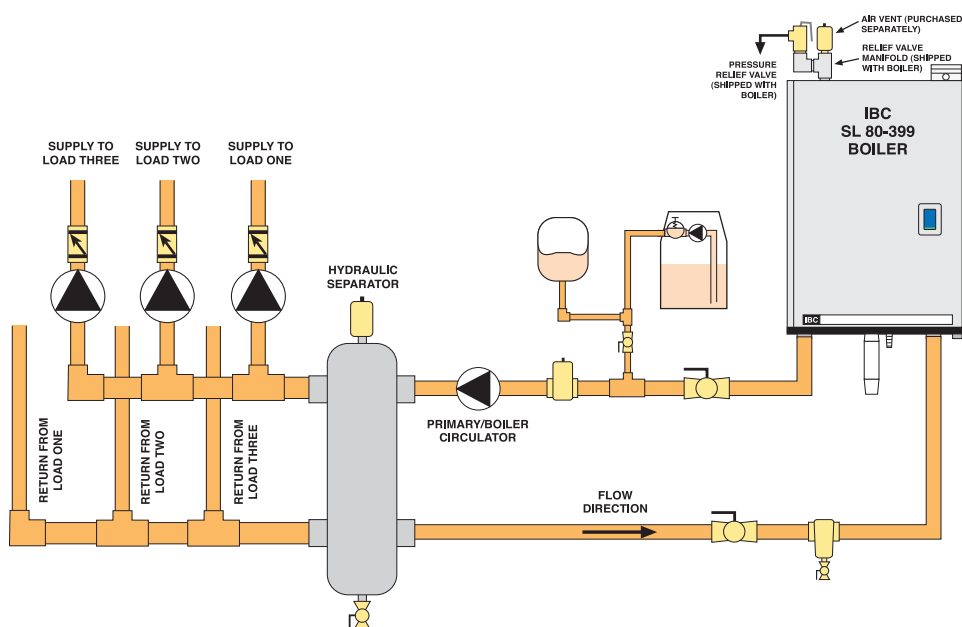


Figure 21: Primary/Secondary piping concept with hydraulic separator

The SL modulating series 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 a mixing valves.

A variety of application drawings showing basic design options are available from the IBC web site at: www.ibcboiler.com

PRESSURE VESSEL HEAD

Flow rate (gpm)	20	25	30	35	40	45
Head @ flow (ft wc)	1	1.5	2	3	4	6

Table 6: Pressure Vessel Head

Ensure 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 actual performance by measuring ΔT (under high and low flow conditions) after establishing the correct firing rate.

⚠ WARNING

Water quality has a significant impact on the lifetime and performance of an IBC Boiler heat exchanger.

Improperly prepared water in a heating circuit may cause damage to the heat exchanger through corrosion or fouling. 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 remove all dissolved solids. Other water chemistry allowable limits are as follows:

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 less than 400µS/cm (at 25°C)

Hardness is to be 7 Grains or less

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

We require water flow after burner shutdown to utilize legacy heat – this is significant due to the mass of the heat exchanger (50 Kg) plus its 26L internal water volume. Default software values 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 software will run the Load 1 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 (*see Section 2.7 Set Up & Load Definition*).

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

Schematics for several piping layouts are provided, and additional drawings are available at www.ibcboiler.com. Installers shall conform the piping design to one of the provided configurations to simplify the control application, promote good loads and flow management.

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. As a rule of thumb, a 50%:50% solution of propylene glycol and water will require an increased system circulation rate (gpm up 10%), and system head (up 20%) to provide performance equivalent to straight water.

1.6.2 Installation Rules

If the installation involves small loads, as in typical zoned baseboard heating applications, use of a buffer tank is recommended. To aid in temperature transition from hot to cool loads, a 3-way mixing valve can be placed at the entrance to the cool load (this will also provide floor protection). This will permit immediate circulation of mixed flow into the cool loop. See separate publication *Application Notes* for more detail (*available at www.ibcboiler.com or from your IBC Representative*).

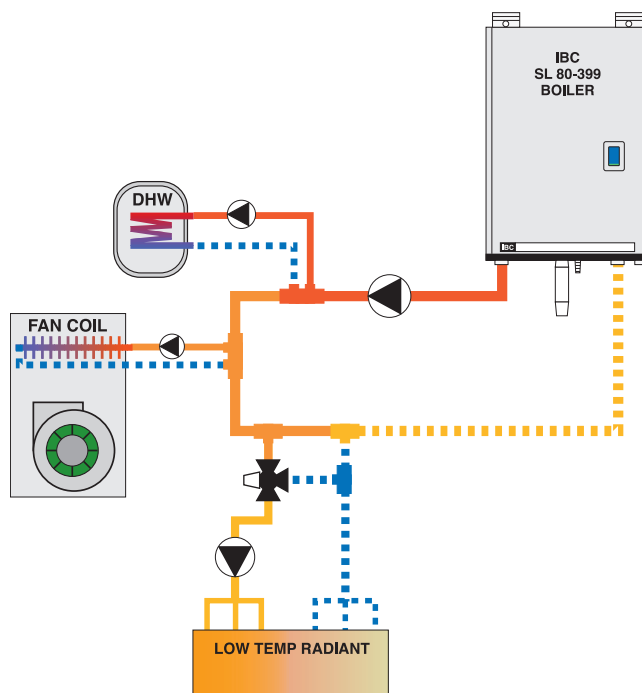


Figure 22: Primary/Secondary piping concept with simultaneous setpoint calls

⚠ 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, 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.

⚠ NOTE

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

⚠ NOTE

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

Always ensure that loads sensitive to high temperatures (e.g. radiant floor) are protected using appropriate means such as a manual mixing valve, or an aquastat (set to 130°F, for example) wired to the boiler's auxiliary interlocks.

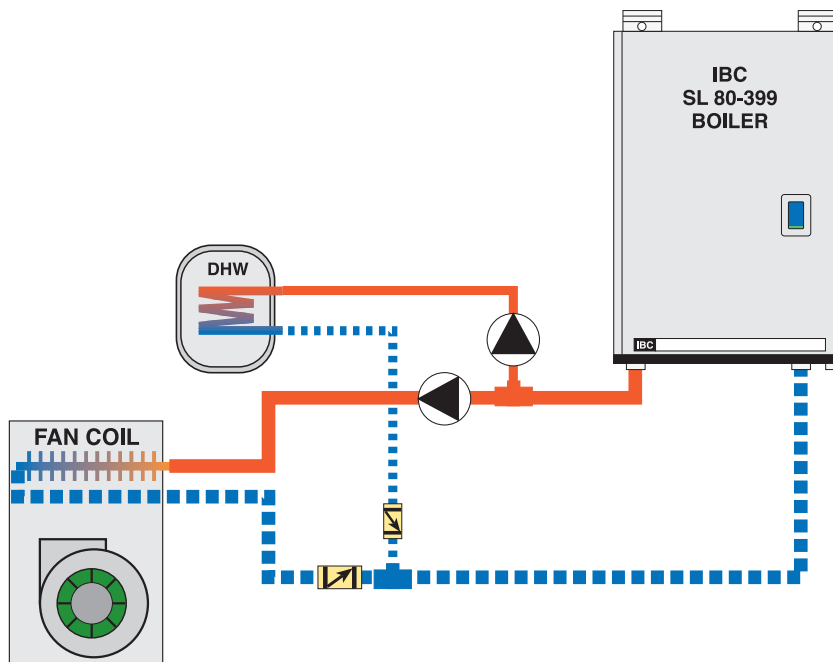


Figure 23: Two pump, two load - parallel piping concept

Compared with the Primary/Secondary approach, the above design saves one pump. Lost is the simplicity of constant head and flow at the boiler.

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 (20 gpm).

For further information and details, consult our *Application Notes* – which provide detail on specific single and multiple boiler applications “Piping”, “Wiring” and “Settings”. (available at www.ibcboiler.com or from your IBC Representative).

NOTE

This 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.

NOTE

Load Combining is now available to operate 2 compatible water temperature loads at the same time.

When using the sequential load feature of the IBC boiler, attention must be paid to the operation of system components in order to ensure they are compatible.

Many air handlers (fan coils) for instance have a thermostat connection that will energize an internal relay to operate the air handler circulator and its fan on a call for heat. This may result in operation of these components when other loads are running at a higher priority, resulting in cold air blowing, or robbing heat from another load.

Some wiring alteration may be required to divorce both of these functions from thermostat control in favour of more effective control from the IBC boiler.

MULTI BOILER TRIM OPTIONS

IMPORTANT NOTE: NONE OF THE EXTERNAL DEVICES SHOWN ON THIS DRAWING ARE SUPPLIED BY IBC AS STANDARD EQUIPMENT EXCEPT FOR THE PRESSURE RELIEF VALVE. THE OTHER DEVICES CAN BE PROVIDED BY YOUR IBC DISTRIBUTOR OR BY SPECIAL ORDER FROM IBC

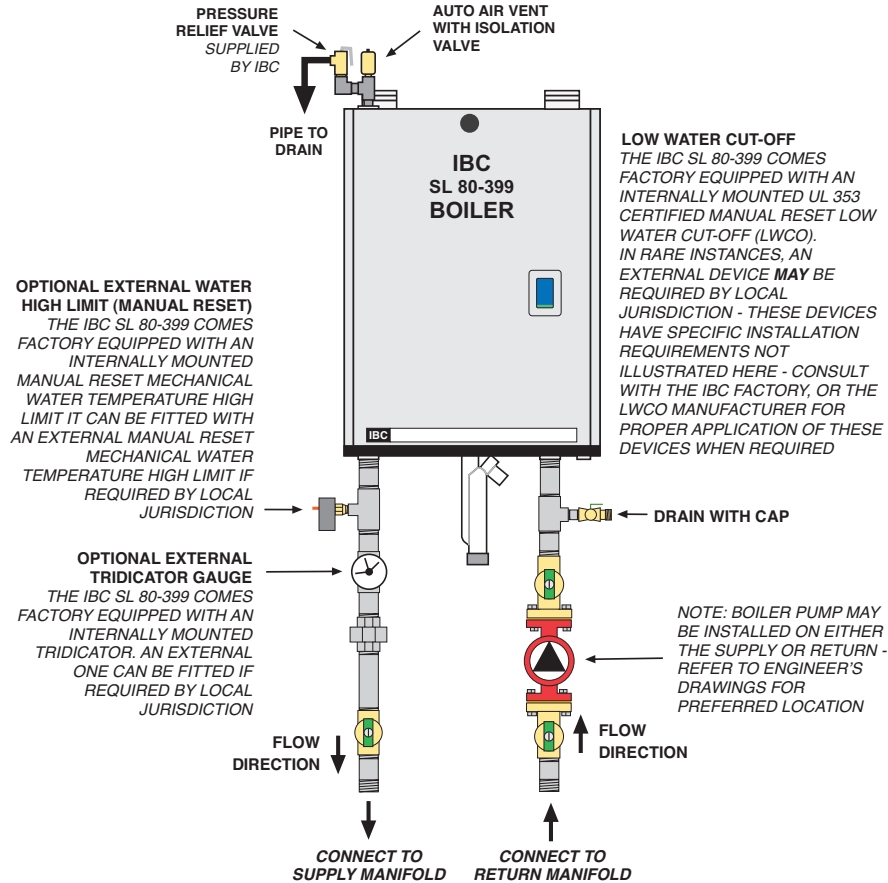


Figure 24: Trim for multiple boiler installations



Figure 25: Mulit-Plex Racking System

NOTE

When using the sequential load feature of the IBC boiler, attention must be paid to the operation of system components in order to ensure they are compatible.

Many air handlers (fan coils) for instance have a thermostat connection that will energize an internal relay to operate the air handler circulator and its fan on a call for heat. This may result in operation of these components when other loads are running at a higher priority, resulting in cold air blowing, or robbing heat from another load.

Some wiring alteration may be required to divorce both of these functions from thermostat control in favour of more effective control from the IBC boiler.

NOTE

For further information and details regarding Multiple Boiler application, consult our *Technical Notes - Multiple Boiler Systems*. These notes provide necessary detail on specific single and multiple boiler applications "Piping", "Wiring" and "Settings". (available at www.ibcboiler.com or from your IBC Representative).

4 STAGED BOILERS SINGLE LOAD

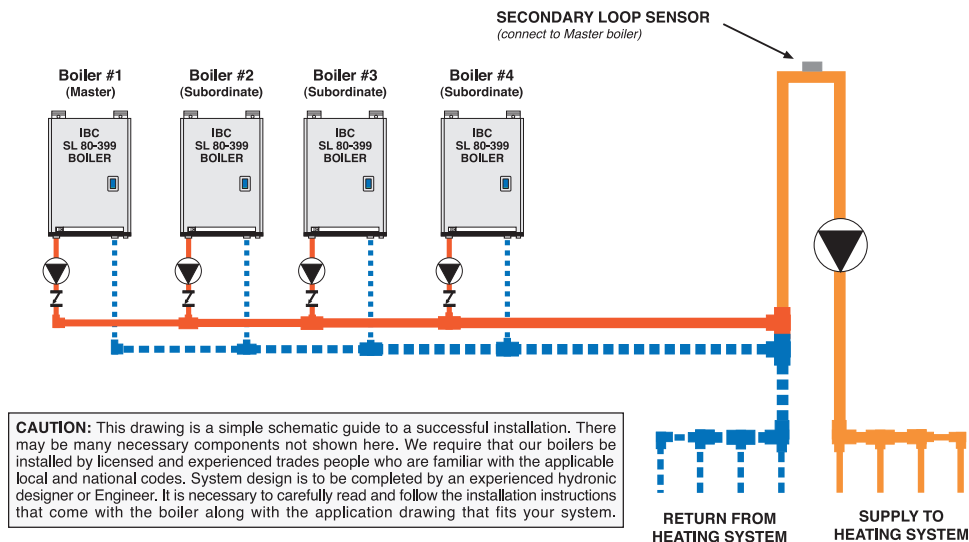


Figure 26: Multiple boiler piping

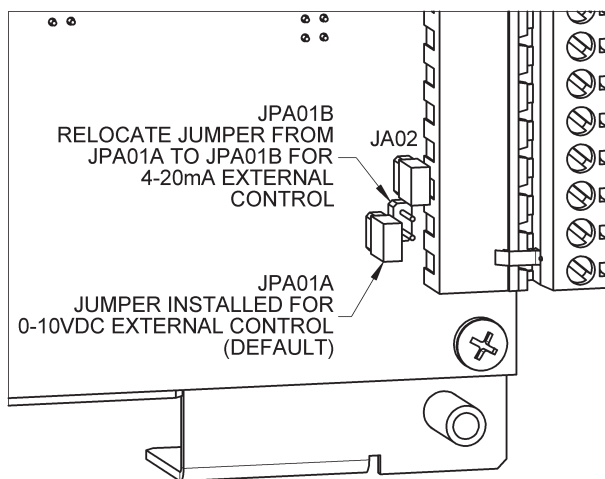


Figure 27: Jumper

CIRCUIT BOARD JUMPER REMOVAL FOR NETWORKED MULTIPLE BOILERS

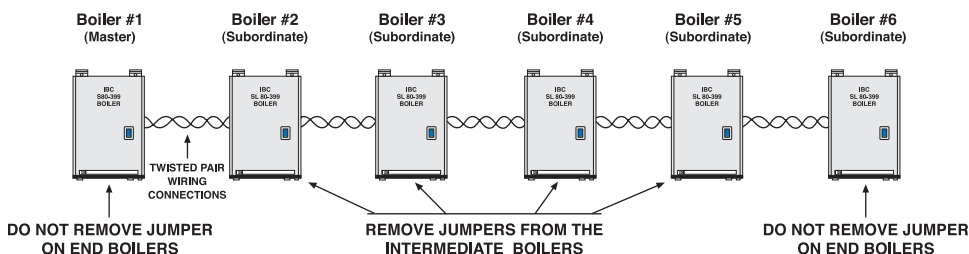


Figure 28: Multiple boiler inter-wiring

1.7 GAS PIPING

NOTE

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

It is essential to 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, when the regulator is in a “lock-up” condition and during operation, throughout the boiler’s full modulation range.

Pay special attention to retrofit situations where existing regulators may have an over-sized 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.

The boiler requires an inlet gas supply pressure of at least 5.0" w.c. for natural gas or propane during high fire operation. This will ensure that gas pressure measured at the gas valve inlet pressure tap does not droop below 4" w.c. at high fire. 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 3/4" NPT (female).

Adequate gas supply piping shall be provided with no smaller than 3/4" Sched 40 (e.g. Iron Pipe Size (IPS)) and using a 1" w.c. pressure drop, in accordance with the following chart:

MODEL	3/4" IPS	1" IPS	1 1/4" IPS	1 1/2" IPS
SL 80-399 (Natural Gas)	10	40	150	350
SL 80-399 (Propane)	30	100	400	900

Table 7: Maximum Pipe Length (ft)

Gas piping must have a sediment trap ahead of the boiler’s gas valve (see Figure 29). A manual shutoff valve must be located outside the boiler, in accordance with local codes/standards. All threaded joints in gas piping should be made with an approved piping compound resistant to the action of natural gas/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 1/2 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 Figure 32). Note that manifold pressure varies slightly in accordance with firing rates with the modulating series boilers, but will always be close to 0" w.

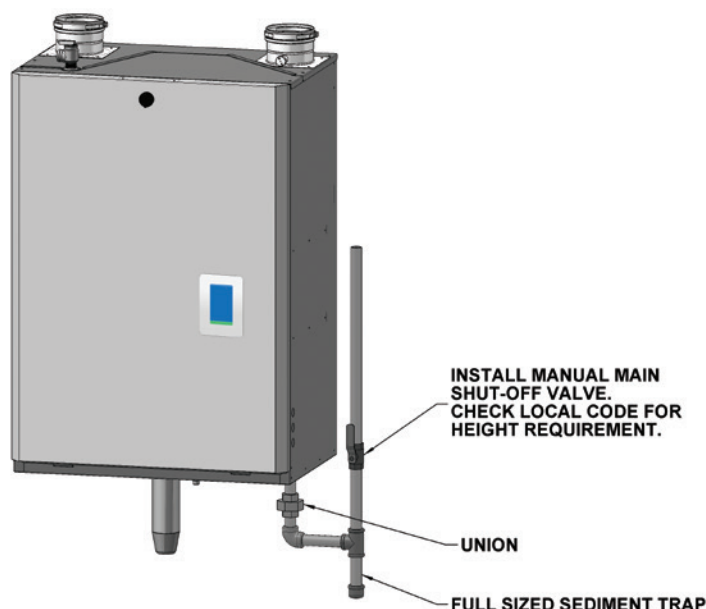
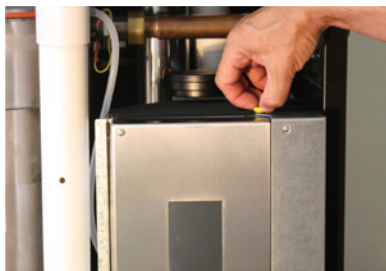
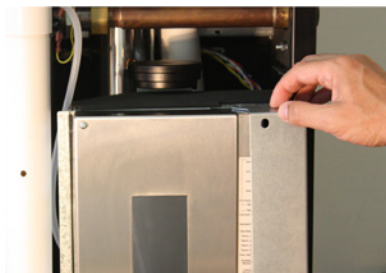


Figure 29: Typical gas piping

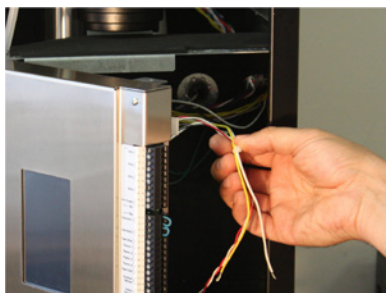
1.8 ELECTRICAL CONNECTIONS



Removing wiring box covers



Line voltage leads for power supply, primary pump and VS output



Line voltage load pump terminals



CAUTION

The internal 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.

INSTALLATION

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

1.8.1 120VAC Line Voltage Hook-up

Line-voltage wiring is done within the field-wiring box. (Refer to Section 6.2. Wiring Diagram on page 6-4). 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.

Connect a 120 VAC / 15 amp supply to the “AC IN” tagged leads in the wiring box. The max. actual draw (with 5 typical residential size pumps) is less than 4 amps.

The 120 VAC power supply to the load pumps (P/V1, P/V2, P/V3, and P/V4) have been factory installed and connected to P/V-L and P/V-N for your convenience. If you are to use the P/V relay connections for zone valves then the 120 VAC connections at P/V-L and P/V-N will have to be removed and properly capped off. 24VAC can then be applied using an external transformer to supply power to zone valves. The upper 4 pairs of contacts on this green 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 will manage all the loads without need of further relays (for loads up to 1/3 HP; for more – use a protective relay).

The boiler (primary) pump is connected to the White/Yellow pair labeled *Primary Pump*. This lead is factory wired to the controller (and its 120 VAC supply) at the upper right backside of the controller board – do not attempt to connect the primary pump to the Pump/Zone Valve Terminal Block along the controller’s right edge - this is for the secondary pumps and/or zone valves only. Connect the pump’s Black wire to the Yellow of this pair (switched Hot). The White/ Yellow pair should be individually capped if the primary pump does not obtain its power from this pair (e.g. if a variable speed primary pump is connected to the mains power).

Pumps can be switched on/off using the touch-screen, so there is no need for temporary pump wiring during system filling / air purging. If pumps are hard-wired to the panel during the system fill/purge phase, re-wire the boiler pump to the Primary Pump leads inside the wiring box so the primary pump purge function is active.

In a new construction application- **use a construction thermostat – or jumper with in-line on/off switch – for on/off management of the boiler. Do not just pull power from the unit, 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 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.

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.

DANGER

Do not connect thermistor sensors to “Therm” terminals. An overheating hazard can result in serious personal injury and/or property damage. See *Controller Manual section 2.1.1 for detailed instructions.*

NOTE

The IBC Touch-Screen controller has the ability to connect to most power stealing thermostats. See the *Wiring Diagram* for details.

1.8.2 Power Quality and Electrical Protection

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

1.8.3 Zone Valve Hook-up

If zone valves rather than pumps are used to manage multiple heating loads, then 24VAC for the zone valves should be provided to the power contacts on the Pump/Zone Valve Terminal Block. Disconnect the 120 Vac leads connected to PV-L/PV-N and cap off. Use a separate transformer – the 40VA unit inside the wiring box is for internal systems only. The individual load/zone valves are then to be wired to their associated contacts on the secondary pump/zone valve connector. Do not confuse such “load/zone valves” with similar valves used to segregate a single load type (e.g. those used on a zoned radiant floor) – *see next section.*

1.8.4 Thermostat / Sensor Wiring

Dry contacts for thermostats for each of 4 loads are provided 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) to present a common thermostat signal to the controller. Ensure there are no disturbing influences on the call-for-heat lines - e.g. no coils to switch an air handler motor. Most power stealing thermostats can be connected directly to the Therm terminals. *See Controller Manual section 2.1.1 for more detailed instructions.*

1.8.5 Other Wiring

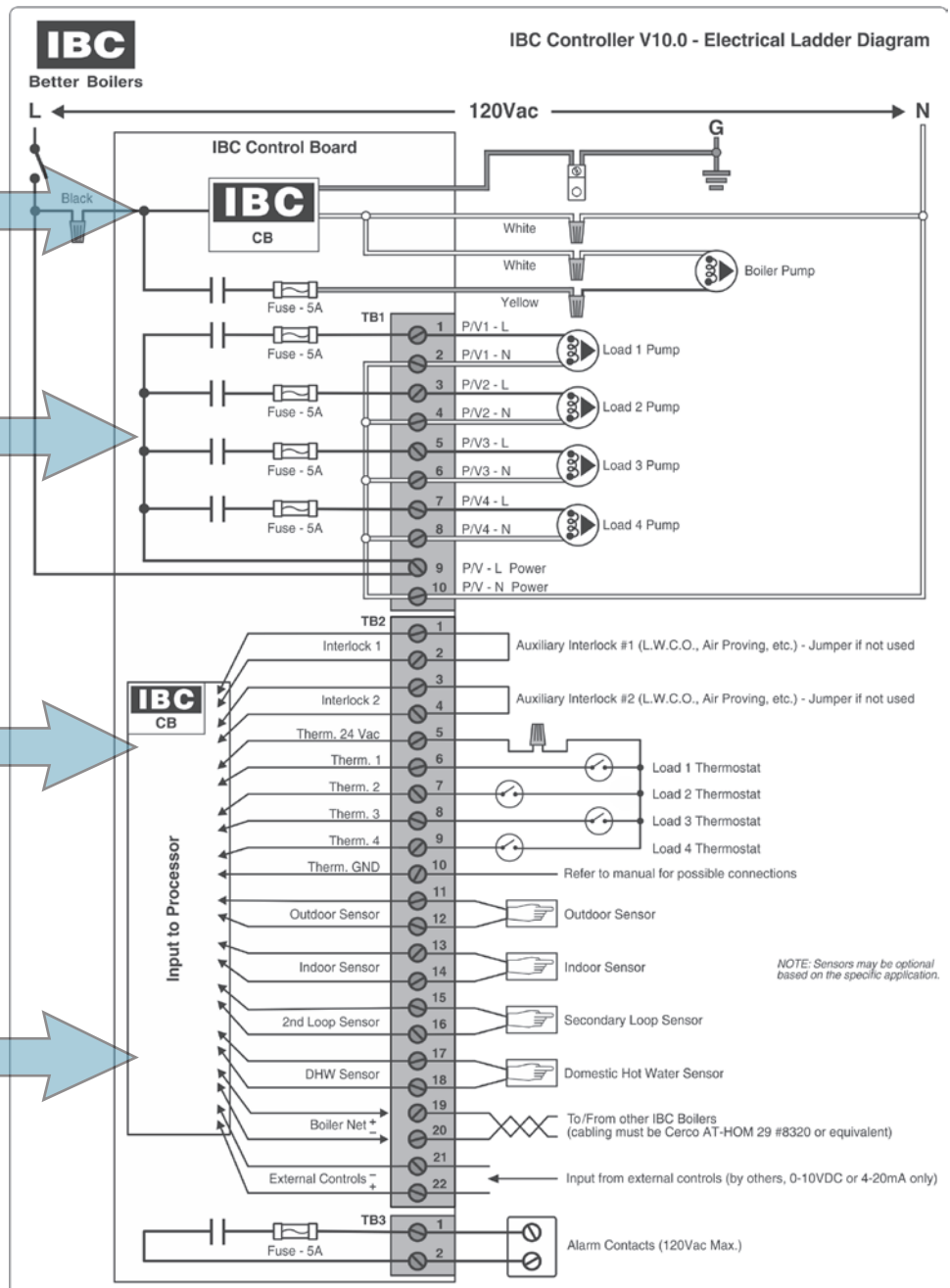
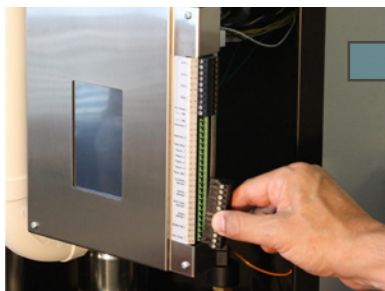
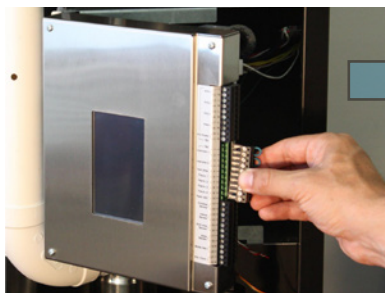
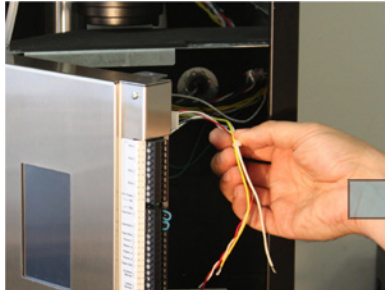
Other optional low voltage connections to the control board include:

- Two auxiliary interlocks - for external safety devices as may be required by some jurisdictions, such as a low water cut-off or a low gas pressure cut-out (for off-grid propane). A floor-protecting aquastat can use one of these, to cause a full boiler shutdown in the case of excess floor temperature.
- Contacts for indoor and outdoor temperatures sensors associated with Reset Heating. A 10K ohm thermister for outdoor reset sensing is supplied with the boiler, to encourage use of this temperature compensating space heating technique 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 will automatically notice and go to 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 SL and/or VFC modulating units for autonomous staging. *See separate Technical Memo for guidance.*
- The bottom pair of contacts, to receive 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. User must enter maximum and minimum boiler supply temperatures.

NOTE: Sensors connected to any sensor input contacts must be of NTC Thermister - type with a resistance of 10,000 ohms at 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.

1.8.6 Thermostat Heat Anticipator

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



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2.0 IBC BOILER CONTROLLER

2.1 GENERAL



This boiler is equipped with the V-10 Touch Screen controller. The controller simplifies the programming of the boiler while providing greater flexibility. For more detailed instructions, reference the ***Touch Screen Boiler Controller Manual***.

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
- Alarm dry contacts
- Load Combining – simultaneous operation of 2 similar water temperature loads
- The control can manage and/or operate in a network of up to 24 IBC VFC or SL boilers

Some of the new features available in the touch screen control include:

- Express Setup Menu for simple, quick programming
- Software updatable in the field with a SD card or a USB stick
- Setup configuration back-up and cloning using SD card or USB stick
- Superior warning messages while setting up the control
- Advanced Error messages with visual display on the Home Screen
- Internet/LAN connectivity
- BACnet (with activation)

2.2 CONTROL



WARNING

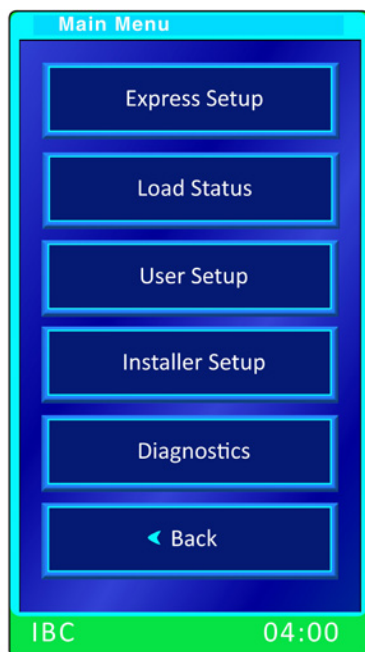
No sharp or metallic object should be used on the touch screen as this will cause damage. Use only a Stylus or a clean finger."

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
- 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

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.

2.3 CONTROL INTERFACE



The control interface is provided through a 2-1/4 x 4 inch, color Touch Screen display. The Touch Screen responds to a light finger touch on the screen. You can also use a stylus 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 touch screen.

The controller display is divided into two areas, the screen active area and the boiler status bar. All screens have an active area consisting of the screen title bar at the top and a boarder surrounding the active area. At the bottom of the display there is space reserved for the boiler status bar.

Prior to any interaction with the touch screen the display will be showing the Home screen that includes 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 with 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 touch screen has not been touched. The pop-up windows will also step back automatically in 2 minute intervals.

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 though whatever alarms that are present.

3.0 STARTUP AND COMMISSIONING

3.1 LIGHTING AND SHUTTING DOWN THE BOILER

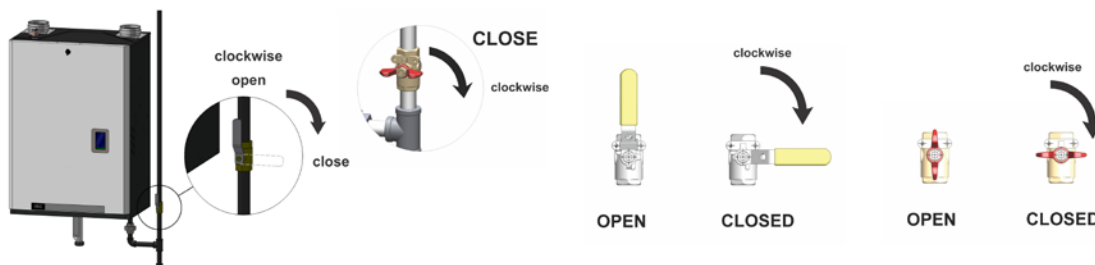
FOR YOUR SAFETY READ BEFORE OPERATING

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.



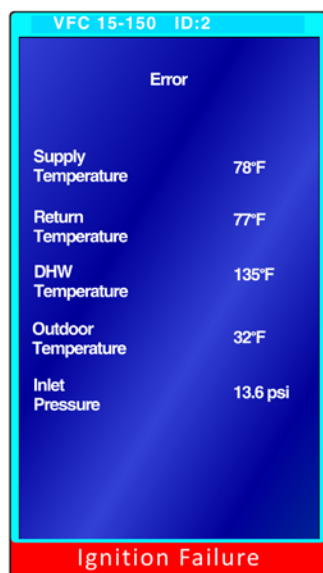
TO TURN OFF GAS APPLIANCE

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.

3.2 PRIOR TO START-UP

⚠ WARNING

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



Error displayed after testing ignition safety shut off

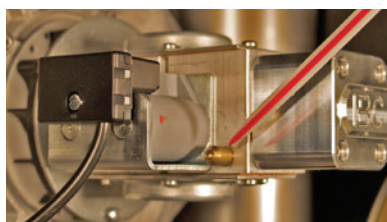
3.2.1 Pre-Ignition Checks

1. Ensure venting system is complete and seal tested. Confirm any common venting system at the installation site is isolated and independent of the SL boiler, that any holes left from removal of a previous boiler have been sealed, and that any resizing of the old flue has been done. Fill condensation trap.
2. Check water piping system is fully flushed and charged, and that all air has been discharged through loosened bleed caps. Note it is possible to switch all pumps on/off from the Touch Screen – without a call for heat. This greatly simplifies system filling and air bleeding (go to *Installer Setup*, System Settings, Site Settings, change Manual Pump Purge to “ON”. When complete, return to *Off*, or this will automatically occur with a call for heat). Use a minimum water pressure of 12 psig. And confirm pressure relief valve is installed and safely drained.
3. Check to see that adequate gas pressure is present at the inlet gas supply test port. Open the test port (using a small (1/8” or 3 mm) flat screwdriver, open the test port by turning its center-screw 1 full turn counterclockwise. Connect a manometer and open the gas control valve. Requirements are minimum 5” w.c and maximum 14” w.c. Check to ensure no gas leaks.
4. Perform a final check of electrical wiring and provide power to the boiler to initialize operation.

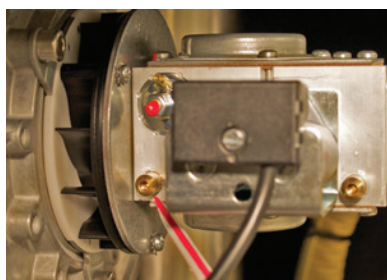
3.2.2 Test Ignition Safety Shutoff

With the boiler in operation, test the ignition system safety shutoff device by shutting the gas control valve immediately outside the boiler case. Ensure boiler has shut off and the appropriate Error information is displayed on the Touch Screen. To restart boiler, reset power or press “Clear Errors” in the Advanced Diagnostics section.

3.3 COMMISSIONING



Inlet gas supply pressure test port



Manifold pressure test port

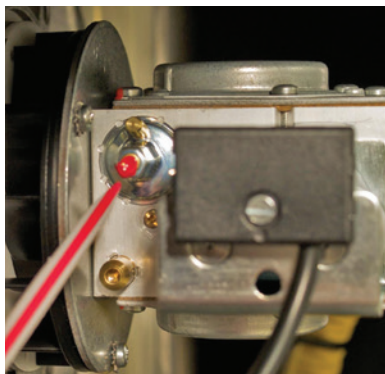
The SL 80-399 modulating boiler is factory calibrated to operate with natural gas (or propane if so ordered) at sea level. The Low Fire (Zero Offset) valve adjustment cap has been factory sealed using paint-seal compound. ***This cap must not be tampered with. The Low Fire (Zero Offset) screw is not to be adjusted in the field.*** The High Fire (Gas:Air ratio) adjustment screw may have to be adjusted to attain optimum combustion results if required, however, ***no mixture adjustment shall be performed unless done by a qualified technician using properly functioning and calibrated combustion analyzing equipment.***

The controller will automatically detect the installations 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. Refer to the IBC Altitude tables for further information.

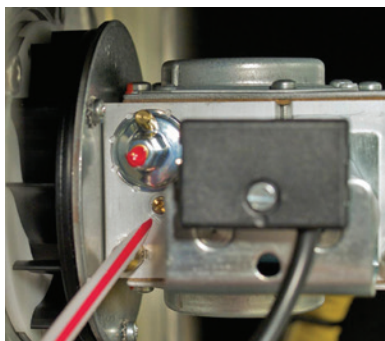
1. Turn gas supply off. With a small (1/8” or 3 mm) flat screwdriver, open the inlet gas supply pressure test port by turning its center-screw 1 full turn counterclockwise. Attach a manometer to the pressure test port and turn on gas to appliance. Static manometer reading should be ideally 7” w.c., for Natural Gas and 11” w.c. for Propane. Minimum and maximum static pressure should be between 5” and 14” w.c. Monitor pressure throughout the commissioning

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.



Low Fire (Zero-offset) adjustment range – WARNING! DO NOT ADJUST!



High fire (Gas:Air ratio) adjustment screw



Flue gas test port plug

procedure. Pressure may droop up to 1" to 2" w.c. at high fire but under no circumstances should it drop below 4" w.c. at the gas valve inlet test port.

2. Allow the boiler to ignite. Run against a large load, to maintain high fire.
3. With a combustion analyzer probe in the flue gas test port, turn the High Fire (Gas:Air Ratio) Adjustment screw (see Figure 32) (see Table 8 below for corresponding CO₂ values - set for CO₂ target at high fire). This screw offers very fine adjustment, and may require several turns. **NOTE:** This screw has significant backlash. When changing direction of turn, it may take up to a full turn before any change is indicated on the analyzer reading. Clock the gas meter to confirm full maximum rating plate input.
4. Confirm the minimum fire level settings. Re-define the load as "Manual Control". Use Heat Output in "Configure Load x" to control the output as needed. Reading should be within Low fire range. Re-test at high fire.
5. Turn boiler off by removing the call for heat (use the Installer Setup screen to turn load to off if no other ready means available). Turn off gas then remove the manometer connections, and turn the centre-screw in the manifold pressure test port clockwise until fully closed. Ensure fully closed, but not over-tightened. Restore gas and soap test for leaks.

MODEL	HIGH FIRE		LOW FIRE		CO MAX PPM
	RANGE	TARGET	RANGE	TARGET	
SL 80-399 (Nat. Gas)	8.6 to 9.6% CO ₂	9.4% CO ₂	8.2 to 9.4% CO ₂	8.9% CO ₂	< 100
SL 80-399 (Propane)	10.0 to 11.0% CO ₂	10.7% CO ₂	9.4 to 10.7% CO ₂	10.1% CO ₂	< 150

Table 8: Combustion test target ranges - CO₂ / Maximum CO



Removal of flue gas test port plug



Insertion of flue gas analyzer probe

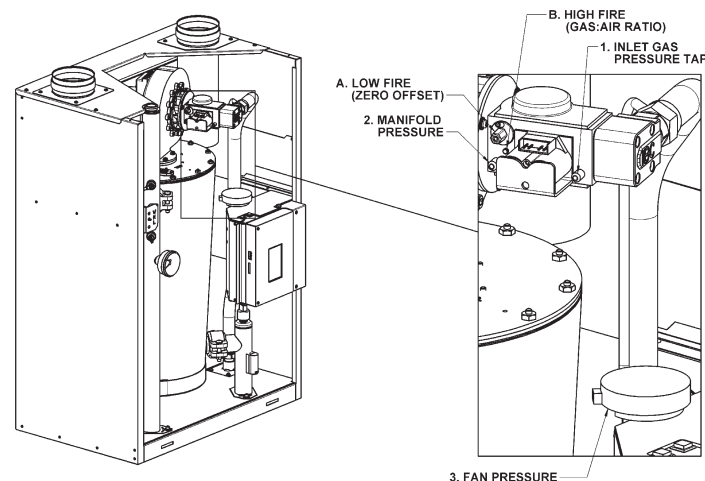


Figure 32: Gas Valve and Pressure Reference System

3.4 FUEL CONVERSION

WARNING

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.

DANGER

Operating any IBC boiler using a fuel other than the fuel listed on its rating plate is prohibited. If the information in this section related to conversion to alternate fuels is not followed exactly, a dangerous situation can result, leading to fire or explosion, which may cause property damage, personal injury, or loss of life.

The SL 80-399 modulating boiler is 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 following conversion procedure is completed by a qualified technician.

Refer to the preceeding section 3.3 - COMMISSIONING. The Low Fire (Zero offset) valve adjustment cap on the gas valve has been factory sealed using paint-seal compound. ***This cap must not be tampered with. The Low Fire (Zero offset) screw is not to be adjusted in the field.***

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.**

The following procedure can be carried out by a qualified technician:

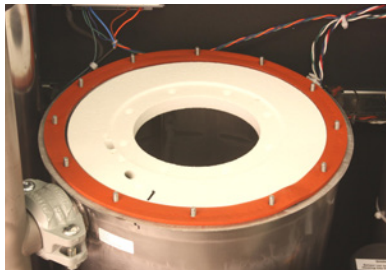
1. Ensure you are installing the correct fuel conversion kit for your boiler. Compare the boiler model number with the Kit# found in table 8.
2. Ensure the fuel conversion instructions supplied with the fuel conversion kit are read, understood and followed carefully.
3. Carefully follow the procedures on page 3 of the relevant Fuel Conversion Instruction document, Combustion Testing and Adjustment.
3. Carefully follow the procedures listed in the on the page 3, Combustion Testing and Adjustment of the FUEL CONVERSION notes included in the applicable kit.
4. Place the conversion labels associated with the new fuel onto the boiler at the positions indicated on page 4 of the relevant Fuel Conversion instruction document.

MODEL NUMBER	NATURAL GAS TO PROPANE	PROPANE TO NATURAL GAS
SL 80-399	P-175	P-177

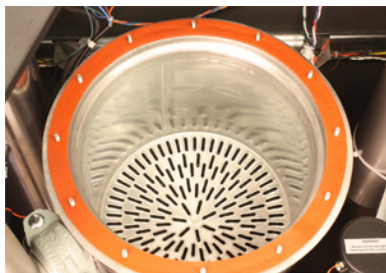
Table 9: Fuel Conversion Kits

NOTE

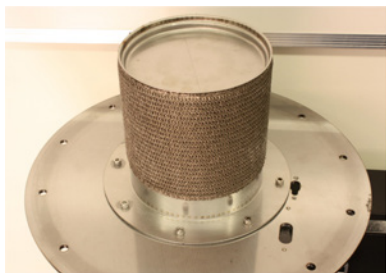
The safety warning regarding burner refractory on page 4-2 of this manual must be observed.



Heat Exchanger Lid removed



Refractory removed



Burner and Heat Exchanger Lid

3.4.1 Gaining access to combustion chamber, burner removal instructions

1. Remove fan and gas valve assembly. See "Fan and gas valve removal instructions" on page 4-6 of this manual.
2. Disconnect the igniter cable and move it out of the way.
3. Remove the two screws that secure the igniter to the lid using a # 2 Phillips screwdriver.
4. Carefully remove the igniter by sliding it straight up.
5. Remove the igniter gasket and place parts on a clean dry area.
6. Remove the 12 hex nuts that attach the heat exchanger lid to the heat exchanger. A 10 mm open end wrench or socket will be required.
7. With a permanent marker or equivalent, make an alignment mark between the lid and heat exchanger.
8. Before removing the lid, it is important to be positioned directly above it to ensure a straight up extraction. Failing to do this may result in refractory damage.
9. Slowly lift the lid-burner assembly off the heat exchanger. The refractory should remain in place in the combustion chamber shoulder. Note that there is less than 1/8" (3 mm) clearance between the burner walls and the refractory. Care must be observed to ensure minimal contact between these parts to prevent refractory cracking.
10. Place the lid with the burner attached, on a clean dry area.
11. With a permanent marker or equivalent, make an alignment mark on the refractory lining it up with the same mark made earlier between the lid and heat exchanger.
12. Carefully remove the refractory and place in a clean dry area.
13. If burner needs to be removed, gradually loosen up the 8 screws that secure the burner to the heat exchanger lid using a #2 Phillips screwdriver. Remove screws and burner.

RE-ASSEMBLY

1. Inspect burner gasket. Look for cracks, deterioration or signs of gas bypass. Replace if necessary.
2. Place heat exchanger lid on a flat surface and position the gasket on the lid, aligning it with the screw holes.
3. Install the burner in place with its 8 screws, tightening the screws gradually and in a cross sequence. Do not over tighten, hand tight plus 1/2 turn should be sufficient to maintain a good seal and prevent deformation of the burner flange.
4. Inspect refractory for cracks, degradation and flatness. If in doubt, replace with a new one.
5. If installing a new refractory, first place it onto the lid, aligning it at the igniter hole, then make an alignment mark on the refractory to coincide with the previously made line on the lid.
6. Carefully insert refractory onto heat exchanger combustion chamber, using the alignment marks for proper positioning.
7. Ensure that the lid (orange) gasket is in place and flat.
8. Carefully insert the lid-burner assembly straight down ensuring limited contact between burner and refractory and observing the alignment markings.
9. Install the 12 hex nuts to secure the lid in place, tighten by hand, then an extra 1/2 turn. Caution! Over-tightening these nuts will cause lid to warp and possibly leak fumes or flames.
10. Re-install igniter, tightening its screws by hand, then an extra 1/2 turn.
11. Re-attach igniter wire to igniter.

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4.0 MAINTENANCE

4.1 BOILER MAINTENANCE

CAUTION

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

CAUTION

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

WARNING

Fill trap with water before boiler is first fired to prevent exhaust fumes from entering room. Never operate the boiler unless the trap is filled with water.

Failure to comply will result in severe personal injury or death.

WARNING

Whenever the burner is removed for inspection or boiler servicing, the sealing gaskets must be examined and replaced if damaged. Upon re-assembly, an approved leak test solution must be applied around the burner flange sealing area to ensure there is no leakage of combustible gas/air premix.

4.1.1 General Care

- Keep combustible materials and flammable liquids and vapours away from the boiler.
- Keep vent terminals clear of obstructions (snow, dirt, etc.).

4.1.2 Inspection

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

4.1.3 Venting

- Check vent terminals for and remove any obstructions (e.g. leaves, dust, other debris).
- Check, and clean or replace intake air filters or screens as required.
- Check for holes or leaks in venting. Replace venting as needed.
- Examine for any signs of moisture caused by sweating intake air pipes; insulate as required.
- Ensure proper resealing or reinstallation of venting on each servicing.

4.1.4 Condensate Traps

- Condensate trap must be examined every two months to see if cleaning is necessary (*refer to trap cleaning instructions, section 1.5.3 of this manual*). Ensure that trap has been re-filled completely before firing boiler.
- If condensate neutralization is used, check pH level of condensate discharge.

4.1.5 Burner

- Annually, remove burner to inspect for extent of fouling (*refer to burner removal and reassembly instructions, section 3.4.1 of this manual*). Blow clear using compressed air. Evaluate the magnitude of clearing required, and establish a reasonable burner inspection schedule. Some boiler / locations may call for annual service, others showing clean burners will only need attention every 2 – 5 years. Consider adding air filtration if burner requires cleaning every year. In alternate years, visually inspect burner through sight glass. Ensure flame is stable and without excessive fluttering. Normal flame pattern is evenly distributed over the burner surface.
- If burner is operating improperly, remove and clean or replace. Use a CO₂ analyzer to determine proper combustion. See Table #8 for correct values.

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, which contain crystalline silica, can be converted into cristobalite - which is classified as a possible human carcinogen.

Care should be taken to 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.

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.

4.1.6 Heat Exchanger

During annual inspection (with the burner removed), examine the heat exchanger for signs of contamination and clean if necessary. In areas of poor gas quality, there may be a buildup of black plaque (typically sulfur). Other fouling agents: airborne dust, debris and volatiles.

Refer to burner removal instructions in Section 3.4.1 for access to combustion chamber and heat exchanger. **Note that the safety warning regarding burner refractory on this page must be observed.**

4.1.7 Pump

Check that the pump is on in normal operation and that the water $\Delta^{\circ}\text{T}$ is reasonable for a given firing rate (e.g. 10°F between supply and return when firing at 200,000 Btu/hr.).

4.1.8 Gas Piping

Check for damage or leaks and repair as needed.

4.1.9 Control Module

- Check that boiler operation is consistent with the steps in the **Touch Screen Boiler Controller Manual**.
- Check that water temperature targets and setpoint is satisfactory and have not been adversely amended.
- 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 control, consult troubleshooting guide.

4.1.10 Water

- Check water pressure and temperature. There should be no noticeable change if boiler is functioning normally. Check for any noise in the system.
- Check water piping for damage or leaks and repair as needed.
- Check for 12-15 psig in normal operation, and look to ensure pressure does not run up toward 30 psig at high temperature. If pressure rises sharply, consider replacement of expansion tank. Check also for noise at high fire, which may signal water quality problems.
- Check water piping for damage or leaks and repair as needed.
- Water chemistry shall be of a quality generally accepted as suitable for hydronic applications.
- Ensure any direct "city fill" water connections are left in the closed position to minimize exposure to leaks and flooding.

4.1.11 Freeze Protection

Check freeze protection. Use only antifreeze made specifically for hydronic systems. Inhibited propylene glycol is recommended. Antifreeze volume must not exceed 50% of the total volume of water in the system.

⚠ 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, 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.

⚠ 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.

⚠ CAUTION

Before testing the relief valve, make certain the discharge pipe is properly connected to the valve outlet and arranged to contain and safely dispose of equipment discharge.

4.1.12 Boiler Treatment

- Check consistency of any boiler treatment used, for appropriate mixture. Chemical inhibitors are consumed over time, lowering their density.
- Verify proper operation after servicing.

4.1.13 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.

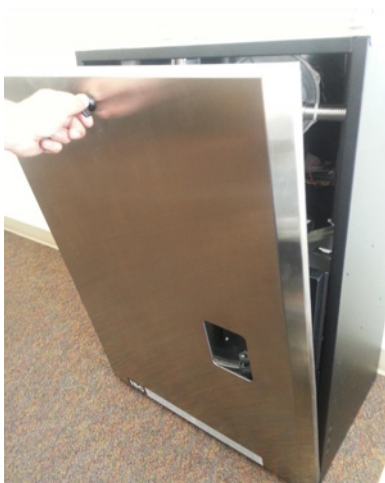
Test at or near maximum operating pressure by holding the test lever fully open for at least 5 seconds to flush the valve seat free of sediment and debris. Then release the lever and permit the valve to snap shut.

If the lever does not activate, or there is not evidence 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. It is highly recommended that a system pressurization unit, such as an Axiom Industries model MF200 be employed to refill and pressurize your system. Capture the discharged fluid in a container and recycle it by returning it to the system feeder unit. 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.

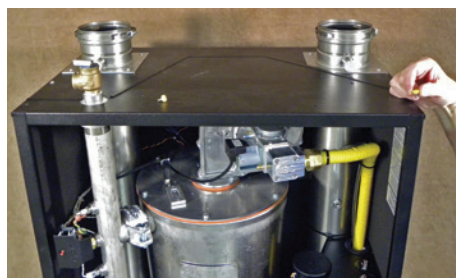
4.2 GEOGRAPHY & COMPONENTS



Turn cover button counter-clockwise to open



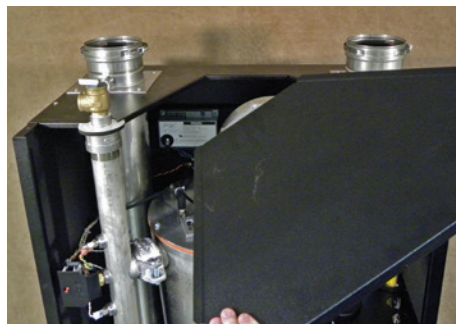
Clear access to front components



Remove top cover button bolts



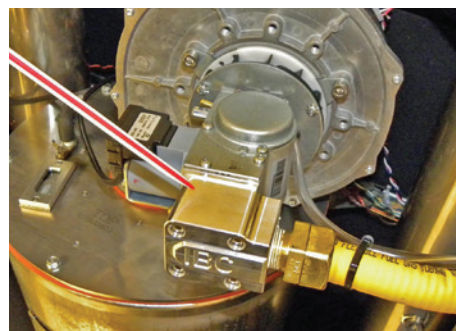
Lift top cover up at front



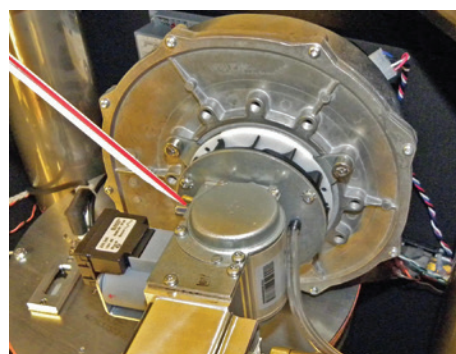
Top cover lifts up and out



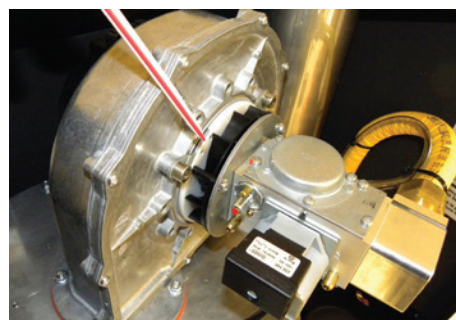
Clear access to top components



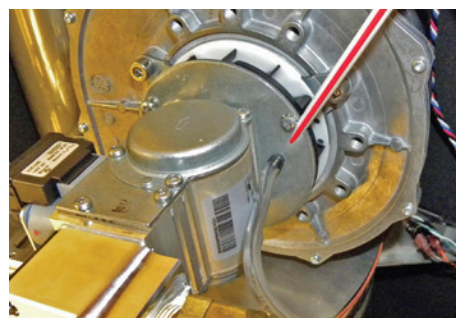
Gas Inlet Block



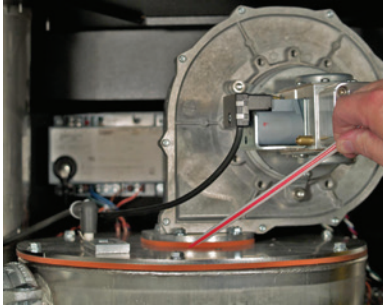
Gas Valve Body



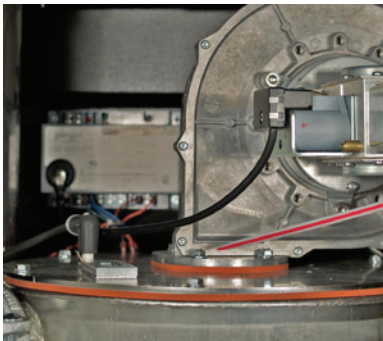
Fan Swirl plate (Air Inlet) between Fan and Gas Valve



Fan air pressure reference tube



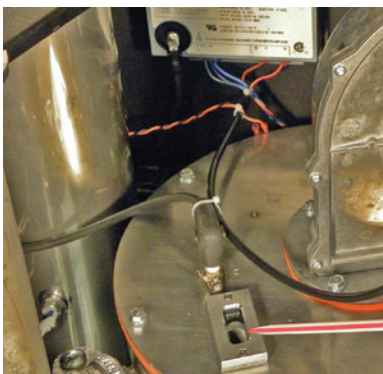
Burner Flange Bolts x 12 Bolts



Fan Flange Bolts



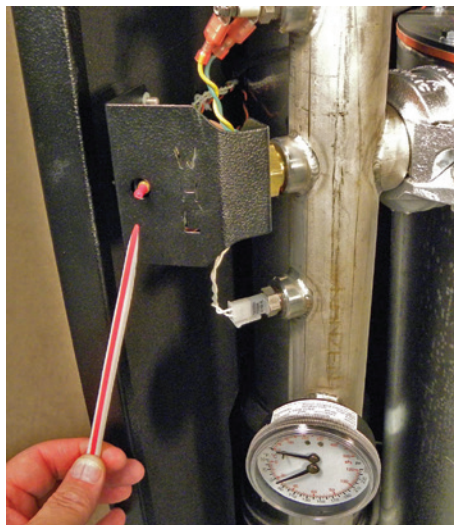
Ignitor Cable connected to Ignitor



Sight glass (inspection port)



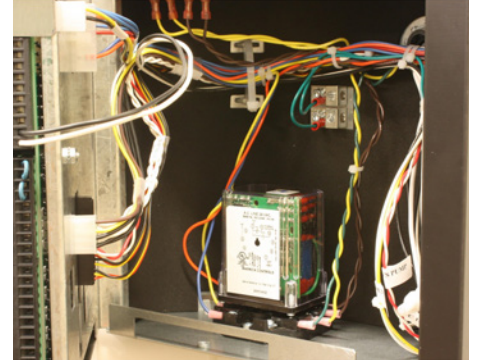
Tridicator Gauge on Supply Riser



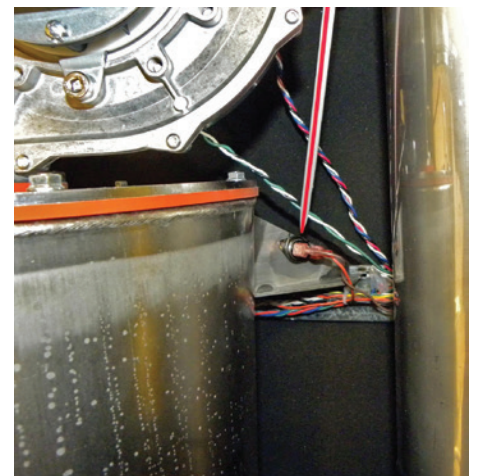
Manual Reset Water High Limit Switch on Supply Riser (red button is reset)



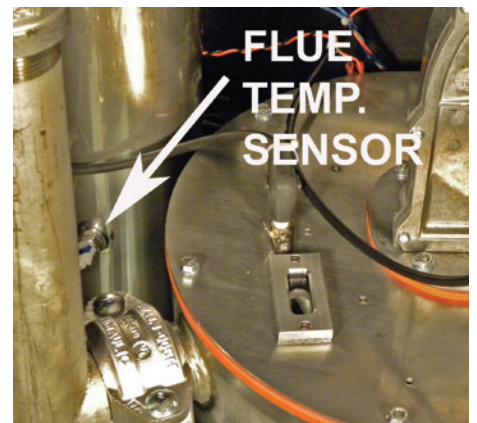
Low Water Cut-Off Probe on Supply Riser



Low Water Cut-Off Module behind Control Panel



Upper Vessel High Limit Switch on pressure vessel upper support bracket



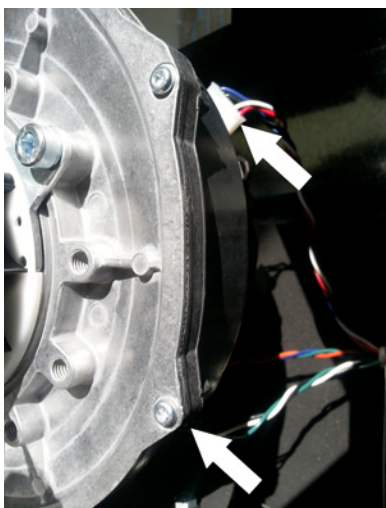
Flue Temperature Sensor on the vent behind the Supply Riser



Fan mounting nuts



Fan-burner gasket



Fan motor electrical connectors



Gas valve electrical connector

4.2.1 Fan and gas valve removal instructions

1. Turn off electric power and gas supply to the boiler.
2. Ensure boiler cools down to ambient temperature. Do not drain the boiler unless freezing conditions are expected during this procedure.
3. Remove front cover, then remove boiler upper-front cover by removing the two yellow thumbscrews at the top right and left corner of the boiler. No tools are required.
4. 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.
5. Unplug both upper and lower electrical connectors from the fan.
6. Unplug the electrical connector from the gas valve by removing the 1/4" connector attaching screw.
7. Position the harnesses out of the way of the heat exchanger lid.
8. Unplug the clear tube from the swirl plate pressure reference port.
9. Remove the 4 hex head socket screws that attach the gas inlet block to the gas valve using a 4 mm hex (Allen) key or driver. These screws should be first loosened up slightly in cross sequence to prevent deformation of the mating parts.
10. With the yellow flexible gas line still attached, the gas inlet block is now free to move but should only be separated from the gas valve a maximum of 1 inch (25 mm), which is sufficient for fan and gas valve removal. There is an o-ring installed between the gas inlet block and gas valve, and it should remain positioned on the block's groove. If it falls out it is important that it be positioned back on the groove or saved for re-assembly.
11. Remove the 4 hex nuts that attach the fan to the heat exchanger lid. A 10 mm open end wrench or socket will be required.
12. With the gas valve and swirl plate 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.
13. If the fan is being replaced: With a permanent marker or equivalent, make an alignment mark between the fan and swirl plate adapter and use a 6 mm hex (Allen) key or driver, remove the 3 screws that attach the gas valve/swirl plate assembly to the fan.

4.2.2 Fan and gas valve re-installation

1. If the gas valve has been removed, reattach it to the swirl plate.
2. Re-attach gas valve and swirl plate assembly onto fan observing the alignment marks made during disassembly.
3. Ensure that fan (orange) gasket is in place.
4. Re-install fan-gas valve assembly onto heat exchanger lid tightening the 4 hex nuts by hand then an extra 1/2 turn.
5. Re-plug both upper and lower fan harness connectors.
6. Re-plug gas valve connector and tighten up retaining screw.
7. If a new gas valve is being installed, remove the protective cover from the gas inlet now.
8. Re-attach gas inlet block onto gas valve ensuring that the o-ring seal is in place. If this O-ring is lost, it must be replaced with a factory supplied O-ring.
9. Tighten up the 4 gas inlet block screws in cross sequence, first hand tight and then an extra 1/2 turn.
10. Re-connect clear pressure reference tube onto swirl plate port.
11. Open up gas valve and check for possible leaks.
12. Return electric power to the boiler and perform start up routine.
13. Check for gas or fumes leaks after 10 minutes of continuous operation.

5.0 TROUBLESHOOTING

NOTE

This boiler is equipped with a blocked vent shutoff system, which closes the gas supply upon detection of an irregular venting condition. In such event, the electronic controller will automatically carry out a reset/ retry every 5 minutes. See *Section 5.3.1 Airflow Error* for Troubleshooting steps.

The troubleshooting section is divided into 3 sections:

5.1 Preliminary Checks

5.2 Electronic Components

5.3 Troubleshooting Guide

Often, a problem can be identified and solved through simple checks of the basics: confirming the electrical power supply, gas flow and resetting the thermostat control. To extend the cover of such preliminary checks, the boiler's control module offers a clear visual display of the status of the various control circuit components.

Should a problem remain unsolved after applying the preliminary checks, proceed to the detailed system review, using the Troubleshooting Guide. The Guide covers potential error conditions as grouped into the following categories:

5.3.1 Using Control Module Errors Displayed

5.3.2 Ignition Problems

5.3.3 Cycling Problems

5.3.4 Temperature Problems

5.3.5 Miscellaneous

Below each section is a list of Symptoms, Diagnoses, and Remedies.

Also provided with this manual are a number of diagrams (see *Section 6.0*) for use with troubleshooting including:

- Electrical Wiring Diagrams
- Sequence of Operations Flowchart
- Boiler Component Layout Diagrams

5.1 PRELIMINARY CHECKS

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

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

1. Confirm power to the boiler: check that control module display is on (e.g. display is lit. The Touch Screen controller's display will be fully functional in 90 seconds after power is restored to the boiler.)
2. Check that boiler is not in a safety lockout.
3. Ensure wiring is clean and secure.
4. Check that gas is reaching the unit.
5. Confirm water system is properly charged to 12 psig (or higher as appropriate on systems intended for up to 80 psi) and pump is serviceable.

5.2 ELECTRONIC COMPONENTS

This section details the method for troubleshooting the non-standard electronic components on the boiler including the electronic differential air pressure sensor and the temperature sensors.

5.2.1 Temperature Sensors

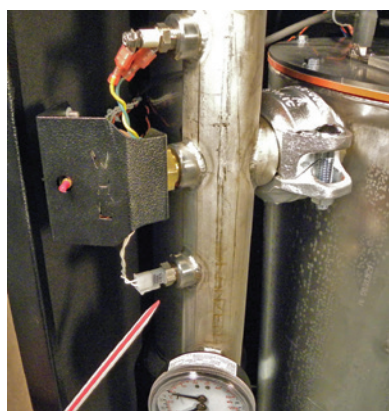
The resistance of the temperature sensors varies inversely with temperature. To test, measure the temperature of the sensed environment and compare with the value derived from the measurement of the resistance (obtained by connecting a good quality test meter capable of measuring up to 5,000 k Ω (5,000,000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

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

For the return water temperature sensor, locate the blue 2-wire leads coming from the strap on sensor on the return pipe. Disconnect the Molex connector located approx. 6" from the sensor. Place multi-meter probes into the sensor's female Molex connector socket. Do not apply voltage.



Return water temperature sensor



Supply water temperature sensor

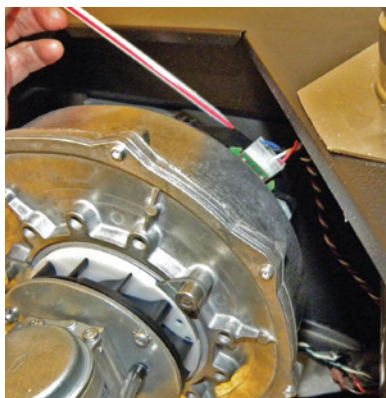


10K Ω sensors supplied with boiler

2 x Water temperature sensors
1 x Outdoor sensor (shown above)
1 x Vent temperature sensor
See table #10 for resistance values

TEMPERATURE		RESISTANCE	TEMPERATURE		RESISTANCE
$^{\circ}\text{F}$	$^{\circ}\text{C}$	Ω	$^{\circ}\text{F}$	$^{\circ}\text{C}$	Ω
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	32	7,334	190	88	983
95	35	6,532	195	91	903

Table 10: Temperature Sensor resistance values



Control wire plug



Unplug to run fan full speed

5.2.2 Fan/Blower

Operating power is provided by means of a separate 120Vac connector at the bottom of the fan (white/black/green). Control of the fan is provided via a four lead connector at the top of the fan. 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.

LEAD COLOR	FUNCTION	TROUBLESHOOTING
Red	35 VDC Positive power terminal	Fan will only operate at max. speed if disconnected.
Blue	35 VDC Negative power terminal	Fan will only operate at max. speed if disconnected.
Black	Signal from controller	Fan will only operate at max. speed if disconnected.
White	Fan tach.	2 pulses/rev (freq x 30=rpm)

Table 11: Fan Operation

5.2.3 Differential Air Pressure Sensor

Do not blow into the ports of the sensor, this is not a switch and “does not click when closed”. Excessive pressure will damage the sensor thus requiring replacement. The sensor values are located in the advanced diagnostics section of the controller. In general, the Fan Pressure and the Required Pressure should be very close to each other while the boiler is in operation. If the required pressure is higher than the actual pressure there are several possible causes.

- Exhaust and/or Air Intake piping installed longer than allowed
- Improper grading of the Exhaust and/or Air Intake piping allowing condensate to be trapped in the piping
- Re-Ingestion of flue gasses has caused the Swirlplate and/or Fan Impeller to erode, becoming ineffective.
- Air Pressure Sensor tubing not correctly attached.

5.2.4 Water Pressure Sensor

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

5.2.5 Hi-Limit Switches (water and vent UVHL)

Check resistance between leads. If resistance is very low, temperature should be acceptable. If resistance is very high, temperature should be out of bounds. A simple means of checking whether a high limit switch is open is by measuring the AC voltage across the device. If the reading is 24 VAC the switch is open. If a 0VAC reading is shown, it is closed. NEVER connect an ohm-meter or continuity checker across a live circuit.

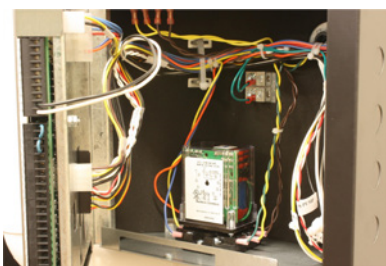


Fenwal ignition module - Microamp (μ A) test points are shown at top left corner of module (beside red L.E.D.)

5.2.6 Ignition Module

There are two approved ignition modules - Fenwal (grey) Standard and Capable Controls (white) Alternate. Each have a red LED lamp providing the following signals: Fenwal – 1 rapid flash on 1st entering Pre-purge, 3 rapid flashes upon Failure to Ignite After 3 Attempts; the Capable Controls module provides a single flash at the start of each Purge and Interpurge cycle, continuous rapid flashes during the 4 second spark interval, solid illumination following successful ignition until burner shutdown, and a slow on/off with a 3-try failure.

Flame current can be monitored on the Fenwal. Connect an electrical test meter - set to read DC Microamps (symbol μ A) to the two test pins at the top right of the ignition module. Recycle the boiler so it enters another trial for ignition and monitor the flame current reading. When the burner ignites, a steady reading of 2-7 DC Microamps should be measured by your meter. The control will lock out if the reading drops below 0.7 Microamps. (see Section 5.3.1 - “Control Module - Maximum ignition trials error”, and Section 5.3.2 - “Ignition problems”).



LWCO Module

5.2.7 Low Water Cut Off

A UL 353-certified probe-type low water cut off device is standard equipment on the SL 80-399 boiler. The LWCO has Test and Reset buttons, located inside the case near the base of the Rating Plate. The LWCO will reset upon power up of the boiler and return the device to its state at the time of any power cut.

If the LWCO has been tripped, either from a low water incident or by pushing the test button for 3 seconds, the boiler will go into a “hard” lockout for one hour. If immediate reset is required:

1. Push the reset button.
2. Check that the red lamp inside the LWCO Module is illuminated.
3. Enter Diagnostics, Advanced Diagnostics and press “Clear Errors” or cycle the power to the boiler off and back on.

A red lamp will be illuminated when the LWCO confirms presence of water. If the red light does not come on:

1. Confirm that the system is fully charged and that all air has been released (see Figure 24 for best placement of the air bleed device).
2. Check for power at LWCO control module (24 Vac between terminals 1 (yellow) and 3 (blue)).



Test and Reset Buttons

5.3 TROUBLESHOOTING GUIDE

5.3.1 Using Control Module Errors Displayed

The bottom line of the Touch Screen is reserved for displaying the boilers error status. The boiler status bar will normally be Green but can change colour to Yellow or Red. The colours represent the following boiler operating status. 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.

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

SYMPTOM	DIAGNOSIS	REMEDY
AIRFLOW ERROR Touch Screen Message: <i>Error – Low Air Flow</i> <i>Low combustion airflow; soft error; will retry in 5 minutes</i> <div style="background-color: black; color: white; padding: 5px; display: flex; align-items: center;"> WARNING </div> <p>Never attempt to repair the control module (circuit board). If the control module is defective, replace it immediately.</p>	Check fan operation	<ul style="list-style-type: none"> • Check lead is attached at fan. • Cycle power off/on; listen for fan initialization. If no action, focus your attention on the fan itself.
	Check/Clean condensate trap	<ul style="list-style-type: none"> • Ensure condensate trap is not blocked.
	Check for fouled reference lines and air sensor	<ul style="list-style-type: none"> • Check clear vinyl air pressure line for presence of water. After disconnecting from black air pressure sensor, blow clear (do not blow into sensor). Check for exhaust re-ingestion, or repeated power interruptions . • Go to Advanced Diagnostics and check differential air pressure sensor (at rest and with fan on). See Section 5.2.3.
	Check achieved fan power	<p>In Advanced Diagnostics, during Pre-purge, Fan Pressure (FP) should move close to Required Pressure (RP); if FP is not within 30% of RP and getting closer, then check for actual vent system blockage: (a) disconnect intake within boiler case; (b) open burner then fan/gas valve looking for debris. See Section 4 – Warnings and Cautions.</p>
	Water noise in vent. Excess condensate in venting.	<ul style="list-style-type: none"> • Check condensate trap for obstructions. Remove obstructions and refill condensate trap with water. • Check vent length, size and configuration.

SYMPTOM	DIAGNOSIS	REMEDY
MAXIMUM IGNITION TRIALS ERROR Touch Screen Message: <i>Error – Ignition Failure after 3 tries</i> <i>Boiler has failed to ignite on 3 successive attempts. Boiler in lockout for 1 hour, then repeats 3-try seq. Consult service technician if error recurs.</i>	No spark when igniting. Igniter probe/flame sensor disconnected.	Check that igniter 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 igniter probe rods is too large or too small.	Adjust ignitor probe rod gap as follows: With Fenwal module – between 1/8th and 3/16th (3.2-4.7mm) With Capable Controls ignition module – 3/16" (5mm)
	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 between blue and brown wires during an ignition cycle. Replace module if no current detected
HI LIMIT ERROR Touch Screen Message: <i>Error – Water High-Limit Exceeded</i> <i>Water temperature exceeds hi-limit. Boiler in hard lockout. Will reset in 1 hour. Consult service technician.</i>	Boiler ignites, but shuts off at the end of the ignition trial. Improperly grounded pressure vessel/burner or unserviceable ignition lead or spark module.	<ul style="list-style-type: none"> • Ensure pressure vessel is grounded. • Check the igniter probe/flame sensor is electrically isolated from the vessel, and its ceramic insulator is intact. • Replace ignition lead • Replace spark module
	Defective or disconnected hi-limit switch.	<ul style="list-style-type: none"> • Check wiring to hi-limit switch and control module. • Check hi-limit switch. See Section 5.2.5.
VENT HI-LIMIT ERROR Touch Screen Message: <i>Error - Vessel/Vent High-Limit Exceeded *** Call for service!</i> <i>Vent temperature has exceeded the vent limit switch or the upper vessel high limit has been tripped. Boiler in lockout. Consult service technician.</i>	Indicates one or both switches has tripped.	<ul style="list-style-type: none"> • Check wiring to ensure switches are properly connected to control module. • Check for evidence of any damage to vent system and signs of excess heat near switches. • Push manual reset button(s), maintain constant watch during boiler operation to evaluate vent/cabinet temperatures at maximum operating settings. Ensure no unsafe condition exists, e.g. max flue temp. or heat escapement at the burner flange.

SYMPTOM	DIAGNOSIS	REMEDY
TEMPERATURE SENSOR ERROR Touch Screen Message: <i>Error - Max. Inlet/Outlet Sensor Temp. Exceeded. -> Check water flow</i> <i>Water temperature signal not within acceptable range. Potential flow or sensor failure. Consult service technician.</i>	Current outlet temperature exceeds operating limit.	<ul style="list-style-type: none"> Check water flow.
	Defective or disconnected temperature sensor.	<ul style="list-style-type: none"> Check wiring to temperature sensor and control module. Check temperature sensor. See Section 5.2.1.
MISCELLANEOUS Touch Screen Message : <i>Blank – screen dark, but fan running Indicative of power-surge damage to appliance</i>		<ul style="list-style-type: none"> Check transformer; replace if damaged. Check circuit board for visible damage.

5.3.2 Ignition Problems

SYMPTOM	DIAGNOSIS	REMEDY
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 ₂ 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.	<ul style="list-style-type: none"> Check system wiring. Check air reference tubing.
	Igniter probe/flame sensor disconnected.	Reconnect probe.
	Defective Control Module.	Check ignition output from 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.

5.3.3 Cycling Problems

SYMPTOM	DIAGNOSIS	REMEDY
RAPID CYCLING	Improper values entered via keypad.	Check load maximum temps are above target temps, by 1/2 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 to <i>Table 3: Maximum Venting</i> .
	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 HX
	Slow combustion air blower.	Check that CO ₂ level is within specification.
	Dirty burner/heat exchanger.	Check pressure drop.
	Low water flow due to improper piping.	Refer to recommended piping in <i>Section 1.6</i>
	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.
	Unit over-fired.	Clock gas meter/check gas pressure with manometer/ check CO ₂ level.
	Unit Oversized.	Check load calculation vs. min. boiler output.
	Improperly set or defective operating/ safety controls.	Check operation with ohmmeter/voltmeter.

5.3.4 Temperature Problems

SYMPTOM	DIAGNOSIS	REMEDY
LOW HEAT	Operating temperature too low.	increase temperature target.
	Priority parameters or load configuration improperly set up.	Review load configuration parameters.
	Unit undersized.	Refer to Load Calculation vs. Boiler Output.
	Air trapped within system.	Bleed system as required.
	Improper system piping.	Refer to recommended piping in <i>Section 1.6</i>
	System pump undersized.	Check pump manufacturer's data/check temp differential across heat exchanger.
	Poor gas/air mixing.	Check CO ₂ level.
	Defective thermostat.	Refer to manufacturer's instructions.
	Obstruction in condensate drain.	Inspect and clean condensate drain.
	Unit 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.	Check with Ammeter.
	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 per manufacturer's instructions.

5.3.5 Miscellaneous

SYMPTOM	DIAGNOSIS	REMEDY
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.
TOUCH SCREEN MESSAGE: <i>Unknown Error</i>	Temperature sensor input problem.	Test each temperature sensor for appropriate readings and Replace defective temperature sensor.
BOILER REMAINS IN STANDBY DURING CALL FOR RESET HEATING OR SET-POINT (DHW OPERATION WORKS AS NORMAL). (5 BUTTON CONTROLLER)	Boiler may be in Warm Weather Shut-down.	In Installer Setup / Heat Load Configuration / Configure Load (Heating) adjust Summer Shutdown Temperature to a temperature above that registered by outdoor sensor.
'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 CUT-OFF 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 temp
BOILER OUTPUT NOT MODULATING UP TO MAXIMUM DESPITE TARGET NOT BEING REACHED.	Possible flow issue: check for 35 or 40 degree 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 Touch Screen Controller)
PRIMARY PUMP RUNS DURING PARALLEL-PIPED DHW CALL.	Load definition as DHW.	Re-define DHW load as DHW Loop 2 (5 button Controls) to turn off primary pump during domestic hot water calls. On Touch Screen Controllers set the boiler pump to off in the Installer Set-up Menu.

6.0 DIAGRAMS

6.1 - PARTS DIAGRAM

6.2 - WIRING DIAGRAMS

6.3 - SEQUENCE OF OPERATION

6.1 PARTS DIAGRAMS

SL 80-399 Modulating Boiler - Parts assembly

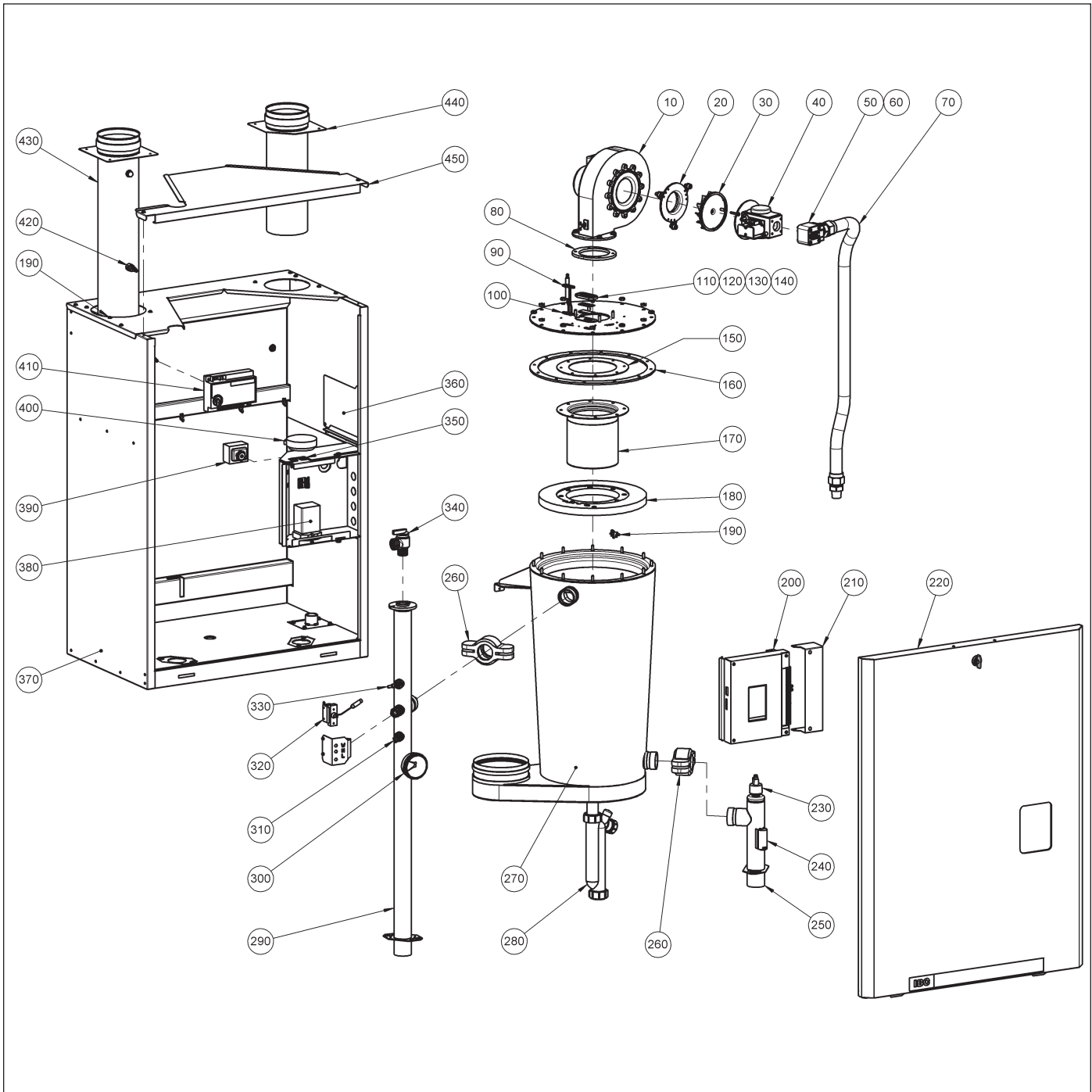


Diagram 6.1-1: Boiler assembly parts

ITEM	PART NO.	DESCRIPTION	QTY
10	240-001	FAN	1
20	180-001	GAS VALVE ADAPTER PLATE	1
30	180-002	AIR INTAKE SWIRL PLATE	1
40	180-003	GAS VALVE	1
50	250-548	GAS INLET BLOCK	1
60	150-001	GAS INLET O-RING	1
70	190-053	GAS LINE	1
80	250-048	FAN GASKET	1
90	240-002	IGNITOR	1
100	250-050	IGNITOR GASKET	1
110	250-057	SIGHT GLASS FRAME	1
120	250-058	SIGHT GLASS LOWER GASKET	1
130	250-059	SIGHT GLASS	1
140	250-060	SIGHT GLASS UPPER GASKET	1
150	250-049	BURNER GASKET	1
160	250-319	HEAT EXCHANGER LID GASKET	1
170	180-004	BURNER	1
180	250-022	HEAT EXCHANGER REFRACTORY	1
190	240-030	VENT/VESSEL TEMP. HIGH LIMIT SWITCH	2
200	500-044	V10.0 CONTROL MODULE	1
210	250-488	CONTROLLER TERMINAL BLOCK COVER	1
220	500-003	DOOR ASSEMBLY	1
230	240-006	RETURN WATER PRESSURE SENSOR	1
240	240-012	RETURN WATER TEMPERATURE SENSOR	1
250	250-027 250-353	RETURN WATER PIPE RETURN WATER PIPE w/EMERSION SENSOR	1
260	190-001PC	WATER CONNECTION COUPLER	2
270	170-003 170-008	HEAT EXCHANGER 80 PSI CAPACITY 80 PSI CAPACITY	1
280	180-013	CONDENSATE TRAP	1
290	250-026	SUPPLY WATER PIPE ASSEMBLY	1
300	180-019	TRIDICATOR	1
310	240-013	SUPPLY WATER TEMPERATURE SENSOR	1
320	240-007	WATER HIGH LIMIT SENSOR	1
330	240-010	LOW WATER CUT-OFF SENSOR	1
340	180-005 180-025	SAFETY PRESSURE RELIEF VALVE 30 PSIG 75 PSIG	1
350	240-028	TEST AND RESET SWITCH	2
360	250-187	RATING LABEL, PANEL	1
370	500-002	CABINET	1
380	240-005	LOW WATER CUT-OFF MODULE	1
390	240-079	TRANSFORMER	1
400	240-003	FAN PRESSURE SENSOR	1
410	240-004	IGNITION MODULE - ALTERNATE: CAPABLE CONTROLS 240-049	1
420	240-009	FLUE TEMPERATURE SENSOR	1
430	250-024	EXHAUST DUCT	1
440	250-025	INTAKE DUCT	1
450	250-033	UPPER ACCESS PANEL	1

Diagram 6.1-2: Boiler assembly parts list (refer to Diagram 6.1-1 on opposite page)

6.2 WIRING DIAGRAMS

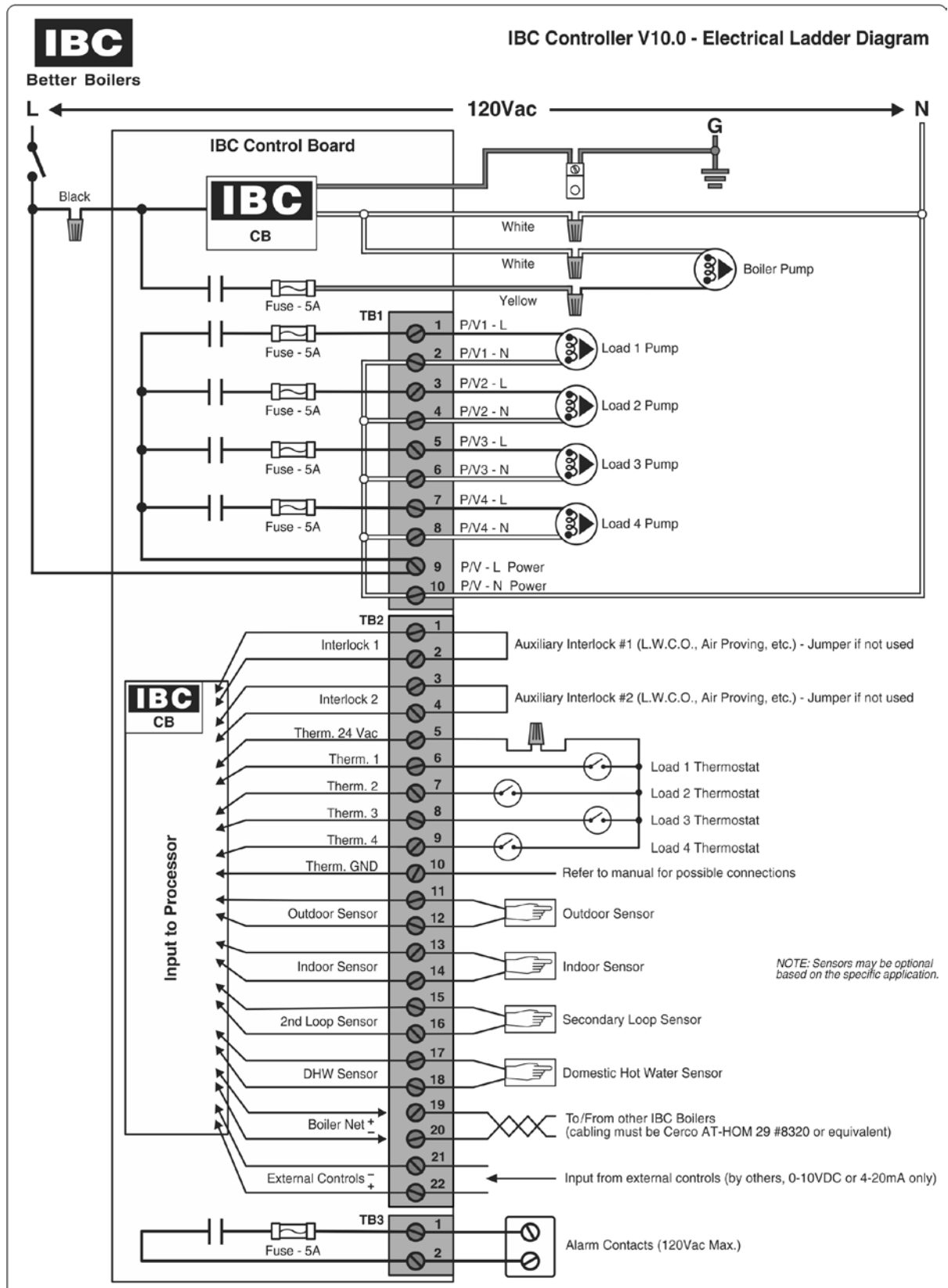


Diagram 6.2-1: Ladder wiring diagram

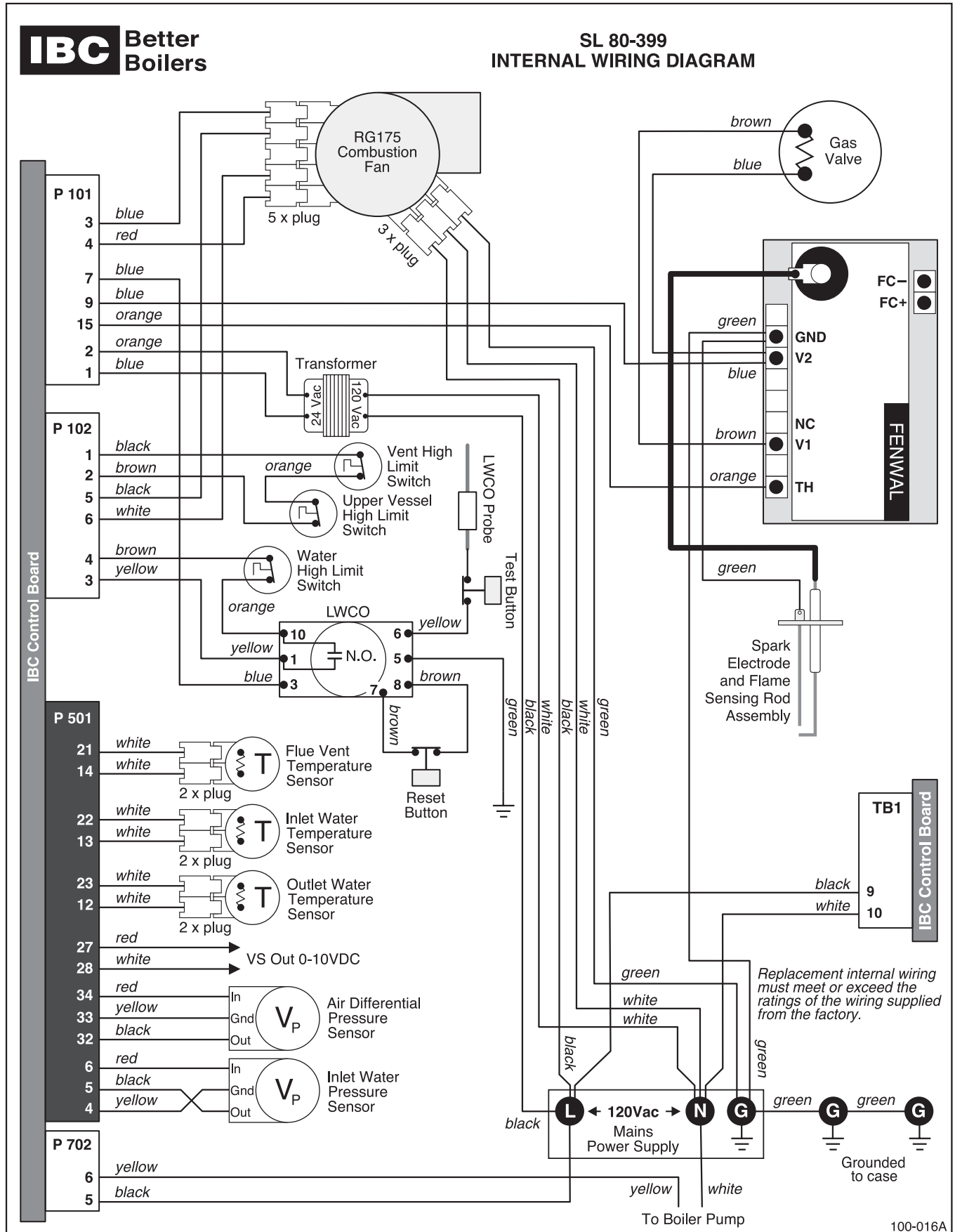


Diagram 6.2-2: Internal wiring diagram

6.3 SEQUENCE OF OPERATION

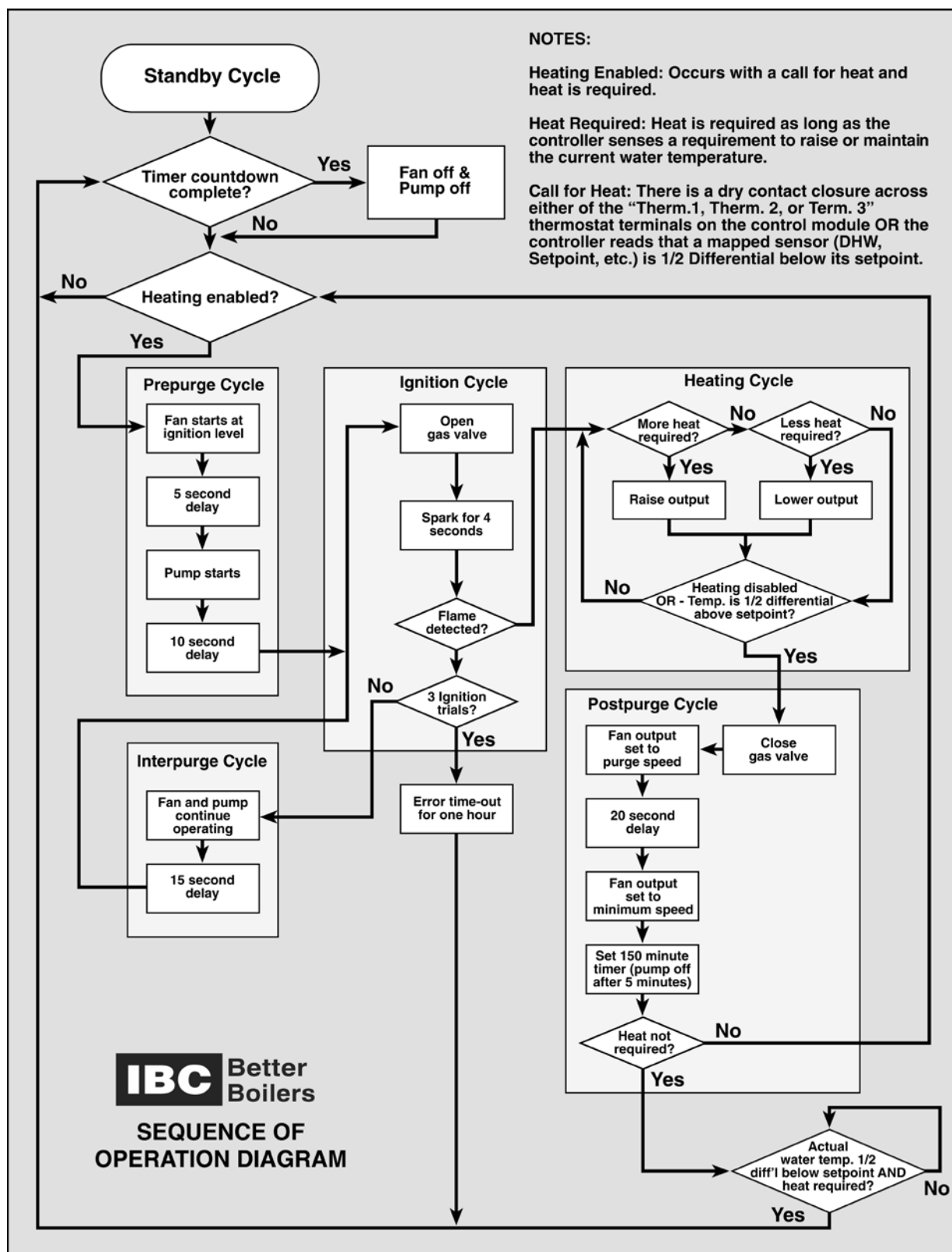


Diagram 6.3: Sequence of operation diagram

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

☐ Installation instructions have been followed and completed (Section 1 of Installation and Operating Instructions).

☐ Check-out procedures have been followed and completed (Section 3 of Installation and Operating Instructions).

☐ Leak testing completed ☐ gas piping ☐ venting system ☐ Fan and 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? Yes/No

☐ Ignition Safety Shutoff test completed. Flame current reading - High fire _____ μ A - Low fire _____ μ A

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

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

Combustion Readings:

CO₂ _____ % O₂ _____ % CO _____ ppm

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

Installers: send this completed sheet - Fax to 604 877 0295 - or - scan and Email to info@ibcboiler.com, and earn an extra year's Parts Warranty coverage (User to submit corresponding Installation Record from User Guide).

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

INSTALLER SET-UP

Load Definition - Load #1 _____

Load Configuration - Load #1

Load Definition - Load #2 _____

Load Configuration - Load #2

Load Definition - Load #3 _____

Load Configuration - Load #3

Load Definition - Load #4 _____

Load Configuration - Load #4

SERVICE RECORD

[illegible]

NOTES

[illegible]

NOTES

[illegible]

[illegible]

REVISION HISTORY

R1 (MAY 2010)	Initial release
R2 (JULY 2010)	Enhanced information on air bleeding; warranty material shifted to separate document
R3 (SEPTEMBER 2011)	SL 80-399 HP model added with 80 psi HX
R4 (AUGUST 2012)	Unified model reference recognizing all units at 80 psi; extension of venting allowance to 200' equiv plus addition of Polypropylene material; insertion of new Table 8 on fuel mixture
R5 (OCTOBER 2014)	Addition of Touch Screen Controller, Minor changes, Updated Fuel Mixture Table 8
R6 (MAY 2015)	Address update

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