INSTALLATION AND OPERATING INSTRUCTIONS

IBC Technologies

SL 20-115

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

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ENERGY STAR

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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.

SPECIFICATIONS

SPECIFICATION	SL 20-115
CSA Input (Natural Gas or Propane*) - MBH CSA Input (Natural Gas or Propane*) - kW CSA Output - MBH CSA Output - kW	20 - 115 6 - 34 19 - 109 5.5 - 32
A.F.U.E.	96.1%
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 (without pumps)	54
Weight (empty) - lbs/Kg	115 / 52
Pressure vessel water content - USG/Litres	2.9 / 11
Maximum boiler flow rate - USgpm	14
Minimum boiler flow rate - USgpm	2
Maximum operating water pressure† - psig	30
Minimum water pressure - psig	8
Approved installation altitude - ASL	0 - 8000’
Ambient temperature - Low (°F-°C) Ambient temperature - High (°F-°C)	32°F / 0°C 122°F / 50°C
Max. relative humidity (non-condensing)	90%
Minimum water temp.	34°F / 1.1°C
Maximum water temp. (electronic hi-limit)	190°F / 87.8°C
Maximum water temp. (mechanical hi-limit)	200°F / 93.3°C
Max. ΔT - supply/return (electronic fence)	35°F
Maximum equivalent vent length - 2” Each side (vent & air intake) - 3” (Natural Gas or Propane) Air intake options: either direct vent or indoor supply	100’ 240’

* Natural gas boilers require propane burner kit - Part # P-103A - to be ordered if conversion to propane is required

† boilers are shipped with 30 psig pressure relief valve

HAZARDS & PRECAUTIONS

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

Points out a <u>potentially</u> 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.

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

CONTENTS

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 the 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.
- 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.
- In sealed combustion applications, 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.
- In locations where power supply quality varies or is unstable, installation of surge protection and power conditioners up to and including battery back-up uninterrupted power supply devices should be considered.

⚠ 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.

1.0 INSTALLATION

1.1 GENERAL

SL Series gas-fired modulating boilers are low pressure, fully condensing units having variable input ranges *(see specification chart - inside, front cover).* 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	SL 20-115
A	Exhaust Outlet	3” Schedule 40
B	Combustion Air	3” Schedule 40
C	LCD Display	2 3/4” x 1 1/2”
D	Water Outlet	1” NPT-F
E	Water Inlet	1” NPT-F
F	Knock-outs (6)	1/2”
G	Gas Inlet	1/2” NPT-F
H	Condensate Outlet	3/4” Hose

Table 1: Connections

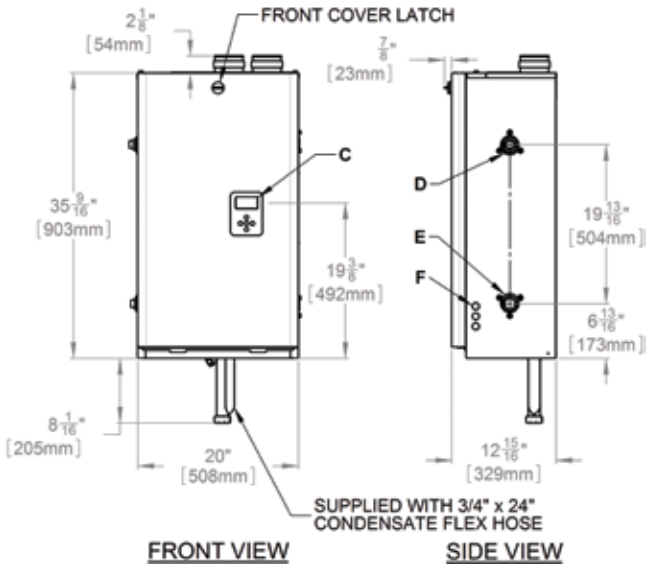


Figure 1a: Dimensions / Connections for SL 20-115

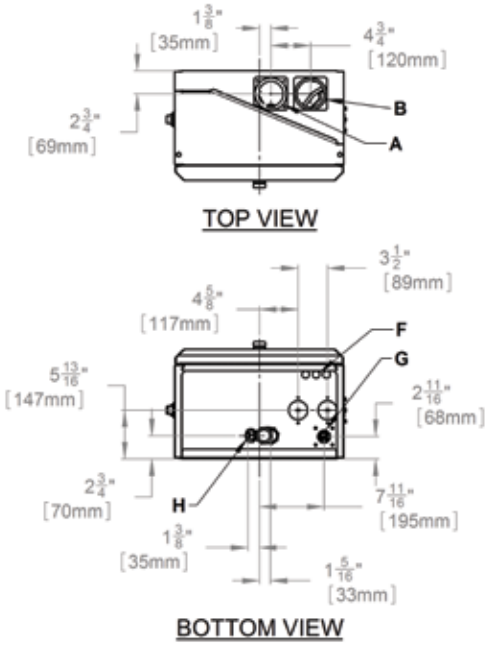


Figure 1b: Dimensions / Connections for SL 20-115

1.2 CODE REQUIREMENTS

The SL 20-115 model was tested to and certified under CSA 4.9-2010 / ANSI Z21.13-2010.

Installation must conform to local codes, or in the absence of these, with the latest editions of CAN/CGA B149 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.

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 – approximately 115 lbs / 52 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 10” 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**

⚠ 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.

contaminants; combustion air should be drawn from a CLEAN source (e.g. outdoors) and the boiler should be isolated from interior dust sources.

SURFACE	DISTANCE FROM COMBUSTIBLE SURFACES	RECOMMENDED DISTANCE FOR INSTALLATION AND SERVICE
Front	2"	24"
Rear	0"	0"
Left Side	1"	4" (min. for piping clearance)
Right Side	1"	4" (min. for piping clearance)
Top	2"	6" (for vent connection)
Bottom	0"	12" (for condensate trap)

Table 2 - Clearance from boiler cabinet

A minimum distance below the boiler of 12" is required to provide clearance for the supplied condensation trap assembly. More clearance will typically be required to accommodate associated water and gas piping.

⚠ WARNING

DO NOT MOUNT THIS BOILER TO HOLLOW WALL STRUCTURES - The combined weight of the boiler, its water contents and associated piping components can exceed 150 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.

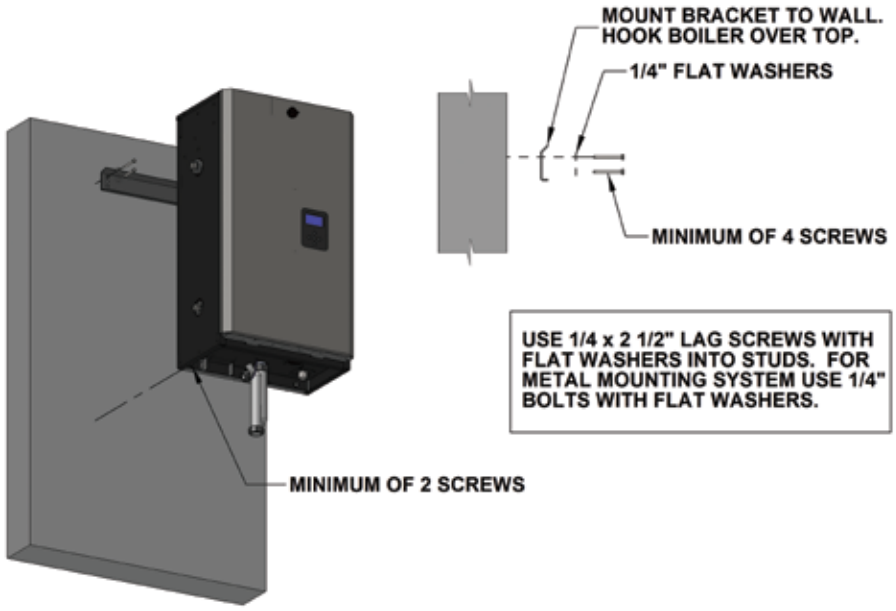


Figure 2: Wall mounting of boiler

1.4 EXHAUST VENTING AND AIR INTAKE

⚠ DANGER

Do not common vent the SL modulating series 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 223.1, latest edition, prevails. Where there is a discrepancy between the installation instructions below, and the code requirements, the more stringent shall apply.

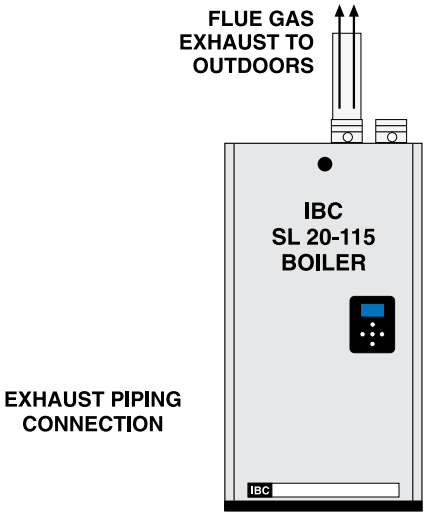


Figure 3: Basic exhaust vent assembly

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 re-sizing any portion of the common venting system, the common venting system should be re-sized 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 B149.1-10 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.*

1.4.2 Exhaust Vent Material

EXHAUST VENT MATERIAL – CANADA

Only 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* are to be used. 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)

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 *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); or CSA approved 2" or 3" stainless vent systems. If PVC is to be used, you shall use a minimum of 10 lineal feet of CPVC, and then transition to PVC using approved transition glue. The installer shall ensure that vent temperatures in the PVC section cannot exceed 140°F.

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

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

For PPs material, use the 3" transition/ adaptor fitting (Sch 40 to PPs) offered

⚠ 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.

by the respective PPs manufacturers Centrotherm / *Innoflue*™ (their part # ISAA0303) or M&G Dura Vent /PolyPro (#3PPS-AD). For 2" venting, use Innoflue part # ISRD0302 or *PolyPro* # 3PPS-R2 (within the PPs piping, after adapting with #3PPS-AD). For PPs material exposed to outdoor weather, follow the venting suppliers' recommendations on UV protection.

Combustion air piping - if used - is inserted directly into the 3" female stainless steel fitting on the right *(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

CPVC or PPs (Rigid Single Wall) piping is the standard venting option; with this, the SL 20-115 boiler, for example, can be sited up to 100 equivalent feet from the vent termination using 2" or up to 240' using 3". The actual vent travel allowance is reduced for fittings in accordance with *Table 3.* – e.g. for an SL 20-115 using 6 x 90º CPVC elbows, the maximum lineal measure of pipe allowed using 2" pipe is 52 feet (100' – (6 x 8' = 48) = 52'). The same boiler using 3" pipe can have up to 192 feet (240' – (6 x 8' = 48) = 192').

For 2" Flexible PPs, up to 45 actual lineal feet are allowed in a nominally vertical orientation (>45°). The equivalent length of 2" Flex PPs shall be computed using a multiple of 1.4:1, e.g. 45' x 1.4 = 63' equiv. With 45' of 2" Flex, up to 37' equivalent of 2" Rigid PPs would still be allowed. For 3" flex PPs, the maximum lineal/vertical travel is 98', and the factor to compute equivalent length for 3" Flex is 1.2:1. PPs 87-90° elbows are considered to be 8' equivalent.

EXHAUST PIPE SIZE	MAXIMUM EQUIVALENT LENGTH
Sched.40; Rigid PPs	
2"	100'
3"	240'
90° long sweep elbow	allow 5' equivalent
90° vent elbow	allow 8' equivalent
45° elbow	allow 3' equivalent
PPs 87-90° elbows	use 8' equivalent
Flexible PPs	
2" Flexible	45' (max.) lineal x 1.4 = equivalent
3" Flexible	98' (max.) actual lineal x 1.2 = equivalent

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" per foot (PPs vent: follow PPs manufacturer requirements) 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.

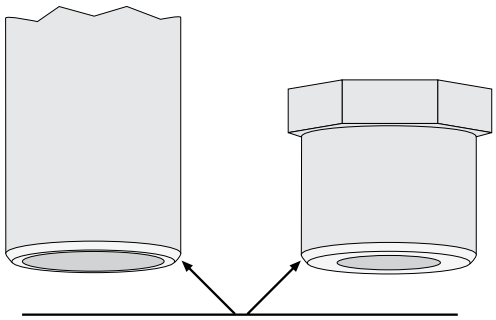
Certain installations of the 20-115 model can employ the 2" vent options. We caution installers when using horizontal runs of 2" pipe. Reason: air friction from the fast moving exhaust during long burner runs at high-fire in a 2" pipe can

overcome gravity on 1/4" / foot vent slope – leaving a pool of condensate at the next upturned elbow. Pooling can impair the achievement of full high-fire rating plate performance.

Exhaust piping is inserted directly into the 3" female stainless steel fitting on the top, left side of the boiler and run horizontally or vertically to the outdoors. Screen material can be placed at the outlet as appropriate for the environment (e.g. insects, dust).

Fan control harness plug

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



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

WET GASKETS AND PIPE BEFORE INSERTION

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

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

All joints must be secured using appropriate solvent cement to bond the respective pipe material (Canada: CPVC cement approved under *ULC-S636, in accordance with its manufacturer instructions;* USA: PVC (ASTM D2564), or PVC/ABS (D2235) - Use transition glue anywhere that PVC and CPVC are joined. Follow the cement manufacturer's instructions closely when joining various components. For 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.

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.
- Some local jurisdictions require a minimum initial length of pipe be exposed or accessible for inspection.
- Pipe clearances - no IBC requirements, but best practice allows a minimum 1/4" open annulus around the pipe to prevent binding and expansion noise; 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 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.**

⚠ 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

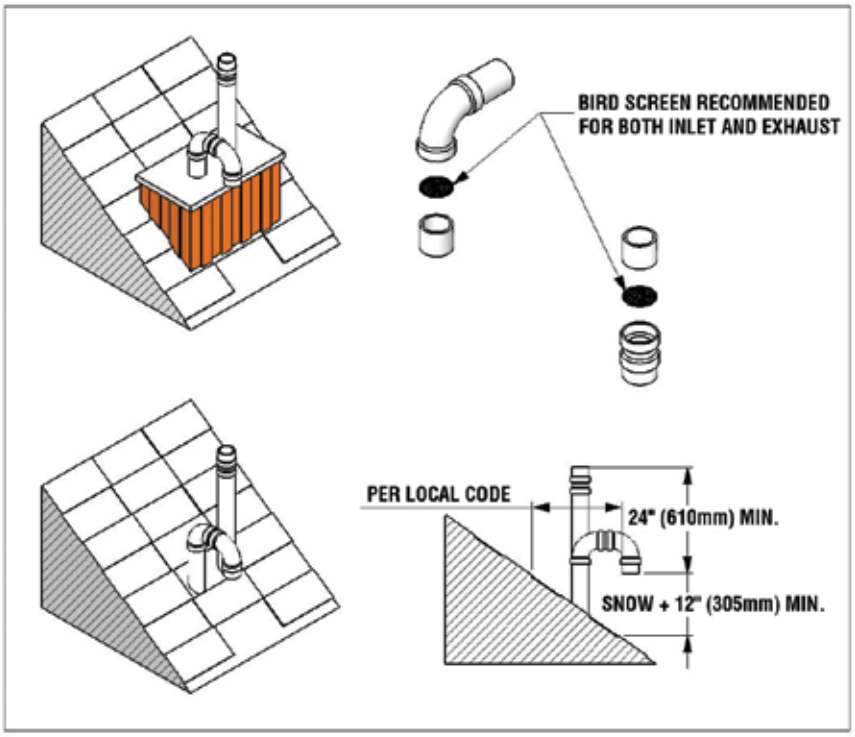


Figure 4: Rooftop vent terminal configurations

⚠ 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.

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 intake re-ingestion of exhaust gases.
- 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.

⚠ WARNING

It is extremely important to maintain at least the minimum separation of exhaust vent termination from boiler intake air as illustrated in figures 3, 4 and 5. 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 sidewall terminals without specific written approval from IBC.

- 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.

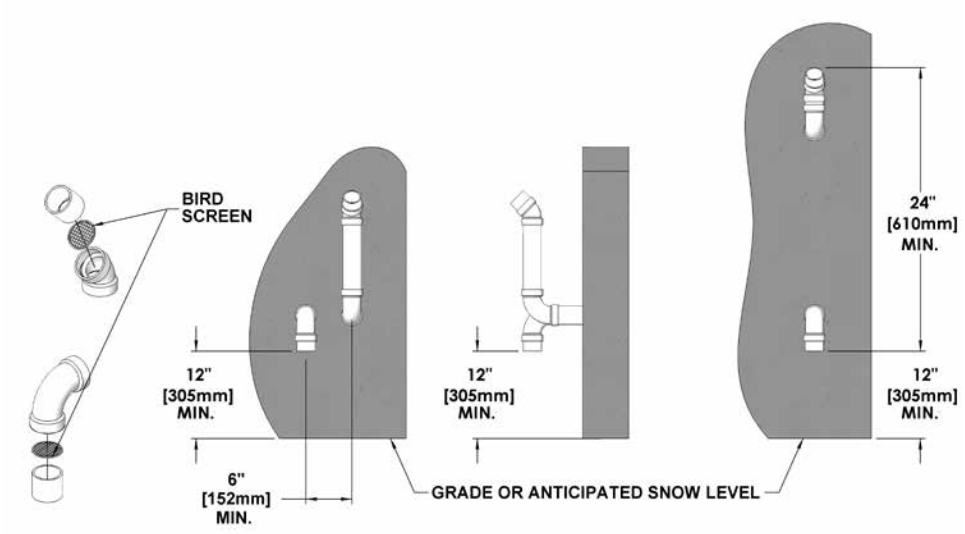


Figure 5: Sidewall vent termination - piping configuration

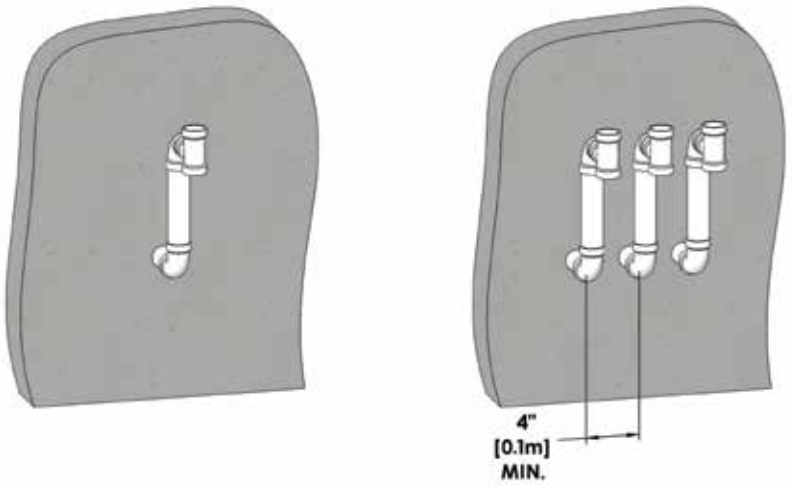


Figure 6: Sidewall vent termination - indoor combustion air applications

⚠ 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.

Sidewall indoor combustion air applications shall be vented as follows:

- The exhaust outlet is to be placed 12" above grade or anticipated snow level (18" min in B.C.; check local code requirements).
- The vent shall be terminated with a tee fitting as illustrated (s*ee 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 4" (minimum) 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.

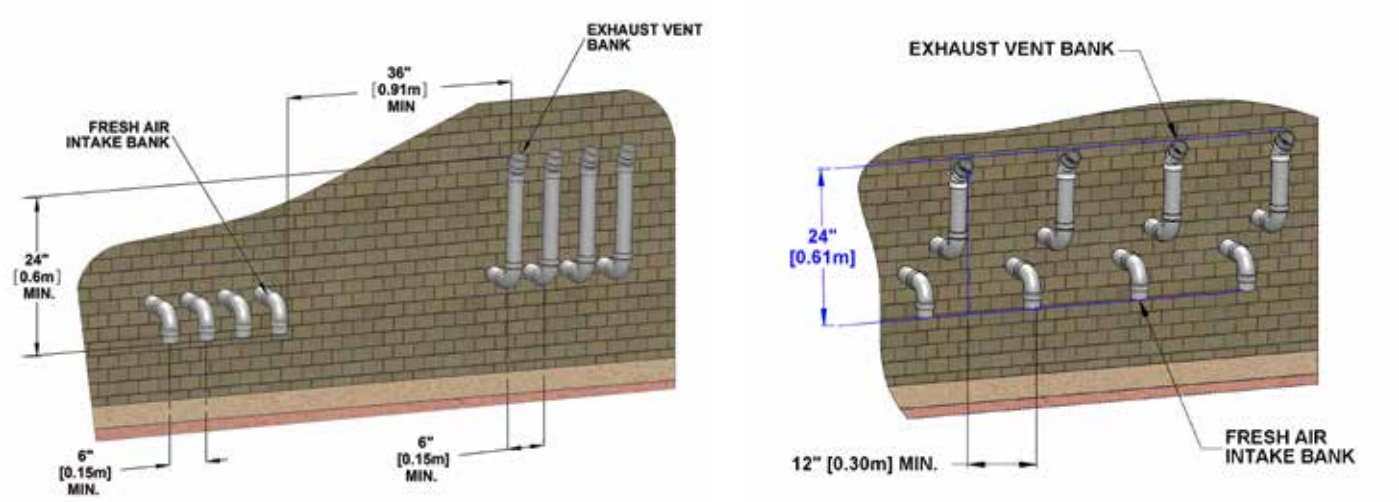


Figure 9: Sidewall vent termination - multiple vent piping configuration

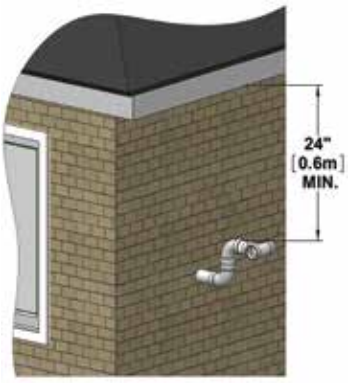


Figure 7: IBC recommended minimum vent terminal clearance under ventilated soffit

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)

Figure 8: Prohibited installation

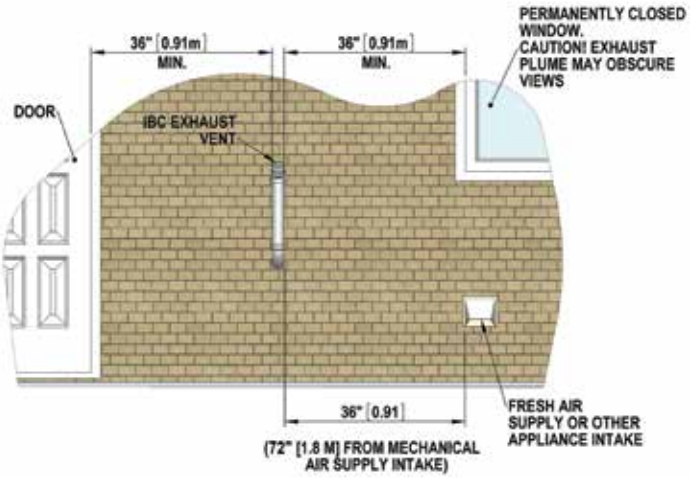


Figure 10: Vent terminal clearances

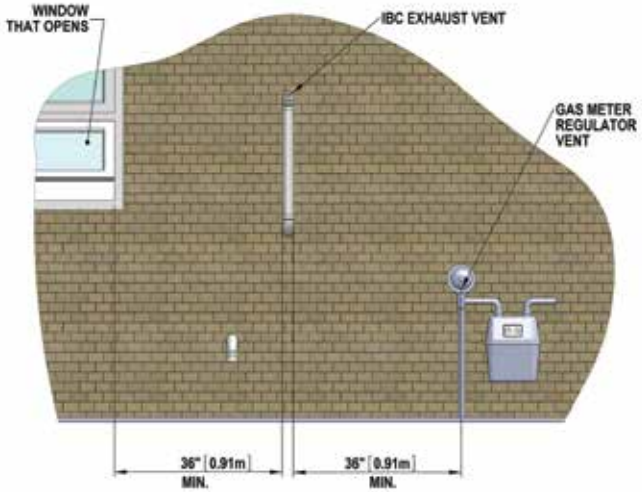


Figure 11: Vent terminal clearances

- 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 24" with the SL 20-115 to avoid damage to the structure.** *Note: Prohibited unless fully open on a minimum of two sides below the floor.*
- Vents must be installed such that flue gas does not discharge towards neighbor's windows, air intakes, and/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.

⚠ 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).

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.

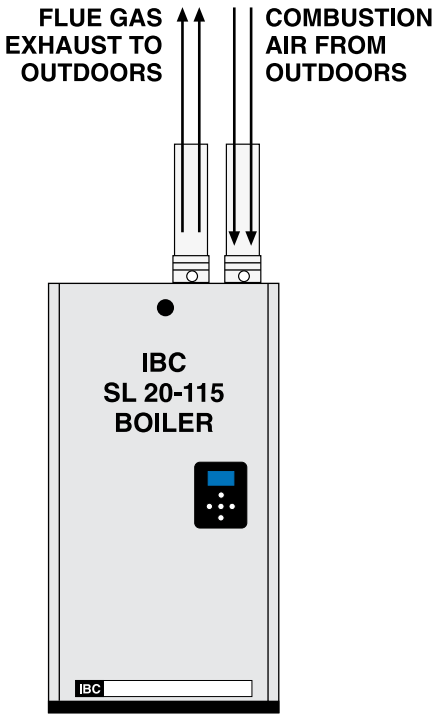
⚠ WARNING

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.



"DIRECT VENT" INSTALLATION

CHECK AIR INTAKE OUTSIDE TO MAKE SURE IT IS CLEAR OF OBSTRUCTIONS

Figure 12: Direct vent combustion air intake

INTAKE PIPE SIZE	MAXIMUM EQUIVALENT LENGTH
Sched.40; Rigid PPs	
2”	100’
3”	240’
90° long sweep elbow	allow 5’ equivalent
90° vent elbow	allow 8’ equivalent
45° elbow	allow 3’ equivalent
PPs 87-90° elbows	use 8’ equivalent
Air Intake Filter (Part #103)	allow 8’ equivalent
Flexible PPs	
2” Flexible	45’ (max.) lineal x 1.4 = equivalent
3” Flexible	98’ (max.) lineal x 1.2 = equivalent

Table 4: Maximum intake piping length

For the **inlet** air – Schedule 40 PVC, CPVC, ABS or PPs piping of any type is permitted. Use same diameter as Vent pipe.

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 3” 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.

⚠ WARNING

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

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

1.4.8 “Indoor Air” Combustion Air Intake

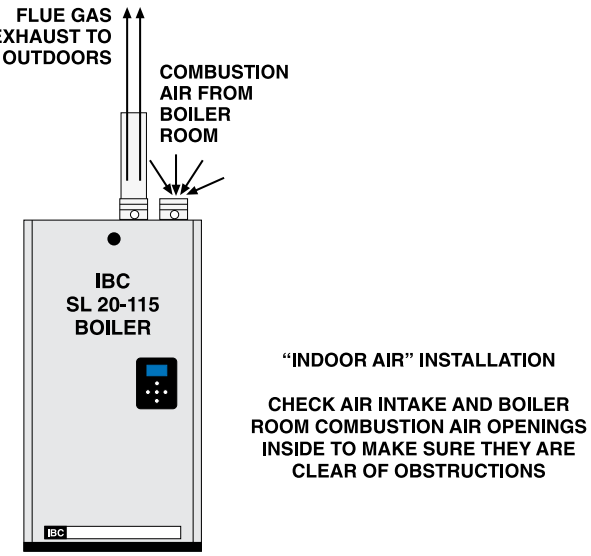


Figure 13: Indoor combustion air intake

⚠ 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, our optional air intake filter should be installed.

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

Diagram 15: Intake Air Filter Assembly, IBC Part #SC-100A (Filter Element Alone is IBC Part #P-102A)

Air Intake Filter Assembly, IBC Part #SC-100A

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

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 B149.1-10**

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. IBC supplied air intake filters have a known pressure drop and fouling factor and should be used as a component of the combustion air system according to the allowable intake length in *Table 4.*

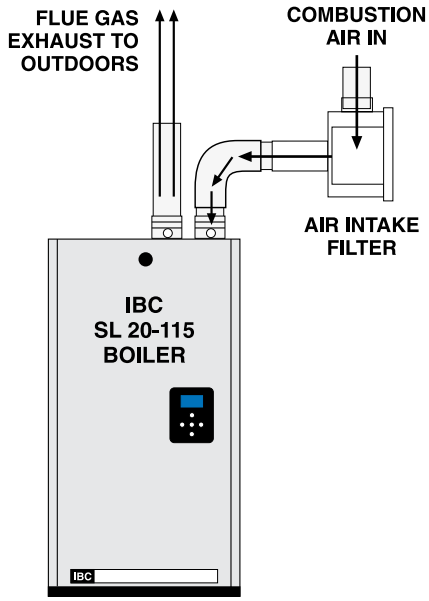


Figure 14: Direct vent - intake, exhaust system with optional air intake filter (filtration may also be used on indoor air applications as required)

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).

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.*

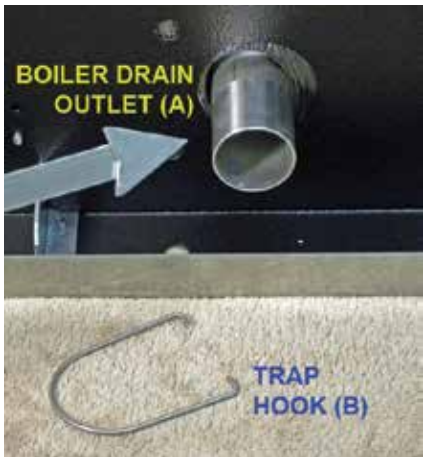
1.5.2 Condensate Trap Assembly - Installation

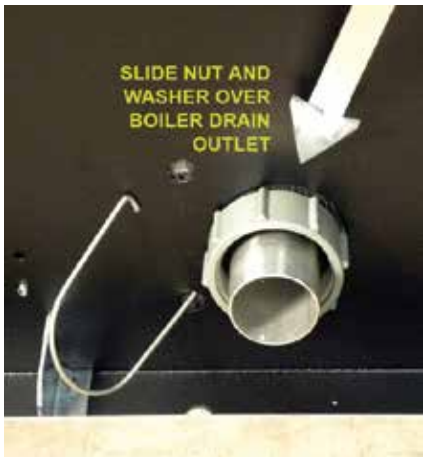
1. Undo Drain Spout Compression Nut (E), remove Drain Hose (G) from Trap Drain Outlet (F). Place Vacuum breaker cap (J) over the Vacuum breaker opening and push firmly home. Remove Upper Compression Nut and Washer (C) and slide over Boiler Drain Outlet (A). Insert one Trap Hook barb into the back mounting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

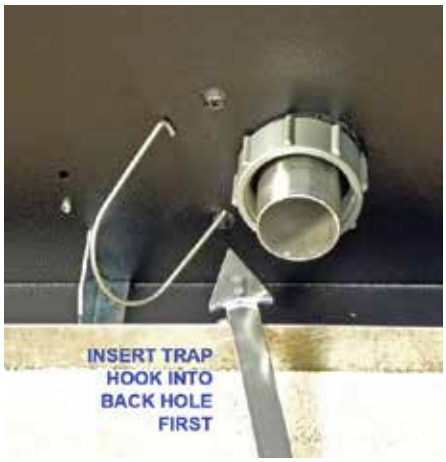
Condensate Trap as shipped

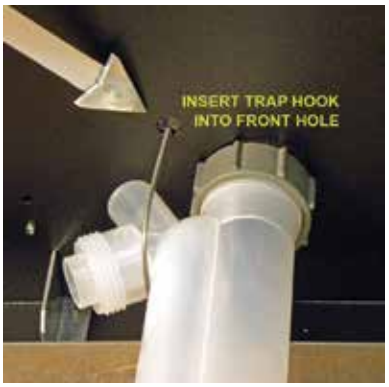
Condensate Trap, disassembled

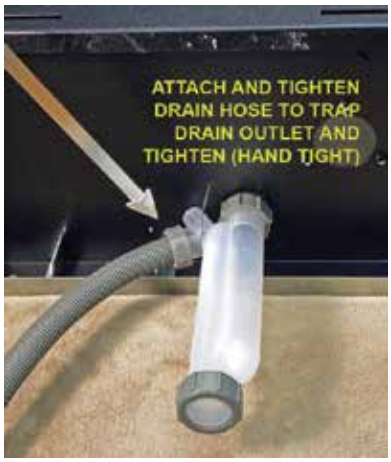
2. ***Fill Trap with water,*** and slide Trap Body (D) over Boiler Drain Outlet (A). Swing Trap Hook (B) around the Drain Outlet (F) connection threads. Insert remaining Trap Hook barb into the front hole. Pull the trap slightly downward to seat it against the hook and tighten Upper Compression nut (C).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











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.

⚠ 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.

1.5.4 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.

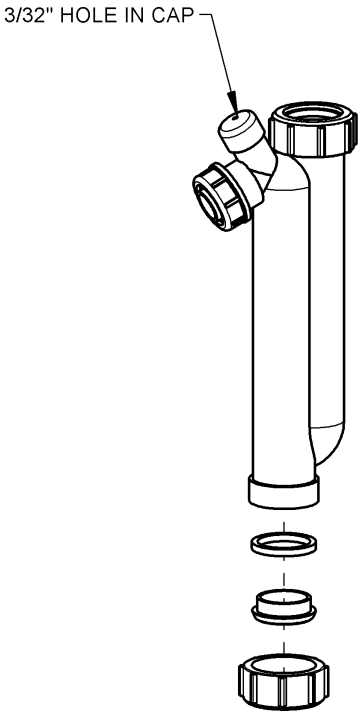


Figure 17: Condensate trap disassembly for cleaning

⚠ 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.

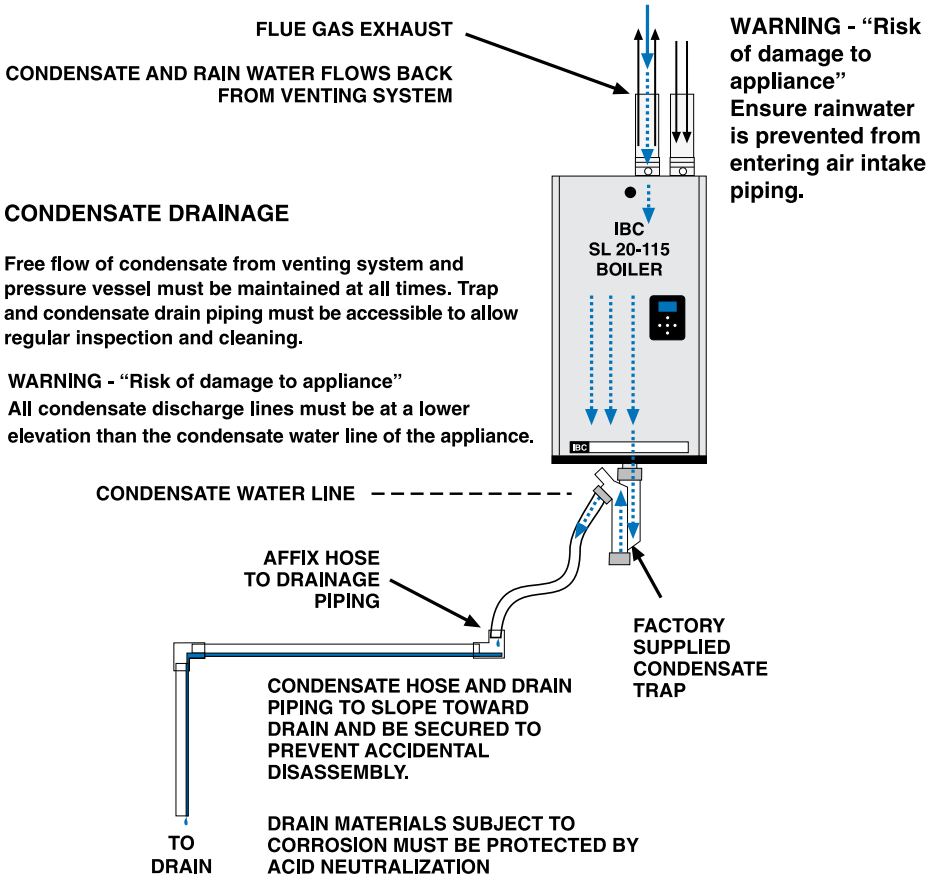


Figure 18: Condensate trap drainage

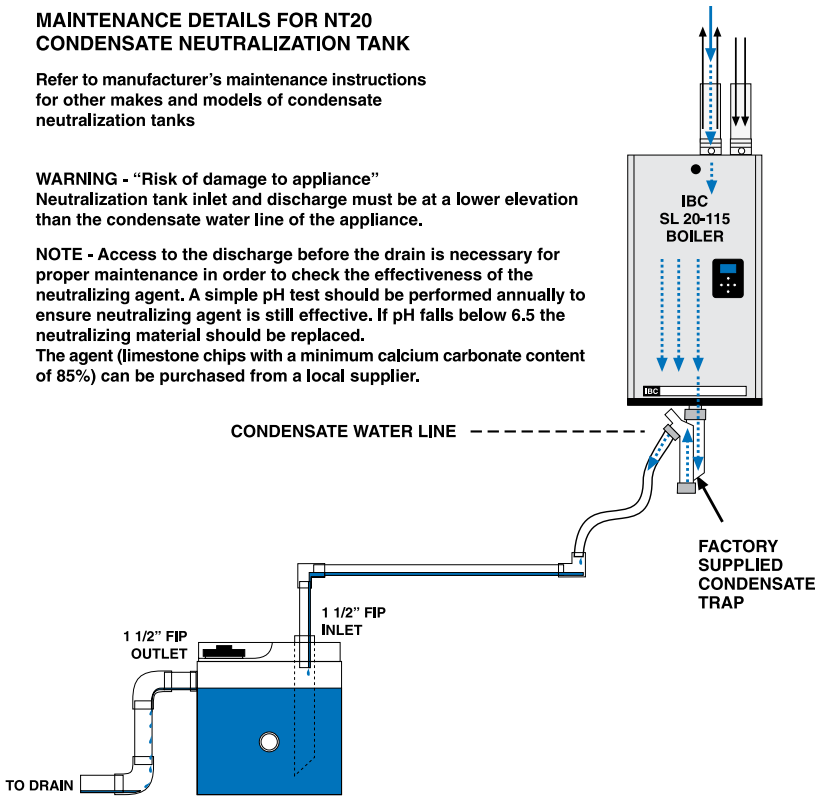


Figure 19: Condensate neutralization tank

1.6 WATER PIPING

Water outlet, right side

Water inlet, right side

Outlet, left

Inlet, left

1.6.1 General Piping Issues

The SL 20-115 boiler was designed to be easy to install in almost any application. Its unique multi-port piping design allows connection from either side or both sides at once. With the purchase of the optional bottom connection kit, available from IBC, piping can be routed below the unit for connection to system piping or primary loop.

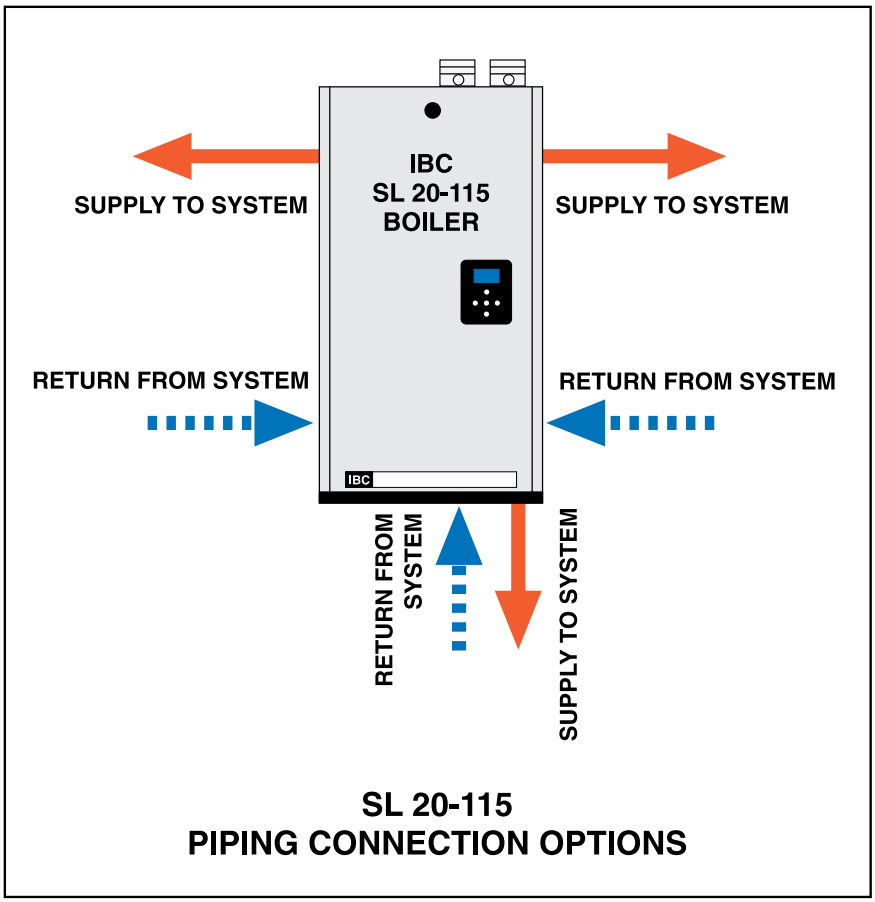


Figure 20: Overview of piping options

Primary/secondary piping, or the use of a hydraulic separator is recommended for maximum flexibility in multi-load applications, but piping loads in parallel is also encouraged in systems that only have two loads, or when loads are operating simultaneously. The extremely low pressure drop through the SL Series heat exchanger allows many options not available in other designs. In short – IBC has built a boiler that will allow you to pipe the system the way you prefer, rather than try and dictate your piping practices from boiler to radiator.

There are some important details to consider however, and this section of the Installation and Operating Manual will walk you through them so you can enjoy a trouble-free installation.

⚠ 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.

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 at one of the locations shown in the following illustrations. Relief valve discharge piping must terminate between 6" (15cm) and 12" (30cm) above the floor or per local Code.

Due to the various piping options available, positioning the pressure relief valve can vary. When piping from either side, the relief valve is installed in the upper port opposite the supply outlet, using the fittings provided. *Figure 21*

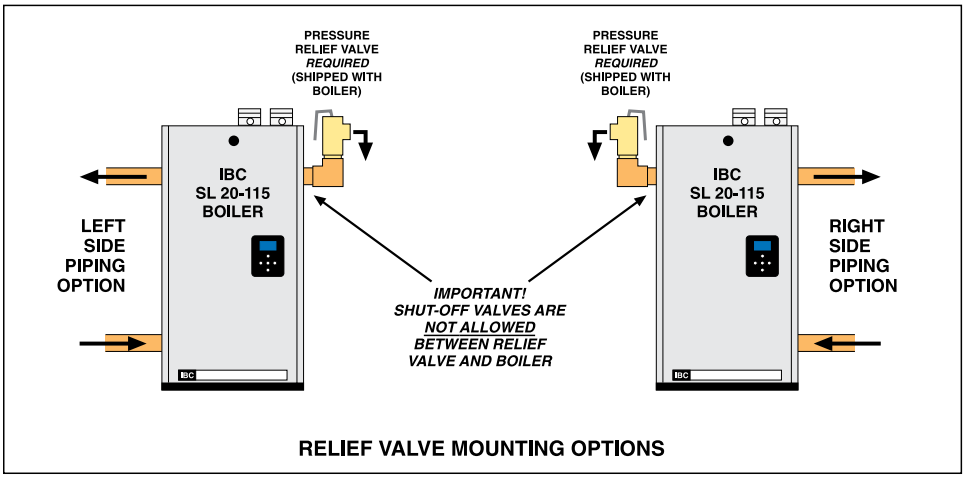


Figure 21: Relief piping with single side piping connections

If piping from both sides at the same time, a tee must be installed on either supply outlet, immediately on exiting the boiler so that there is no possibility of installing an isolation valve between the pressure vessel and the relief valve.

The bottom connection kit includes a header fitting that allows installation of both the relief valve and the air vent in the top Left hand port, as illustrated *Figure 22*

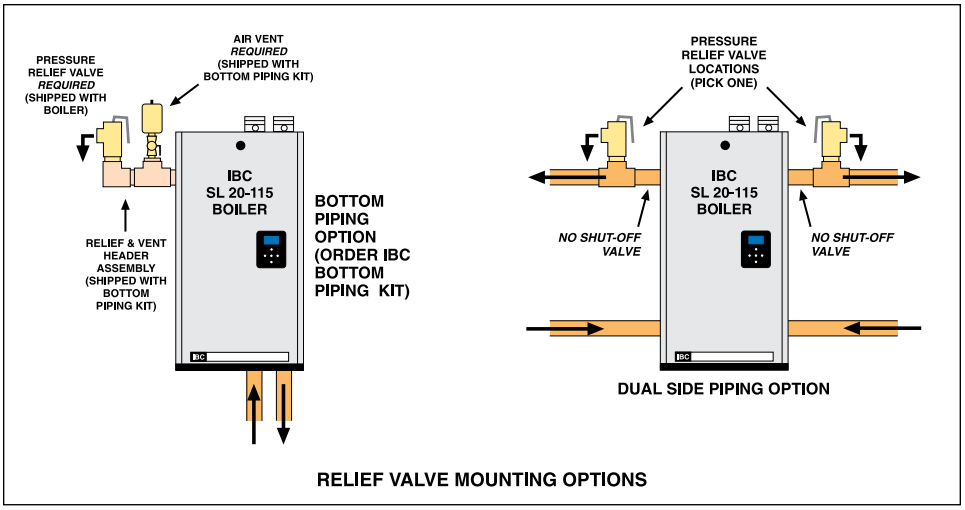


Figure 22: Relief piping with dual side or bottom piping connections

Order the bottom connection kit from IBC as Part #P-104A The kit includes supply and return risers to bring the piping to the bottom of the boiler case, escutcheon plates to secure and seal the pipes as they exit the case, an auto air vent and the relief and vent header fitting. Follow the instructions that come with the connection kit. Instructions can also be accessed on line from www.ibcboiler.com

System piping is connected to the boiler using the 1” NPT Female threaded fittings on the right or left side connection ports, or bottom (order bottom connection kit). 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” clearance from combustible materials.

⚠ WARNING

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

⚠ NOTE

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

www.ibcboiler.com

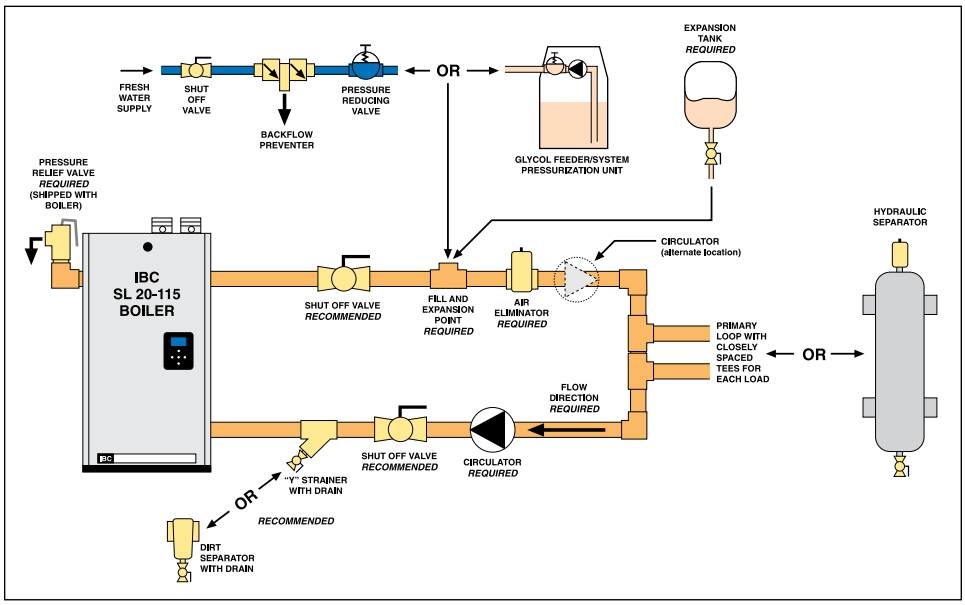


Figure 23: Boiler trim basic options - side piping

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.

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 1” piping for the SL 20-115. Heat exchanger head is only 1’ at 4 USgpm and approximately 9’ at 10 USgpm.

The minimum flow rate required through the heat exchanger is 2 USgpm with a maximum of 14 USgpm allowed. Primary/Secondary piping ensures adequate flow and de-couples Δ°T issues (boiler vs. distribution). Aim for a 20° to 30° F Δ°T across the heat exchanger at high fire (there is a boiler protection throttle fence limiting the Δ°T to 35°F).

⚠ 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 0.5 mg/l

Cu less than 0.1 mg/l

Conductivity is to be less than 400µS/cm (at 25°C)

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

The SL Series modulating boilers are designed to supply three different heating loads with temperatures within the range 34°F to 180°F - to meet three separately piped loads. Use closely spaced tees to connect each pumped “load” (e.g. DHW, baseboards or radiant floor) to the primary loop, or employ the use of a hydraulic separator to isolate the boiler loop from the system and pipe the system from the secondary side of the separator. Two-load systems may be piped with a variant of parallel piping commonly used, including our unique dual side piping configuration.

Always ensure that loads sensitive to high temperatures are protected using means such as a mixing valve set for maximum limit (say 140°F) to protect radiant floors, or an aquastat (wired to the boiler’s auxiliary interlocks).

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 Δ°T (under high and low flow conditions) after establishing the correct firing rate.

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

PRESSURE VESSEL HEAD SL 20-115						
Flow rate (gpm)	4	6	8	10	12	14
Head loss @ flow (ft wc)	1.5’	2.5’	3.0’	4.0’	4.5’	6.0’

Table 6: Pressure Vessel Head

We recommend water flow after burner shutdown to utilize legacy heat – this is significant due to the mass of the heat exchanger (32 Lbs) plus its 11L 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 5 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 – 300 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.

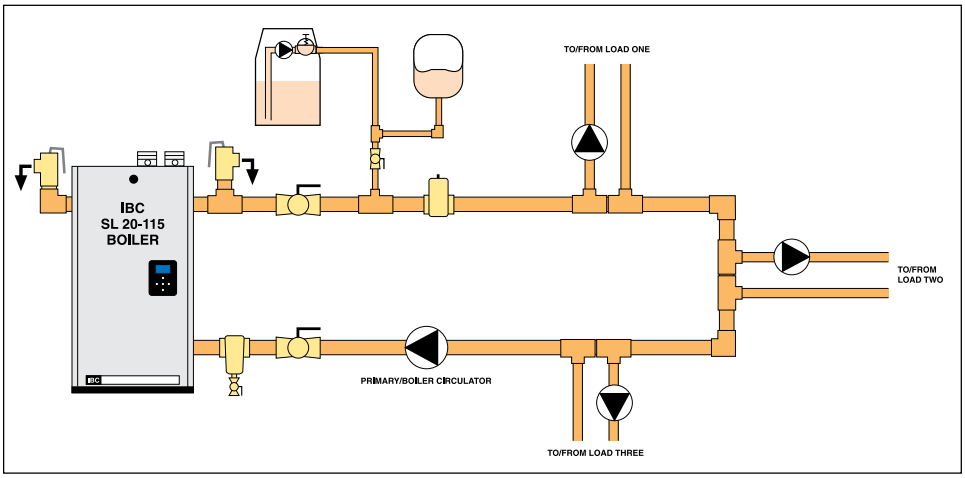


Figure 24: Basic Primary/Secondary piping with closely-spaced tees concept

⚠ 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.

Schematics for several piping layouts are provided herein, 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.

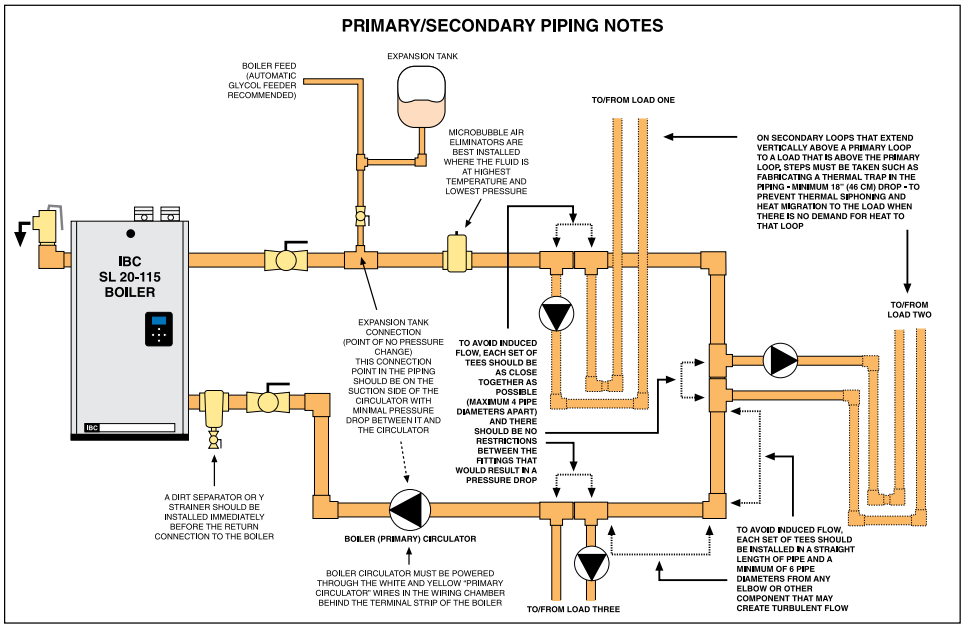


Figure 25: Important Primary/Secondary piping details with closely-spaced tees

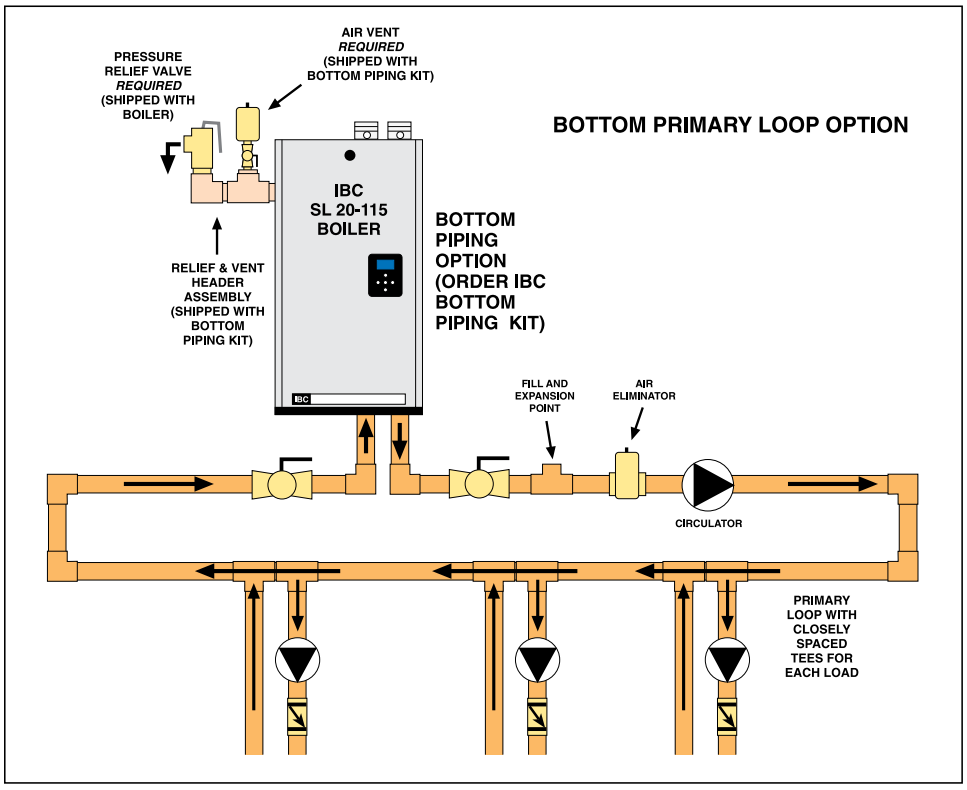


Figure 26: Basic Primary/Secondary piping with bottom piping connection option

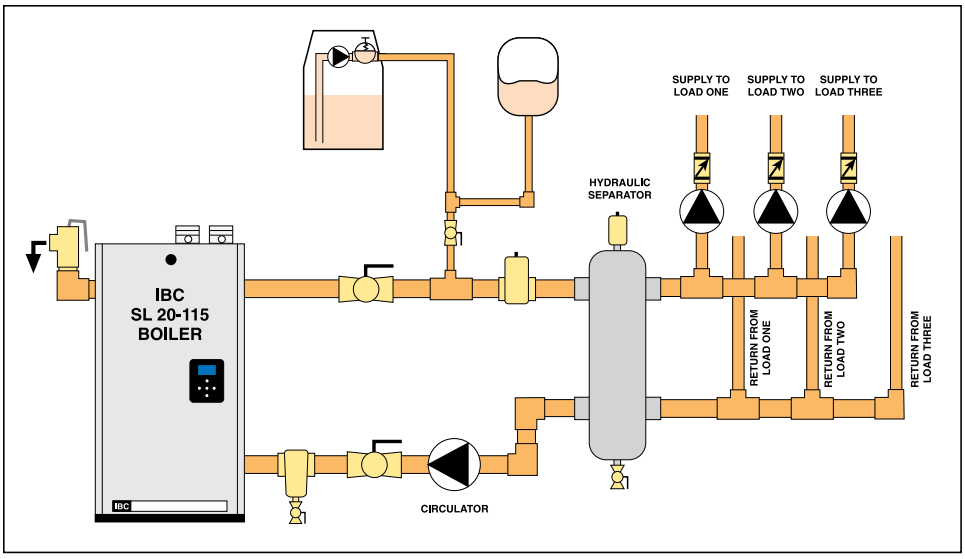


Figure 27: Basic Primary/Secondary piping with hydraulic separator concept

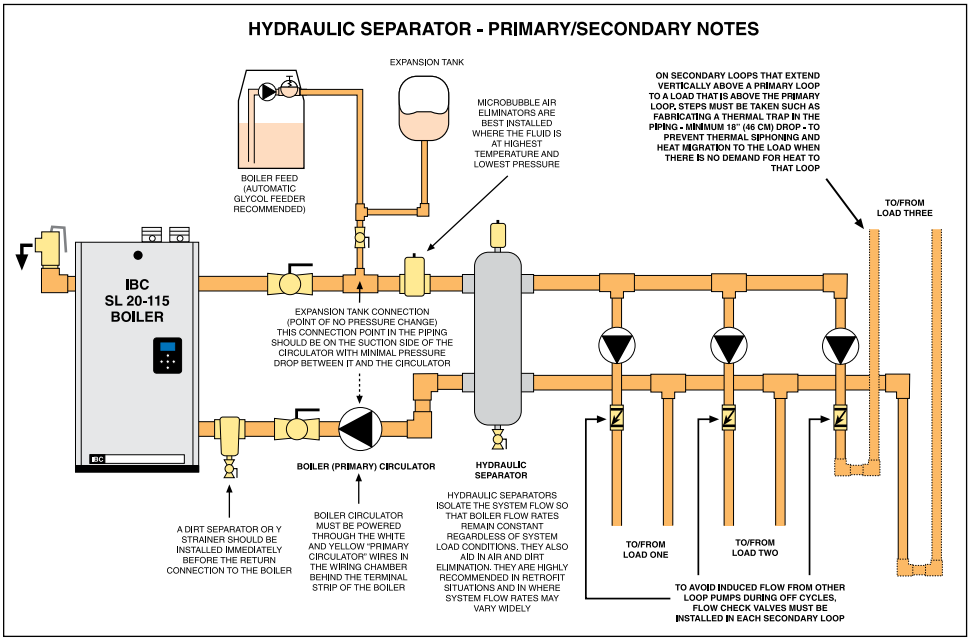


Figure 28: Important Primary/Secondary piping details with hydraulic separator

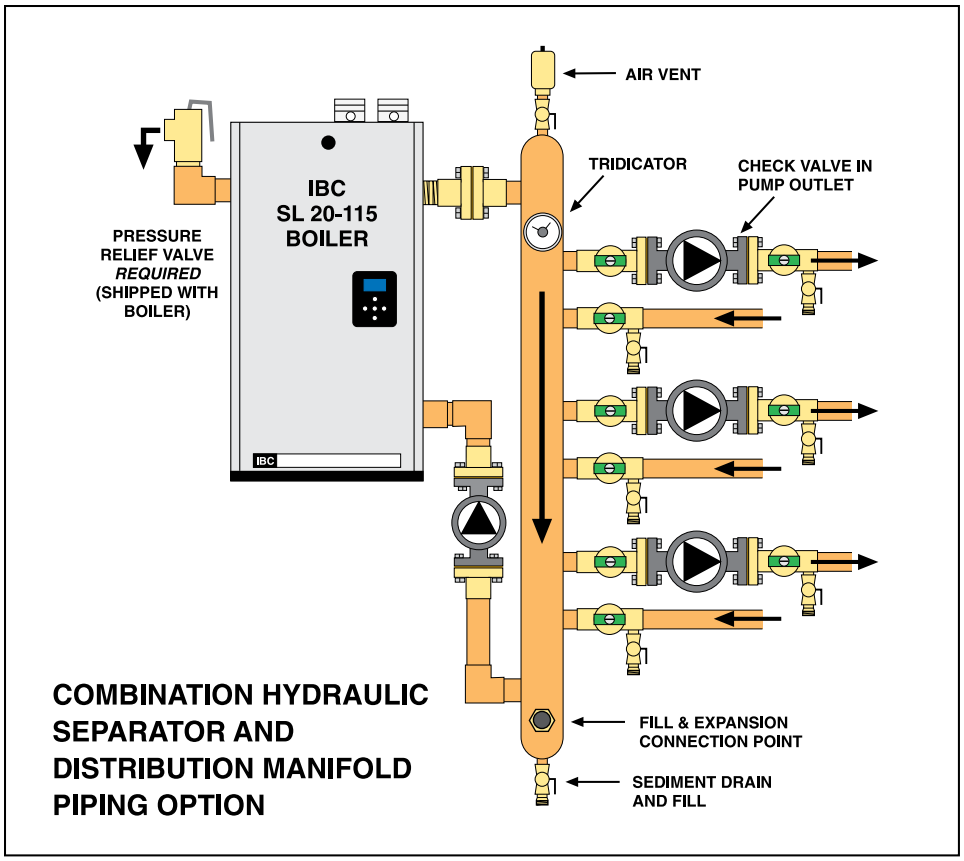


Figure 29: Primary/Secondary piping to a hydraulic separator / distribution manifold

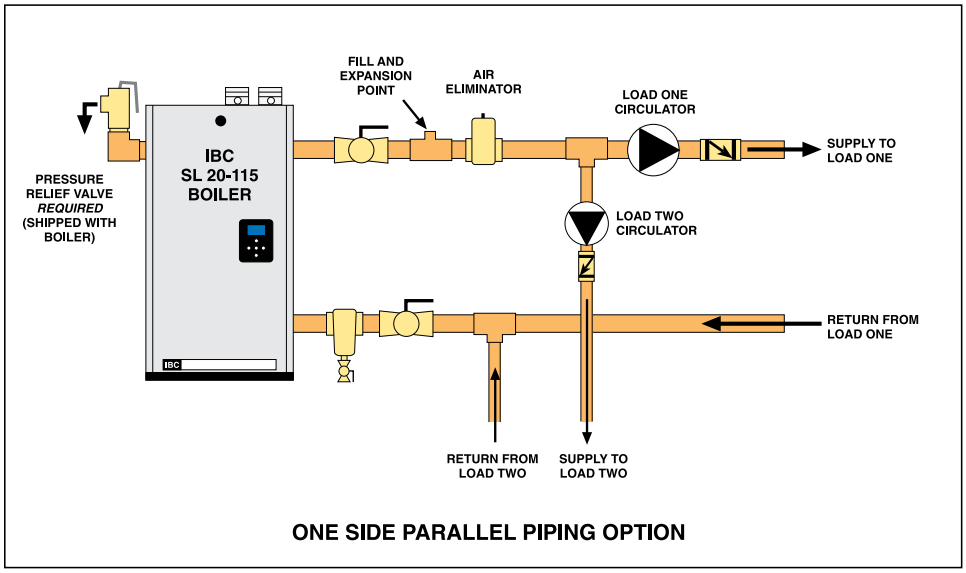


Figure 30: Parallel piping connection to one side

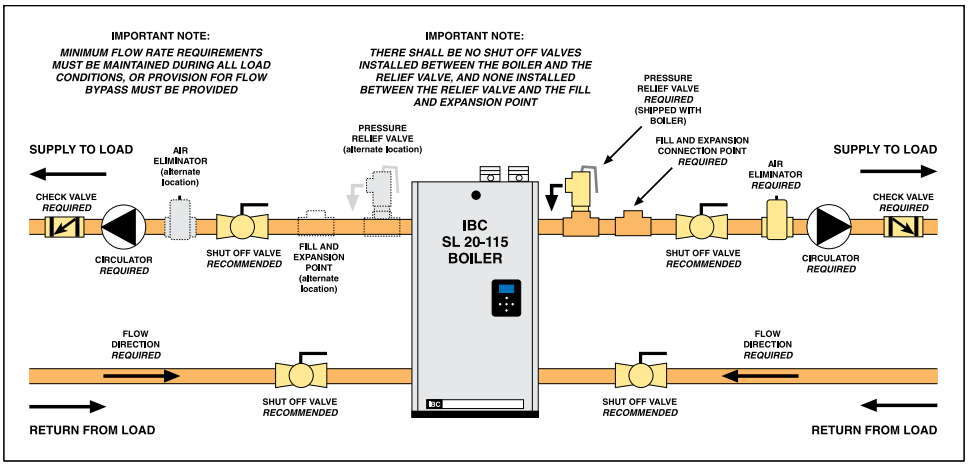


Figure 31: Parallel piping connection to two sides

⚠ 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.

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.

The SL series modulating boilers offer exceptional matching of heat generation to radiation. The low minimum firing is better suited to low thermal loads presented in a typical multi-zoned radiation system. However, where individual zones in a heating system have loads under 10,000 Btu/hr, the system will still benefit through use of a buffer tank to ensure a controlled supply temperature, and to prevent short cycling. Buffering should be added on the secondary piping of the relevant load, to avoid bulking up the thermal mass of the primary piping circuit (and potentially lengthen the duration of the transition from hot to cool loads).

SL modulating series boilers can be connected directly to a floor of non-oxygen barrier polybutylene material (PB tubing). For maintenance of warranty on such systems, we require evidence of a thorough flushing of all loops, plus installation of a dirt separator or side stream filter. A separator/filter maintenance routine shall be carried out after the retrofit, with filter clearing after the 1st day, 1st week, month and annually thereafter. Care is to be taken to avoid use of ferrous fittings and pumps on PB tube systems.

1.6.2 Basic System Piping Arrangements

PRIMARY / SECONDARY PIPING - BENEFITS AND INSTALLATION RULES

1. Good circulating water flow through the boiler irrespective of load or radiation system head
2. Allows flexible ΔT° control in secondary loops
3. Adds to the system's thermal buffering, to assist in handling small loads and temperature transition.

A Primary / Secondary piping configuration requires an extra pump, independant from any secondary load pumps. The SL series modulating boilers' controller hosts wiring terminals and integral relays to simplify installation and operation of this preferred layout, offsetting such costs.

For optimal performance, place pumps on the supply side of secondary loops to facilitate air evacuation. Use pumps with internal check valves to avoid ghost flows and thermal siphoning.

The primary loop temperature may need to transition from a 180°F domestic water heating load to a 100°F radiant floor requirement. The secondary pumps will swap off/on simultaneously, *provided the pre-set maximum allowable temperature of the new load is not exceeded.* In the case of the typical maximum limit for a radiant floor (most would enter 140°F); the floor pump would remain off, the boiler shut down, leaving primary circulation on until the primary loop temperature drops into the acceptable range for the floor. Temperature sensing is done using thermistors at the boiler supply and return – no further sensors need to be installed.

⚠ 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.

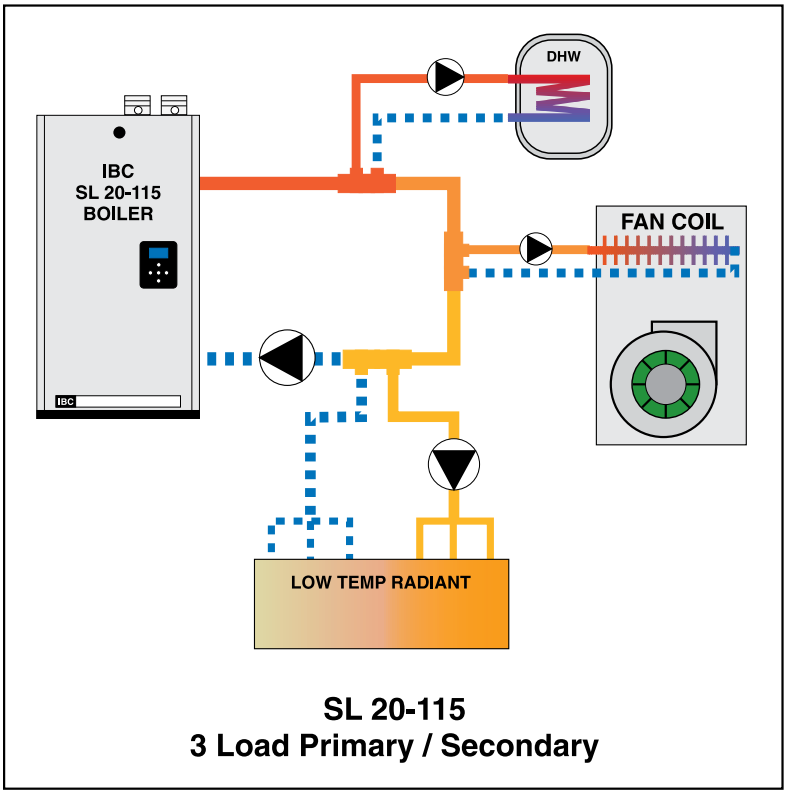


Figure 32: Basic Primary/Secondary, 3 load piping concept

The use of the multi-temperature modulating system is optimized when the need to shutdown the boiler is reduced or eliminated during the transitional period. System design enhancements: (a) keep a relatively low thermal mass in the primary loop, and (b) incorporate a 3-way mixing valve on the “cool” load piping.

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).*

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 to130°F, for example) wired to the boiler’s auxiliary interlocks.

PARALLELL LOAD PIPING - BENEFITS AND INSTALLATION RULES

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

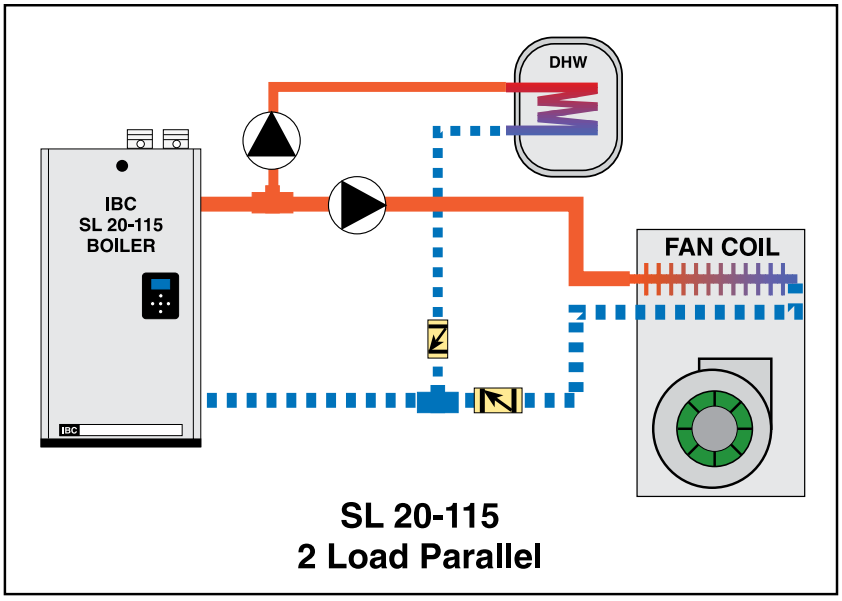


Figure 33: Two pump, two load - parallel piping concept

Wiring: in a parallel piping application, disconnect the wire from the Pump Block, terminal 11 (P/V Power - L), and isolate it using a wire nut, crimp connector or other secure means to prevent the bare wire from contacting anything. Install a wire into the Power Block, terminal 1 (BP - L), and jumper up to Pump Block, terminal 11 (P/V Power - L). This procedure will allow the boiler to operate the load pumps through the Boiler Pump contacts.

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 (2 USgpm).

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

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).

MULTIPLE BOILER PIPING - BENEFITS AND INSTALLATION RULES

Multiple IBC boilers can be installed in a single heating system to provide redundancy, increased output, and greater heating plant turn-down capabilities. Primary/Secondary piping must be employed, and each boiler must be installed with its own pump as illustrated above. This approach provides constant head and flow at each boiler, regardless of flow variations in the main building loop.

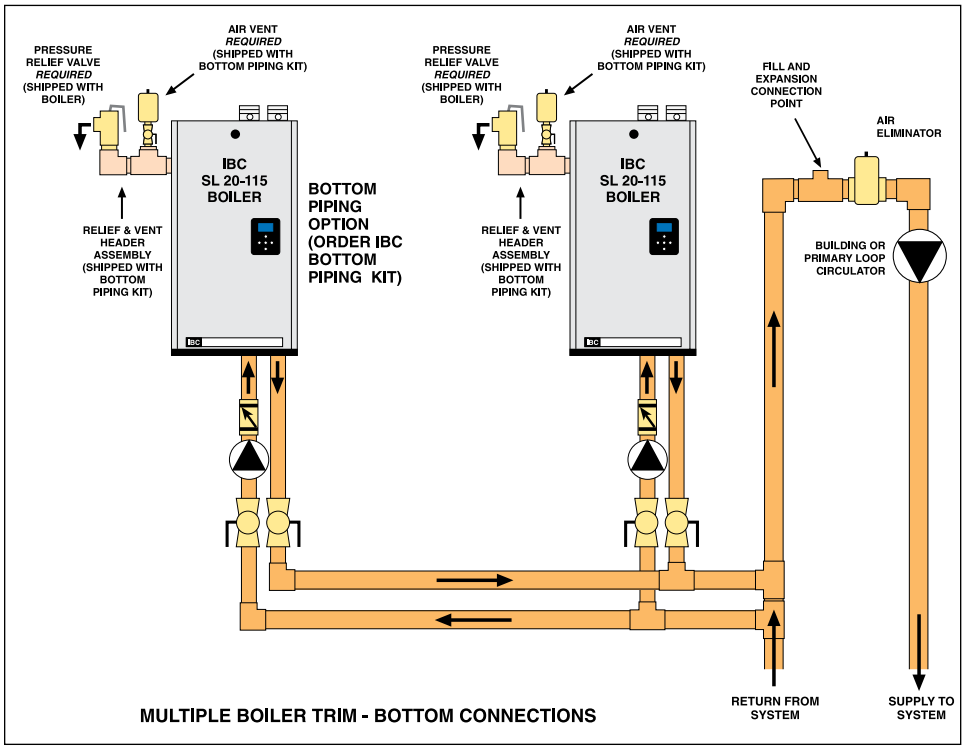


Figure 34: Multiple boiler piping concept

Each boiler will control its own pump, turning it off or on when heat is required. This approach saves electricity by reducing the pumping power required as load conditions are reduced. One boiler control is set up as a "Master" boiler, and up to 23 additional boilers can be added to the system as "Subordinate" boilers by connecting a twisted pair of wires between the boilers. No additional controls are needed.

Check valves are to be used in each boilers piping to prevent reverse flow when the boiler is off.

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).*

1.7 GAS PIPING

⚠ WARNING

This boiler model can burn either Natural gas or Propane if equipped with the correct burner. The boiler should be ordered from the Factory configured for the correct fuel. Examine the rating plate of the boiler to ensure it is configured for the fuel you are using. If the boiler is configured for Natural gas, and it is to be converted to Propane, a conversion kit must be ordered from IBC and the gas valve adjusted accordingly. A boiler configured for Propane can be converted to Natural gas with gas valve adjustments. Refer to section 3.3 for further instruction.

Failure to perform the required fuel conversion can result in an immediate hazard.

Natural gas burner (left)
Propane burner (right)

⚠ NOTE

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.

The boiler requires an inlet gas pressure of at least 3.0" w.c. for natural gas or propane. 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 of the boiler's gas valve is 1/2" NPT (female).

Adequate gas supply piping shall be provided with no smaller than 1/2" Iron Pipe Size (e.g. Iron Pipe Size (IPS) and using a 1" w.c. pressure drop, in accordance with the following chart:

MODEL	1/2" IPS	3/4" IPS	1" IPS
SL 20-115 (Natural Gas)	30'	125'	400'
SL 20-115 (Propane)	90'	350'	1,000'

Table 7: Maximum Pipe Length (ft)

Gas piping must have a sediment trap ahead of the boiler's gas valve *(see Figure 25)*. 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 38)*. Note that manifold pressure varies slightly in accordance with firing rates with the modulating series boilers, but will always be close to 0" w.c.

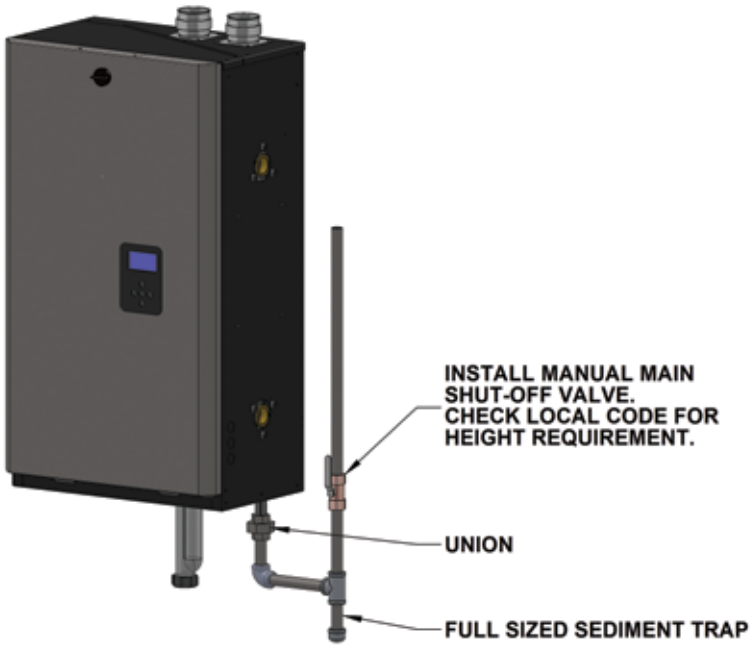


Figure 35: Typical gas piping connection

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 in the IBC control have a maximum rating of 5 Amps or 1/3 H.P. each, with a maximum total allowable draw of 10 amps.

Isolation contactors MUST be used if electrical loads exceed these maximums.

All Electrical wiring to the boiler (including grounding) must conform to local electrical codes and/or National Electrical Code, ANS/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 4 typical residential size pumps) is less than 4 amps.

If primary / secondary piping is used, with pumps to manage multiple loads, add a 12" pigtail to bring 120v to the bottom pair of contacts on the Pump/ Zone Valve Terminal Block located on the upper right-hand edge of the controller. The upper 3 pairs of contacts on this green connector strip are then powered to manage up to 3 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 (OK for loads up to 1/3 HP; for more – use a protective relay). *The green Pump/Valve terminal strip is not pre-wired because some installations will use it to manage 24 v zone valves.*

The 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).

If a parallel pump piping configuration is used rather than primary/secondary, loop the White/Yellow *Primary Pump* pair up to connect this to the lowest pair of contacts on the green Pump/Valve terminal strip, then connect the two load pumps in the normal way – this will bring power to the pump control block.

Pumps can be switched on/off using the keypad, 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 an "Insufficient 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 fusing.

⚠ 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.

Terminal Strip for:
- *Thermostat/switch Inputs*
- *Sensor inputs*
- *Auxiliary Interlocks*
- *Network Wiring*
- *External Control Signal*

⚠ DANGER

Do not connect thermistor sensors to "Therm" terminals. An overheating hazard can result in serious personal injury and/or property damage.

⚠ NOTE

The IBC control only recognizes a true dry contact closure as a call for heat on terminals "Therm. 1, Therm. 2 or Term. 3. Thermostats and other devices that use a "Triac" output cannot be used as a call for heat without the installation of an intervening relay with dry contacts to connect to the IBC terminal strip.

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. 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 3 loads are provided as marked on the lower / orange 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. Where these zone valves are of a non-isolated 3-wire configuration, the zone valve end contacts must be isolated from the load's controller thermostat terminal using an appropriate relay. Required input for enabling the IBC boiler is a dry / mechanical contact; ensure that triac or other parasitically-powered units are not used.

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 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.*
- A final 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 β = 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.

A 2.5 mm Slot screwdriver is required for the bottom terminal strip. Broader or narrower blades may damage the terminal screws.

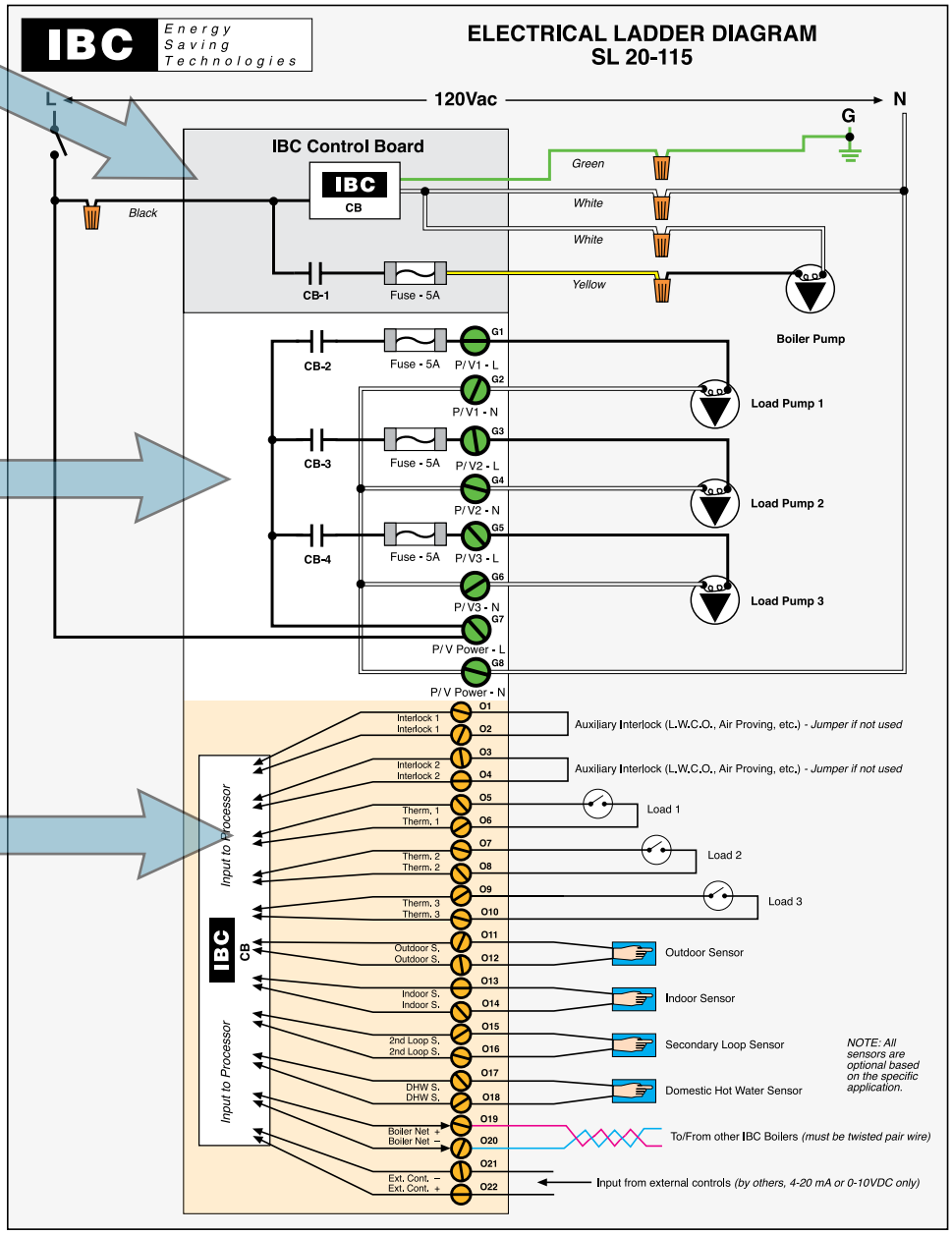


Figure 36: Electrical Wiring Connections (full page ladder diagram at back of this manual)

2.0 BOILER SYSTEMS AND OPERATION

2.1 GENERAL

⚠ 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.

Residential SL series modulating boilers are designed to service three separate, directly piped heating loads using different pre-selected water temperatures and heat regulation routines. External controls can extend applications.

The control is outfitted to provide for outdoor reset, set point regulation and DHW. The design objective is DHW plus radiant floor and baseboard space heating, each operable at a unique temperature.

While the three load “channels” are shipped pre-programmed with default values, they can each be programmed with DHW, set-point control or outdoor reset parameters *(see Section 2.7 Set Up and Load Definition).* The strategy is to deliver high temperature water, as required by most indirect DHW tanks on the market, and by finned tube baseboards, but default to the lowest possible boiler supply temperature to maximize efficiency. The SL modulating series boilers can handle supply temperatures within the range 34°F to 180°F.

2.2 CONTROL

The control unit provides overall management of boiler operations, including:

1. Power-up / set-up / boiler state machine (standby / heat call management etc).
2. Burner, pumps (primary + external) and/or zone valve management.
3. Temperature and throttle operation.
4. Maintenance of a service log with diagnostics.
5. 2 way communications.

Operating and historical data may be accessed at any time, using the Log and Advanced Settings fields, available using the permanently lit LCD screen. *See below.* Data includes the following:

- Ignition counter
- Time records, including burn time by load and the throttle duty cycle
- Error log

2.3 USER INTERFACE

2.3.1 Keypad Functions

A five button keypad is provided for intuitive navigation around the screen. The four outer keys are used to move the cursor up or down, and side to side. The centre button is used to make selections and confirm inputs. The left hand key is also used to back-step to the previous screen; multiple key stokes are used to withdraw back to the operating status screen.

2.3.2 LCD Display

Upon power-up, the LCD screen initially flashes a software release number then switches to a *Standby-* display mode, showing real time data plus key temperature target settings.

When there is a call for heat from any load, that load is identified at the Status line *(e.g. Heating – RFL (for radiant floor) in place of Standby)*. The Target temperature for the relevant load is conspicuously displayed while that load is being handled.

NOTE: The Status line displays those loads that are heating or calling for heat. In this instance *("Heating 3DHW")*, Load 3 has been set up as DHW and is actively heating, with no other loads calling for heat. If you saw *("Heating 3DHW C:1RFL")*, it would indicate Load 3 DHW is actively heating, while Load 1 (Radiant Floor heating with Reset) is shown as requiring heat but awaiting its turn. If a third load has been implemented and is also calling, the Status line display would expand to show the relevant details.

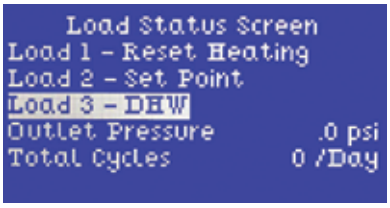
LEGEND:

- **RFI:** Radiant Floor with Reset
- **CIR:** Cast Iron Radiators w/ Reset
- **BBd:** Baseboards w/ Reset
- **AIR:** Air Handler w/ Reset
- **StP:** Set Point
- **DHW:** Domestic Hot Water

Other information is accessible using a menu based system – described in the following sections.

2.4 ACCESS LEVELS

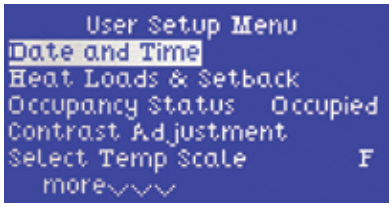
The controller provides for the display of further information (via the *Load Status Screen*) plus three levels of access for the adjustment of control settings. This is done to simplify the control interface for the user while retaining field access to the full functionality of the system for the appropriately trained heating professional. The split access feature offers a layer of security against adventurous "finger trouble", including accidental adjustment to settings that could lead to inefficient operation (e.g. excessive cycling) or dangerous conditions.



To access the *Main Menu*, touch any key. Move the cursor up or down using the top and bottom keys.

The *Load Status Screen* offers a comprehensive summary of all settings and actual readings for each heating load, eliminating a need to jump between screens while doing an extended watch of boiler operation.

NOTE: where the word "more" is displayed at the bottom or top of a screen, it is possible to see more lines by moving the cursor in that direction.



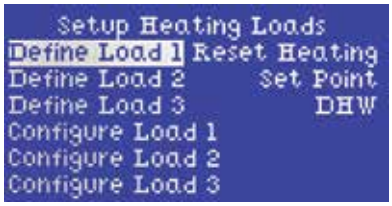
2.4.1 User setup

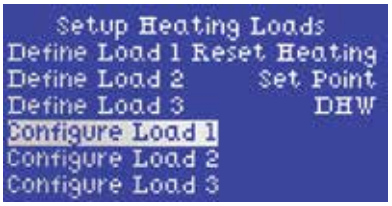
The occupant has access to a number of practical settings. The most meaningful include adjustment of the indoor temperature target plus the temperature setback and occupied / unoccupied modes. The User Menu also provides access to the time & date fields, provides the means to toggle between C° / F° plus allows adjustment of the screen image itself *("Contrast Adjustment").*

2.4.2 Installer Setup

The installer has access to all *"User"* adjustable fields plus a much wider selection of inputs. Loads can be declared and configured, with temperature settings appropriate to the characteristics of the heating system.

Key issues here are selection of appropriate boiler supply temperature criteria for the type of emitter, and the establishment of practical temperature differentials (e.g. DHW tank target vs. boiler supply). A record of the service history is also available for onscreen access.





2.4.3 Advanced Diagnostics

Not an access level, this field allows a view into detailed sensor readings and operating parameters such as fan rpm. This screen is useful for advanced troubleshooting of pressure sensors, etc.

2.4.4 Advanced Setup

This access level is set for the sole use of factory representatives and is permanently password protected.

2.4.5 Passwords

A Password access feature is loaded on the controller, for use in situations where there is exposure to unauthorized and / or uneducated adjustment. The installer is encouraged to consult with the user to determine the need for ongoing access to settings. In risk situations, the password feature can be invoked by selecting *"Password On/Off"* and toggling to *"On"* in either or both of the User and Installer menus.

Pre-set passwords are used:

- For the User the code is "11111" followed by "enter"
- A common "installer" code is also used, to ensure continuing access even with a change in service personnel. Contact IBC for access to this password.

2.5 SEQUENCE OF OPERATION

The control module has 5 cycles during normal operation, as well as an error mode for problem detection:

1. Standby cycle
2. Purging
3. Ignition cycle
4. Heating cycle
5. Circulating cycle
6. Error mode

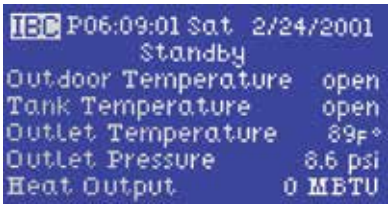
Each state is explained below. A flow chart for the sequence of operation can be found in the back of the manual.

GLOSSARY OF TERMS

This glossary briefly defines some terms used in the Sequence discussion.

- **Call for Heat:** The thermostat indicates that room temperature is below the thermostat setting.
- **Heat Required:** Temperature sensors on the boiler indicate that water temperature is below the water temperature target or setpoint.
- **Heating Enabled:** The boiler is powered and there is a **Call for Heat**, **Heat** is **Required**. The boiler will start and enter the Heating Cycle unless it is in an error mode.

2.5.1 Standby



Waiting for a *Heating Enabled* signal. The burner and boiler pump are off during this time.

2.5.2 Purging

PREPURGE

On a *Heating Enabled* signal, the boiler automatically enters a prepurge cycle.

The fan starts and automatically adjusts to a level suitable for ignition. Ten seconds later, the pump starts. After a total of 15 seconds, the ignition cycle begins.

INTERPURGE

The boiler enters an interpurge cycle if ignition is unsuccessful. The fan and pump continue to run, and ignition is delayed by an additional 15 seconds.

POSTPURGE

The fan remains on for 20 seconds and then reduces airflow to an ultra low flow mode for 90 minutes unless preempted.

The pump remains on for 5 minutes (adjustable) after the **heating** cycle ends.

If the **heating** cycle ends as a result of water temperature exceeding the load specific band limit, the **postpurge** will continue as normal, but the boiler will enter the **circulating** mode.

The cut off temperature levels are specific for each load; they are determined using the preset target plus ½ of the supply differential entered. Default values for such differentials are 22°F (+/- 11°F) for space heating with outdoor reset and 20°F (+/- 10°F) for DHW and other set point loads,

If there is a *Heating Enabled* signal any time during this cycle, the postpurge ends, and a prepurge begins, otherwise the boiler will enter Standby mode.

2.5.3 Ignition

After the prepurge, the gas valve opens for 4.0 seconds.

If no flame is detected at the end of the trial, the **interpurge** cycle is entered. If ignition fails 3 times successively, the boiler locks out for a 1 hour long interval, after which the ignition cycle is refreshed (e.g. for 3 further attempts). Alternately, the boiler can be powered down and restarted to accelerate the re-try sequence. The homeowner should follow up persistent recurrence of the 1 hour reset routine by contacting a qualified service technician, to evaluate the cause of such ignition irregularity.

With a successful ignition, the output of the boiler decreases immediately to a low level, and the heating cycle begins.

2.5.4 Heating

The heating cycle lasts until the *Heating Enabled* state ends (for all loads), or until water temperature exceeds the target temperature by ½ of the supply differential for the last served load and the throttle has fallen to the minimum output. At the end of the heating cycle, the boiler enters a **postpurge.**

During the heating cycle, the boiler addresses the multiple defined loads in accordance with its Prioritization algorithm *(see Section 2.6.1)*. Boiler output changes to meet heating demands as indicated by the temperature characteristics of the boiler supply and return water. Boiler supply water temperature targets vary according to the set up parameters entered, and are subject to further variation for loads where Outdoor Reset has been selected. Where thermal loads are within the boiler's 20 to 115 MBH throttle range, the control algorithm seeks to regulate the boiler supply temperature within ±3°F of the target temperature. On/Off differentials apply to loads below the 20 MBH minimum input rating.

2.5.5 Circulating

This cycle operates when water temperature exceeds target by 1/2 of the supply differential for that load at minimum output, and call for heat is still present. After entering a **postpurge**, the system pump remains on until water temperature is 1/2 of the supply differential below setpoint temperature.

The boiler can also enter the Circulating mode during transition from a high temperature load (e.g. DHW at 180°F) to a cool target (e.g. radiant floor on Outdoor Reset, at perhaps 90°F). In the case in which the temperature is outside the applicable differentials, the burner will shut off while the pump remains on

until the loop drops ½ the differential below the new load target temperature. Note: if there is no place to sink heat during such Circ. mode, this phase will continue indefinitely, affecting heat delivery.

Thermal shock avoidance is key. Wherever two or more loads are used, and settings could permit supply temperature differences greater than 20°F, external 3-way motorized or injection mixing is recommended.

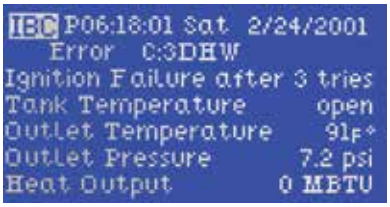
A thermal shock avoidance routine is employed to avoid undesirable effects of large temperature swings: the hot load pump remains on until the boiler's return water sensor detects temperature stability - to sink excess heat. For example, upon satisfaction of a DHW call the DHW load pump will remain running until the boiler return water temperature falls to the DHW tank target temperature. This deposits legacy heat from the primary loop into the water tank before activation of a cooler load.

Always ensure that loads sensitive to high temperatures are protected using appropriate means - e.g. a three way mixing valve set to restrict entering water temperature to 130°F.

2.5.6 - Error Mode

The controller continually checks sensors to see that they are operating within normal parameters. If sensors indicate the boiler is operating outside it limits, it will declare an error condition.

Two types of error conditions can occur:



- **Soft Errors:** result when an abnormal condition exists which does not present an immediate safety hazard. The boiler enters an extended purge, followed by the error cycle of 5 minutes for all conditions other than Maximum Ignition Trials (a modified Hard Error which locks out for 1 hour after 3 unsuccessful ignition attempts). Following the purge, the fan and pump are stopped until the end of the error cycle. Normal operation then resumes.
- **Hard Errors:** result when a condition exists that may be a safety hazard. The boiler enters an extended purge then the fan and pump are stopped. The boiler is in a lockout, and must be checked and restarted by a service technician.

With software versions 3.10.0 and higher, the boiler offers an error status signal feature. *Please see IBC Technical Note: Boiler Status – Analog Output.*

See Section 5.3.1 Control Panel for a list of hard and soft errors and their likely causes. Note that other problems such as disconnected wires or defective sensors may be the cause of the error. Always check connections and wiring first.

2.6 OTHER OPERATING FEATURES

2.6.1 Prioritization

The control module hosts a scheduling routine to manage the boiler's operation when more than one load has been defined. Typically, loads declared as DHW receive significant - but not absolute - priority. A time vs. differential system will allocate heat amongst each of up to 3 loads over time.

Multiple heating loads - with varying temperature targets - are run *sequentially* as opposed to *simultaneously* (with a mixing valve). The objective is to serve each load at the minimum possible temperature, as opposed to running hot then mixing down – with hardware, saving the related hardware and fuel cost. The approach optimizes the low temperature combustion benefits of direct cool

running of a radiant floor. The large throttle turndown range coupled with outdoor reset means that several loads can receive heat in-turn, with less on/off duty cycling than would occur with other heat sources.

The boiler is shipped with default values for each type of declarable load (e.g. DHW, radiant floor). The preset variables for DHW (a value of 80 on a 20-90 scale) give it substantial priority, which declines over time if another load is calling. Spacing heating loads (with Outdoor Reset) are given a default value of 35, while other SetPoint loads start with 50 points. Over time, such points are transferred between the loads in accordance with the system rules. The boiler will automatically shift between loads once the points totals reach an upset value. Upon a load transfer, the burner will modulate down to its base level and will then throttle up as required for the new load. If competing loads have not been satisfied at the load switch stage, the control will register the firing rate and will return rapidly to such rate on the next rotation.

Heat-apportioning can be altered using the keypad in the password protected *Installer* input section. For instance if Baseboards (set up with Outdoor Reset as Load 3) are not providing the desired heat, the on-time of the baseboards can be increased by increasing the Prioritization value relative to the other declared channels (e.g. moving the Load 3 preset value from 50 to 60 or reducing another load's value). Temperature targets for the under-served load could also be raised in this example. The basic function is that the the difference between settings equals the run time (in minutes, for the initial cycle) of the higher load setting before switch-over to the simultaneously calling load, e.g. DHW with priority set to 80 will run for approx. 35 min. before switching to a clashing load set with priority 45. Following such initial cycle, the clashing loads will switch back and forth after further 10 min. intervals pending satisfaction of one or both loads.

To cause repeated unequal run times (for example, constant 35 vs 5 min. runs) it is necessary to integrate an external load removing relay or timer on one of the heat calls (contact the Factory for details).Do not set each load to the top value, and it is generally better to avoid equal ratings. Note: the priority scale values do not need to add up to 100 – they are relative only to each other.

⚠ NOTE

US law effective Sept 2012 requires residential heating boilers under 300,000 btu/hr to be equipped with *Automatic Means* of boiler water temperature adjustment in relation to heat demand. This boiler offers such control but also a means to override it. See the inside back cover of this Manual for a message in respect of the use of such override.

2.6.2 Load Pairing

With software versions 3.10.0 and higher, the controller allows two loads of compatible temperature settings to be run together. *See IBC Technical Note: Load Pairing for further details.*

2.6.3 Reset Heating

The boiler offers Outdoor Reset control as standard equipment; this coordinates the control of boiler supply water temperature for space heating with the outdoor temperature. Outdoor Reset offers enhanced home comfort and efficiency by using variable water temperatures to compensate for the differing rates of heat loss that a building faces as outdoor temperature changes. At any outdoor temperature *above the coldest day expected*, it automatically uses lower heating temperatures than would otherwise be used. This saves energy without sacrificing comfort.

When applied within a condensing boiler, outdoor reset offers direct and significant combustion efficiency benefits by allowing generally lower circulating water temperature. This provides cooler return water to the boiler, promoting more condensation (= energy capture).

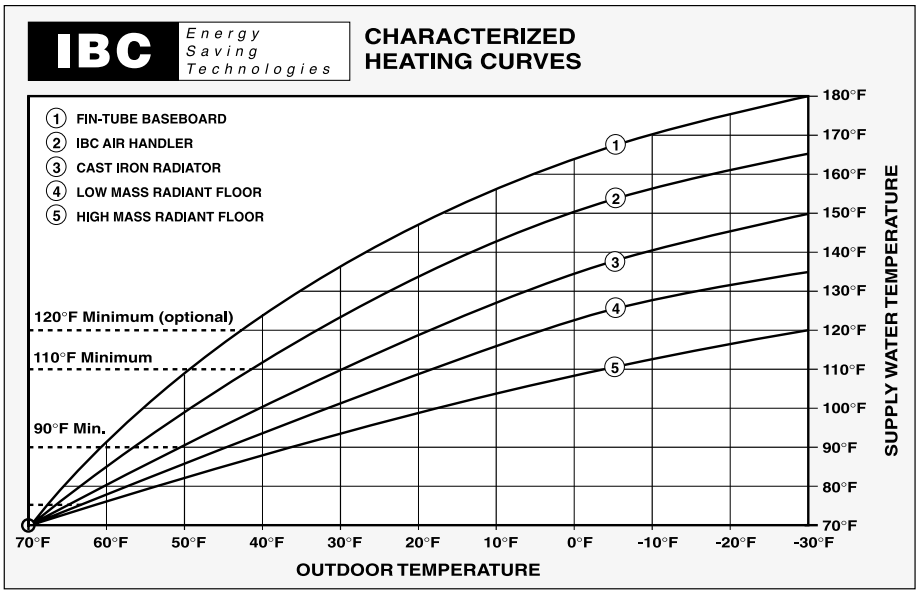


Figure 37: Outdoor reset curves

Contacts are provided for connection of an outdoor sensor (a *tekmar 070* or similar sensor is shipped with each boiler) to be placed in an appropriate outdoor position. The temperature management algorithm flexes the boiler supply temperature according to characterized heating curves that are automatically called up through the load declaration process. Curves are provided for each of the radiation terminal types offered - e.g. high or low mass radiant floor, air handler, finned tube baseboards etc.

In an “open loop” reset system, a room or zone thermostat is used to send a call for heat over a 24VAC lead; this opens the respective zone valve, and signals the boiler to fire using onward leads to the boiler’s dry contacts (use one of the pairs marked “Therm 1, 2 or 3” on the orange connector terminal located on the right edge of the controller). Gang such leads in parallel from multiple zone valves for single connection to the boiler. Note that typical room thermostats simply provide a call for heat, they do not control the circulating water temperature from the boiler in an open loop reset system. Adjustment of a room thermostat from 23°C to 30°C will make no further difference to the delivered temperature if the floor slab has stabilized at the boiler temperature served up by the reset curve.

Where Outdoor Reset is applied without the indoor sensor feedback option, some manual adjustment may be required to achieve the desired comfort level. Fine adjustment can be made at the keypad using the *Indoor Setpoint Temperature* variable, located as Line 1 in the User screen. To increase heat (e.g. from 72°F to 73°) - move the Indoor value upward (warmer) from the level otherwise chosen. This shifts the position of the reset curve, will amend the boiler water temperature by a similar amount. Do not adjust the *Design Indoor Temp.* value - a movement upward in concert with Line 1 adjustment will have the effect of neutralizing the intended effect.

An optional indoor temperature feedback routine can be activated (with field installation of an indoor sensor, connected to the contacts located on the controller) to automate adjustment of the Outdoor Reset routine.

The key inputs on initial set up are (1) *Design Outdoor Temperature* – the coldest expected weather typically experienced at the installation site; (2) the *Design Supply Temperature* – the desired boiler operating level to occur at that coldest day; and (3) the *Design Indoor Temp.* - this is the value that anchors the reset curve. The *Indoor Set Point Temp.* variable is the primary means for the user to “bias” the outdoor reset routine to add or reduce heat.

If outdoor reset is selected and there is no signal received from the sensor, the controller assigns a provisional 0°C value and will adopt the appropriate temperature target from the relevant reset curve.

See Section 2.7 Set Up & Load Definition for activation procedure.

2.6.4 Variable Speed Pumping

This section reserved.

2.6.5 Temperature Setback

For heating loads declared as Space Heating (e.g. with *Outdoor Reset*) and/or *DHW (where a thermistor probe is used),* there are provisions for entering temperature setback intervals. During the setback period, the boiler supply water temperature target is adjusted from the pre-set fixed or floating (with *Outdoor Reset*) levels. There is a simultaneous movement in the *Indoor Setpoint Temperature* or *DHW Tank Setpoint,* to yield a consistent spread and avoid undesirable cycling. Normally users would apply this feature to achieve fuel savings during night-or-away hours. It is also possible to use the feature to set forward (up) the temperature; this may be of use for certain commercial applications where short-term high temperature DHW service is desired.

Up to 56 events / week can be programmed for each eligible load – for example, DHW can be set back twice and returned (twice) each day. The routine can be applied by specific day (Mon-Sun).

The automated setback feature cannot be applied to setpoint loads, including DHW with simple aquastat control. This is due to the lack of linkage with the thermostat; setback without linkage could lead to unacceptable cycling.

Access is via the *User Setup* screen.

2.6.6 Unoccupied Mode

Users can further reduce energy consumption by switching the boiler to the unoccupied mode during holidays or other away periods.

While in the Unoccupied mode, the DHW load is turned off, while Space Heating loads for which Outdoor Reset is activated will drop both the circulating water and the indoor setpoint temperature parameters to 50°F. Set Point controlled loads are not adjusted through this process, to avoid the potential for boiler cycling as there is no linkage with the relevant thermostat.

On the main *User Setup* Menu, select *"Occupancy Status"*, then toggle between *Occupied* (top button) and *Unoccupied* (lower button) as desired.

2.6.7 Summer Shutdown

During the Installer set up process, a cut-off level for outdoor temperature can be selected - to curtail any further space heating. This is typically used to turn off an Outdoor Reset enabled load once the outdoor temperature reaches a threshold level e.g. 60°F. The load will be automatically reactivated once the weather returns to levels below the selected threshold. Use of this feature with a value 5° - 10°F below the *Indoor Setpoint Temperature* is strongly recommended to avoid short cycling of the boiler during very marginal heating conditions.

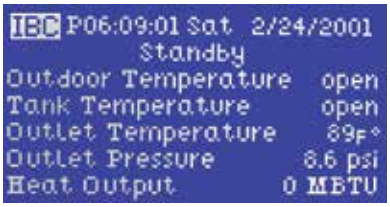
From the main Installer Setup Menu, select *"Heat Load Configuration"*, then *"Configure Load (use the load number tagged as Space Heating)"*, and drop down to "Summer Shutdown". Press Enter to select, then use the keys to move the threshold temperature to the desired level, and press the centre key again to record. The controller must receive a valid signal from the *tekmar 070* outdoor sensor, supplied with the boiler, to operate.

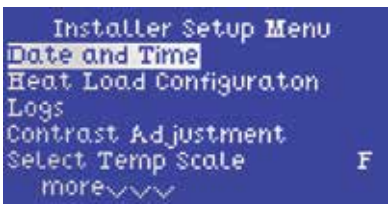
2.6.8 Remote / Subordinate Mode

Installers have the option of placing the control of the boiler under an external electronic controller (such as a *tekmarNET* © control). Connections are provided to receive a 0-10vDC or 4-20 mA signal for throttle management. The default configuration is 0-10V; to switch over to 4-20mA, remove the electrical box corner cover to provide access to the slotted clearance hole on the lower right corner of the control module; use needle-nose pliers to move the plastic jumper tab from the right two terminals to the left two terminals accessible through the slotted clearance hole. Where the IBC controller senses a signal on the remote connections, it automatically subordinates its internal throttle logic, and adopts the external signal. In such slave mode, temperature management is also surrendered to the external controller's sensors. The installer only enters Maximum Boiler Supply and On/Off Differential temperatures; the boiler will respond to these as high limit switches.

From the main Installer Setup Menu, select *"Define Load (with desired #)"*, then locate and enter *"External Control"*. Next, configure the load with the Maximum and Differential temperature values.

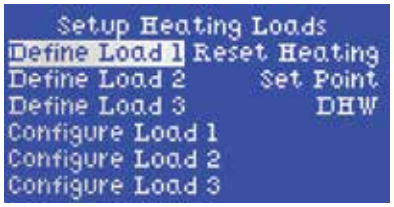
2.7 SET UP & LOAD DEFINITION

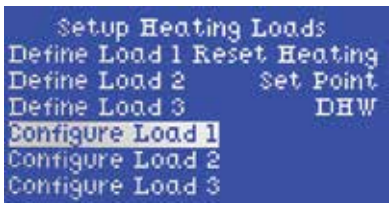




After the boiler is powered up, the installer can use the keypad and display to characterize the application, as follows:

1. In the *Standby* mode, start by pressing any key to call up the *Main Menu.*
2. Using the directional keys, move the cursor to *Installer Setup,* then depress the centre *(Enter)* key. *See Section 2.4.5. Passwords* if these are in use or desired.
3. Select *Date & Time* (and Enter), then move the cursor about to adjust time (on a 24:00 hour basis), date and invoke Daylight Savings if appropriate. Use the upper key to increase a value (e.g. date, time, temperature), the bottom key to reduce. Note that it is often possible to move in steps of 10 or 100 by moving the cursor right or left once a field has been selected for adjustment. Hit the *Enter* key to record the desired / amended information after each value has been selected.
4. Use the left-most key to step back to the *Installer Setup* screen, and select *Heat Load Configuration* for input of the load characteristics.





5. Each of the boiler's 3 Load positions can be configured for any type of heating. SL boilers are factory shipped with default settings as follows: Load 1 set as *Space Heating* or *Reset Heating,* with H*igh Mass Radiant Floor* set as the terminal type; Load 2 as Set Point; and Load 3 as DHW. The factory defaults can be changed using the *Define Load 1-2-3* lines to reverse the order, turn off a Load or do whatever the installer desires.
6. Once the appropriate *Loads* are set, use the left-hand key to move back to the *Setup Heating Loads* screen, then move down to *Configure Load 1* (and hit enter).
7. The screen will display the input fields appropriate to the nature of the load selected, e.g. *Design Outdoor Temp.* for a *Space Heating* (or *Reset Heating*) load. Note: these fields are pre-loaded with default values that are to be altered to reflect the desired parameters.

8. For reset loads, the initial selection to be made addresses the "emitter" type – choices include H(high) Mass Radiant, L(ow) Mass Radiant, Baseboard, Air Handler etc. An appropriate reset curve is called up through this procedure. Reset loads carry a default value for *Design Outdoor Temp.* of -10°F (-23°C). Raise or lower this as appropriate – e.g. for Vancouver or Seattle, use 19° to 25°F, while for Edmonton or Fargo -30°F would be more appropriate. Note: - for some users, this adjustment may seem counter-intuitive. Moving the setting toward a colder design value will have the effect of *reducing* the boiler's target temperature for any given weather, because a given current condition is relatively warmer than the designated "coldest" day.

Moving down the screen, set the *Design Supply Temperature* – the targeted temp. for circulating water on the coldest day. For an in-slab radiant floor this would typically be 125°F (50°C). For finned tube baseboards typically driven at 180°F, try 160°F max. instead, to promote combustion efficiency. For air handlers, try running 20°F lower than typically used. Of course, the appropriate setting will depend on the characteristics of the emitter and the building but in general the SL modulating boiler's large throttle turndown will allow better *average* temp. control, permitting lower *maximums.*

9. For Reset Loads, move down the screen again to display more lines;

   Use the *Summer Shutdown* field to enter a threshold temperature for the avoidance of heating during warmer times. This is typically set at 60° to 65°F so as to eliminate excessive boiler cycling in marginal heating conditions.

   Use the *Minimum Temp.* field to optimize boiler run times on low mass loads. Finned tube baseboards sink very little heat when operated below 100°F; application of a "full reset curve" (e.g. 160°F right down to a 70°F room target) would cause boiler cycling in light-to-moderate heating conditions. Set baseboard minimums at 100-120°F and aim for 4 or less cycles/hr. A minimum setting can also be used to enhance home comfort with single or excessive speed air handlers to avoid the cool blast effect. Set the lowest possible level for combustion efficiency.

10. For all loads, select and enter a *Maximum* allowable temperature and on/off *Supply Differential Temp.* Note these values must be input; they are not automatically assigned as done within some boiler controls. Ensure the Maximum takes account of the construction and safety requirements of each application – e.g., 140°F max. for typical in-slab radiant floor, for avoidance of thermal stress. The Differential shall be set to offer a reasonable temperature control range (suggested values: 22°F for high mass radiant // 30°F for low mass baseboards // 16°F for DHW). Ensure that the spread between the *Target* and *Maximum* temps is greater than one half of the *Differential* (e.g. for a radiant floor *Design Supply Temperature* of 125°F and a *Maximum* of 140°F, a differential of 20°F (half of which is 10°F) fits nicely.

11. Avoid situations where the *Maximum* is close or below the potential Target, or the boiler will cycle off its (software) water high limit.

12. Priority:- where more than one load is present, it is critical that a value be entered to allow reasonable load scheduling *(see Section 2.6.1).*

13. At the lower end of the Load 1-2-3 setup screen, there are 4 lines available for "mapping" of sensor inputs.. For example, *"Indoor Temp. from …..Indoor"* indicates that the boiler will look for a signal from an indoor sensor on the Indoor Sensor wiring contacts. Failing a valid signal, the screen will display *"Indoor Temp. …..Open"*, and there will be no effective indoor trim of the reset curve. These lines do not require amendment at most installation sites. The mapping feature allows reassignment of the sensor contacts to support non-standard functions. For example, re-allocation of the Water Temp. signal from "(boiler) *Outlet*" to *"Secondary Loop"* will allow the throttle management routine to manage a secondary loop temperature rather than the boiler's own direct supply temperature. Use this when injecting into a commercial heating: cooling loop. Another possibility: two separate reset channels – each with its own indoor trim. Sensor ports open for such re-assignment are DHW, Indoor, Outdoor and Secondary Loop.

14. The final 3 lines are for the motorized mixing valve option. *See separate documentation for this.*

15. To compensate for altitude at the installation site, use the *Altitude* adjustment feature, found in the front *Installer Setup* menu (several lines below *"Heat Load Configuration"*. Key in the altitude – in hundreds of feet above sea level. For example, an installation at 2,860 feet should be entered as "29" (as rounded to the nearest hundred).

16. Two lines below *Altitude* adjustment is the field for amendment of the primary pump heat purge time. To shorten the 5 minute post-firing period, reduce the 300 second interval to as low as 60 sec. Similar adjustment of secondary pump run time can be made in the *Heat Load Configuration / Configure Load 1,2,3* fields (down to zero sec.= off).

17. With software versions 3.10.0 and higher, the controller allows two loads of compatible temperature settings to be run together. *See IBC Technical Note: Load Pairing for further details.*

18. Upon completion of the input of load parameters, use the left button to step back through the menu system to return to the Operating Status screen.

19. To enact the control arrangements as input, it is necessary that the piping structure and system wiring are configured appropriately *(refer to Section 1.6.2 Installation Rules, page 1-20 for piping layouts and the Wiring Schematics on pages 6-4 and 6-5).* Ensure that DHW aquastat or thermistor probe leads, thermostat and pump (or zone valve) leads are connected at their respective contact points on the terminal block.

20. Forced shutdown: – use the *Heat Load Configuration* screen to switch off load(s) to remove a call for heat, if no other means are readily available. **Simple removal of power to boiler is to be avoided – this interrupts the moisture management routine.** Treat the unit as you would treat a computer, allowing an orderly shutdown.

3.0 STARTUP AND COMMISSIONING

3.1 LIGHTING AND SHUTTING DOWN THE BOILER

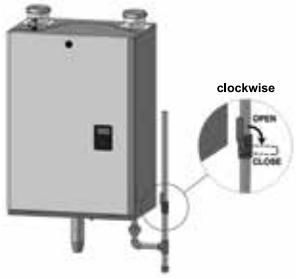
FOR YOUR SAFETY READ BEFORE OPERATING

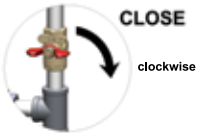
WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life

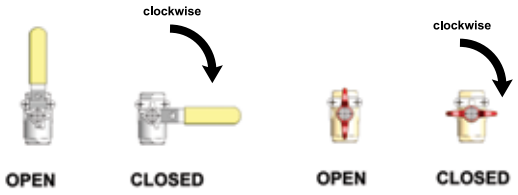
A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will 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.

⚠ 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.

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 keypad – without a call for heat. This greatly simplifies system filling and air bleeding (go to *Installer Setup*, drop down to *Pump Purge* and toggle 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 manual gas valve immediately outside the boiler case. Ensure boiler has shut off and the appropriate Error information is displayed on the LCD screen. To restart boiler, reset power.

3.3 COMMISSIONING

Inlet gas supply pressure test port

Manifold pressure test port

The SL 20-115 modulating boilers are factory calibrated to operate with natural gas (or propane if so ordered) at sea level. The Zero-offset valve adjustment cap has been factory sealed using red paint-seal compound. ***This cap must not be tampered with. The Zero-offset screw is not to be adjusted in the field.*** The 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.**

This boiler model can burn either Natural gas or Propane if equipped with the correct burner. The boiler should be ordered from the Factory configured for the correct fuel. Examine the rating plate of the boiler to ensure it is configured for the fuel you are using. If the boiler is configured for Natural gas, and it is to be converted to Propane, a conversion kit must be ordered from IBC and the gas valve adjusted accordingly. A boiler configured for Propane can be converted to Natural gas with gas valve adjustments.

Upon initial set up, the installer can enter the site elevation to compensate for altitude. Without such intervention, the gas valve will automatically de-rate the maximum input in accordance with the density altitude, by approximately 2% per 1,000' above sea level. The gas valve's zero governor will ensure that the gas:air mixture is not affected at altitude.

⚠ 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.

Zero-offset adjustment screw

Gas:Air ratio adjustment screw

Flue gas test port plug

⚠ 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.

To verify the proper operation of the gas valve in the field, the following procedure can be carried out by a qualified technician *(see Figure 38).*

1. 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 comissioning 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 Gas:Air Ratio Adjustment screw *(see Figure 38, "B")* to achieve 25% excess air (*see Table 8 below for corresponding CO2 values - set for CO2 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 Heat Load Configuration screen to turn load to off if no other ready means available), then remove the manometer connections, and turn the centre-screw in the manifold pressure test port 1 full turn clockwise. Ensure fully closed, but not over-tightened. Restore gas and soap test for leaks.

MODEL	HIGH FIRE		LOW FIRE		CO MAX PPM
	CO^2 RANGE	CO^2 TARGET	CO^2 RANGE	CO^2 TARGET	
SL 20-115 (Natural Gas)	8.4 to 9.6%	9.4%	8.0 to 9.4%	8.8%	< 100
SL 20-115 (Propane)	9.6 to 11.0%	10.7%	9.2 to 10.7%	10.1%	< 150

Table 8: Combustion test target ranges - CO^2 / Maximum CO

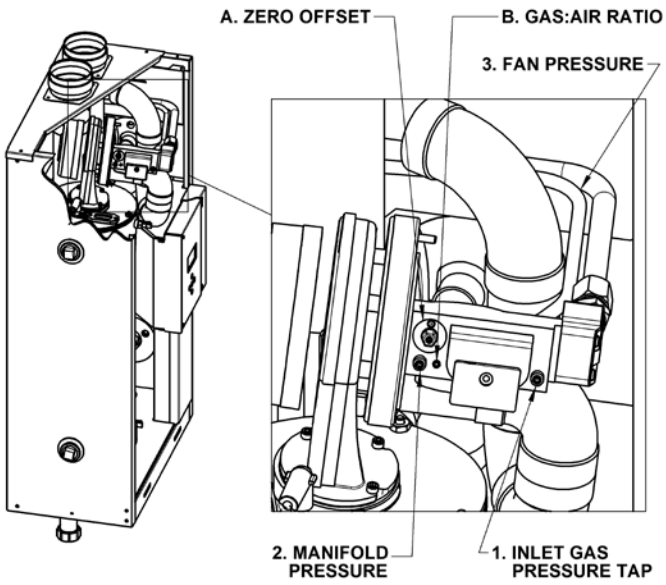


Figure 38: Gas Valve and Pressure Reference System

⚠ NOTE

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

Heat Exchanger Lid

Heat Exchanger Lid Hex Nuts

Heat Exchanger Gasket

Combustion Chamber Refractory

Heat Exchanger revealed

3.3.1 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 4 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 4 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 4 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 4 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.

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 3.3.1 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..*

⚠ CAUTION

The 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 3.3.1 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

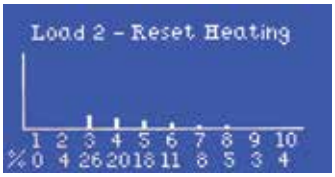
Check that the pump is on in normal operation and that the water Δ°T is reasonable for a given firing rate (e.g. 10°F between supply and return when firing at 50,000 Btu/hr.).

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 **Section 2.5 Sequence of Operation**.
- Check that water temperature targets and setpoint is satisfactory and have not been adversely amended.
- Check the operating history using the screen: - use *Installer Setup // Logs*, to scan for hours of service, cycles per hour, and any logged errors. One method is to use the graphical presentation of the duty cycle by load – go to Logs, move the cursor to a load and push "Enter" to access. This gives a profile of the boiler's duty cycle by throttle level (*see below).*



- 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.

⚠ 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

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.

4.1.11 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.

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

Note: Vent stack piping and air intake riser have been removed in some of these photos for clarity

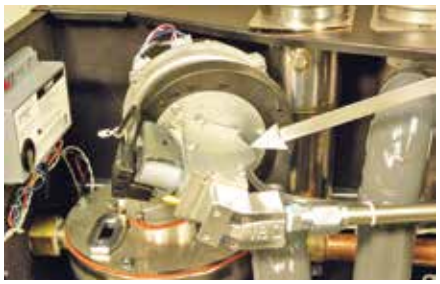

Removing front cover


Removing top service cover


Gas inlet connection on bottom


Gas supply line


Gas valve connection block


Gas valve

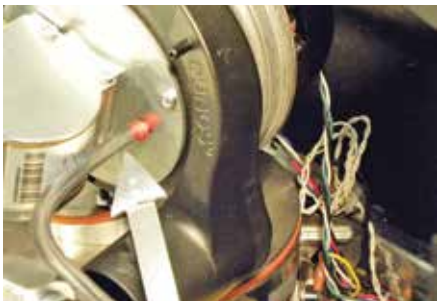

Ignition module


Sight glass (burner observation port)


Ignition wire boot


Fan housing


Fan motor


Fan pressure sensing tube


Fan pressure sensor


Combustion air intake riser


Combustion air intake riser


Removing combustion air intake riser


Removing vent stack


Vent temperature sensor bracket


Water temperature high limit switch

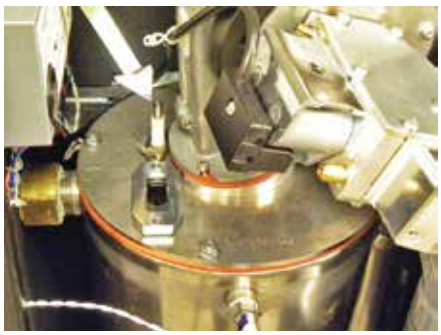

Upper vessel high limit switch


Outlet (supply) water temperature sensor


Inlet (return) water temperature sensor


Removing vent stack test port plug


Water pressure sensor


Ignition electrode/flame sensor


Fan coupler block


Control Module removal


Fan mounting screws


Fan/Burner Gasket


Gas valve connection block


Fan motor electrical connectors


Gas valve electrical connector


Fan pressure sensing tube

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 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. Disconnect (flare-fitting) nut on gas supply line.
10. Remove the 2 hex socket screws plus 2 hex nut screws that attach the fan to the fan coupler.
11. With the gas valve and swirl plate still attached, remove the fan by pulling straight out ensuring that no wires are caught. Place the removed components in a clean, dry area.
12. If the fan is being replaced: With a permanent marker or equivalent, make an alignment mark between the fan and swirl plate adapter and remove the 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 fan coupler, tightening the 2 hex socket screws and 2 hex nut screws by hand then an extra 1/2-1 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 the gas supply line JIC connector (flare-fitting nut).
9. Re-connect clear pressure reference tube onto swirl plate port.
10. Open up gas valve and check for possible leaks.
11. Return electric power to the boiler and perform start up routine.
12. 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 LCD 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 *(see Section 2.5.6 Error Mode.)*

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).
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 and pump is serviceable.

5.2 ELECTRONIC COMPONENTS

Supply water temperature sensor

Return water temperature sensor

Outdoor sensor (tekmar 070)

10KΩ Temperature sensors supplied with boiler (above)

See table #9 for resistance values

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 kΩ (5,000,000Ω) 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).

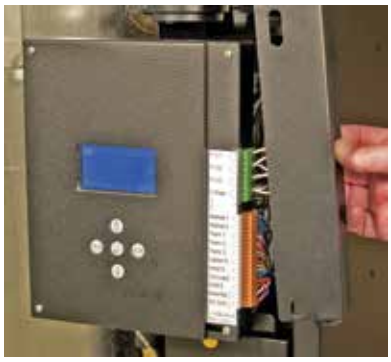
For the return water temperature sensor, locate the blue 2-wire leads coming from the strap on sensor on the return pipe. Disconnect the Molex connector located approx. 6" from the sensor. Place multi-meter probes into the sensor's female Molex connector socket. Do not apply voltage.

TEMPERATURE		RESISTANCE	TEMPERATURE		RESISTANCE
°F	°C	Ω	°F	°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

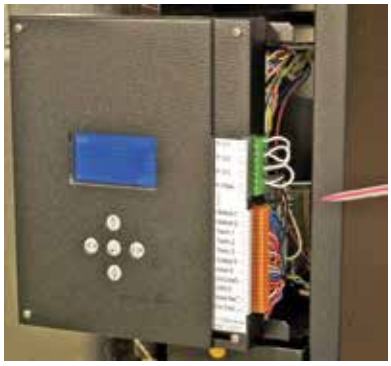
Table 9: Temperature Sensor resistance values

Control wire plug

Unplug to run fan full speed



Removing circuit board terminal cover



Remove terminal plugs, then circuit board cover

5.2.2 Fan/Blower

Operating power is provided by means of a separate 120 VAC 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 10: Fan Operation

5.2.3 Differential Air Pressure Sensor

Go to the *Advanced Diagnostics* screen, and with the fan off (*“Fan Duty Cycle* = 0) look for a *Fan Pressure* reading of 102 +/-5. Next check with fan in operation, and look for an increased *Fan Pressure* value. In normal operation, the *Fan Pressure* reading should move toward the *Required Pressure* value. A backward movement in *Fan Pressure* indicates the clear vinyl air pressure line has been connected to the wrong port on the sensor body.

Circuit board

Figure 29 (right): Test points on circuit board for air pressure sensor voltage readings

Air pressure sensor

Do not blow into sensor ports

Water pressure sensor

Water temperature high limit switch

Upper Vessel High Limit (UVHL)

Next, confirm that the circuit is properly powered. The supply voltage to the sensor should be 13.8 VDC; to check, the simplest technique is to measure the circuit on the face of the controller circuit board (vs. an attempt to splice into the harness / connectors). *See previous page for a presentation of the measurement points.*

Finally, to measure the sensor output, connect a DC volt meter between points "J501-33" (located on the footprint of the 34 pin connector – immediately below the right leg of the LCD display - second pin from bottom right) and GND *(see above).* With the fan off, the measure should read 0.5VDC. With a Fan Pressure of approx. 300, the meter will read 1.5v (approx.). Note:- this component is a sensor, not a switch; do not over-pressurize by blowing into the air reference lines. Maximum pressure capacity is 40" w.c. @ 20 C but only 10" w.c. @ 5C.

5.2.4 Water Pressure Sensor

Go to the *Advanced Diagnostics* screen, and check the top display line — Inlet Pressure. With the pumps at rest and system pressure of 12.5 psi, the *Inlet Pressure* sensor value should read 235 +/- 5.

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 signal 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 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.

5.2.6 Ignition Module

There are two approved ignition modules - Fenwal (grey) and Capable Controls (white). 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 Microamps (symbol µA) 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 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"). For conversion from Fenwal to the Capable Control, specify IBC part# 240-049 – that provides the module plus added wire lead and instructions. Flame current measurement is not possible on Capable Controls module.*

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

5.3 TROUBLESHOOTING GUIDE

5.3.1 Using Control Module Errors Displayed

SYMPTOM	DIAGNOSIS	REMEDY
AIRFLOW ERROR **LCD Screen Message:** *Error – Insufficient Air Flow* *Insufficient combustion airflow; soft error; will retry in 5 minutes* **⚠ WARNING** **Never attempt to repair the control module (circuit board). If the control module is defective, replace it immediately.**	**Check fan operation**	• 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 for fouled reference lines and air sensor	• 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 . • Ensure condensate trap is not blocked. • 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	In Advanced Diagnostics, during Pre-purge, Fan Pressure (FP) should move close to Required Pressure (RP); if FP only 120-150 vs. RP of 190-300, 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, plus page 4-6.*
	Water noise in vent. Excess condensate in venting.	• 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 **LCD Screen Message**: *Error – Ignition Failure after 3 tries* *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.*	**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 Capable Controls ignition module – 3/16" (5mm) With Fenwal module – between 1/8th and 3/16th (3.2-4.7mm)
	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
	Boiler ignites, but shuts off at the end of the ignition trial. Improperly grounded pressure vessel/burner or unserviceable ignition lead or spark module.	• Ensure 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
HI LIMIT ERROR *On boilers equipped with both Water high limit AND factory installed LWCO* **LCD Screen Message:** *Error – Water High-Limit/LWCO* *Water temperature exceeds hi-limit or water level is low. Boiler in hard lockout. Will reset in 1 hour. Consult service technician.*	**Check for illuminated red light on LWCO Control Module if boiler is equipped with factory installed LWCO option.** ***If equipped with Factory installed Water high limit only:*** a) Check for any evidence of actual excess temperature b) Check temperature sensors c) Check for flow problems d) Push reset button (cycle power off and back on after pushing reset button)	**Red light on** Water level OK - check manual reset water high limit: a) Check for any evidence of actual excess temperature b) Check temperature sensors c) Check for flow problems d) Push reset button (cycle power off and back on after pushing reset button) **Red light off** Water level low: a) Check air vent at top of boiler to ensure it is working and boiler is not air locked b) Check tridicator for correct water pressure c) Open water feed point (boiler fill valve or boiler pressurization unit) to make sure system is filled to operating pressure. *If boiler is filled but red light does not come on, check for power at LWCO control module (24 Vac between terminals 1 (yellow) and 3 (blue). Replace LWCO control module as required.*

SYMPTOM	DIAGNOSIS	REMEDY
VENT HI-LIMIT ERROR **LCD Screen Message:** *Error - Vessel/Vent High-Limit Exceeded *** Call for service!* *Vent temperature has exceeded the vent limit switch or the upper vessel high limit has been tripped. Boiler in lockout. Consult service technician.*	**Indicates one or both switches has tripped.**	• 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.
TEMPERATURE SENSOR ERROR **LCD Screen Message:** *Error - Max. In-Out Temp. Exceed. -> Check water flow Water temperature signal not within acceptable range. Potential flow or sensor failure. Consult service technician.*	**Current outlet temperature exceeds operating limit.**	• Check water flow.
	Defective or disconnected temperature sensor.	• Check wiring to temperature sensor and control module. • Check temperature sensor. *See Section 5.2.1.*
MISCELLANEOUS **LCD Screen Message :** *Blank – screen dark, but fan running Indicative of power-surge damage to appliance*		• 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 CO2 level via analyzer.
	Check for proper gas piping.	Check pressure with manometer during ignition.

SYMPTOM	DIAGNOSIS	REMEDY
BOILER WILL NOT ATTEMPT TO IGNITE. FAN AND PUMP ARE OPERATING NORMALLY.	**No power to ignition control module.**	• Check system wiring. • Check air reference tubing.
	Igniter probe/flame sensor disconnected.	Reconnect probe.
	Defective Control Module.	Check 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 *Table 3: Maximum Venting.*
	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 CO2 level is within specification.
	Dirty burner/heat exchanger.	Check pressure drop.
	Insufficient water flow due to improper piping.	Refer to recommended piping in *Section 1.6*

SYMPTOM	DIAGNOSIS	REMEDY
RAPID CYCLING	**Insufficient water flow due to undersized pump.**	Check manufacturer's rating charts/check temperature differential across heat exchanger.
	Insufficient water flow due to restrictions in water pipe.	Check temperature differential across zone/heat exchanger.
	Insufficient 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 CO2 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
INSUFFICIENT HEAT	**Operating temperature too low.**	increase temperature target. *See Section 2.7*
	Priority parameters or load configuration improperly set up.	Review load configuration parameters. *See Section 2.7*
	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 *Section 1.6*
	System pump undersized.	Check pump manufacturer's data/check temp differential across heat exchanger.
	Poor gas/air mixing.	Check CO2 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.

SYMPTOM	DIAGNOSIS	REMEDY
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.
	Insufficient radiation/ excessive heat loss.	Check actual length of pipe using radiation / heat loss calculation.
	Insufficient 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

6.0 DIAGRAMS

6.1 - PARTS DIAGRAMS

6.2 - WIRING DIAGRAMS

6.3 - SEQUENCE OF OPERATION

6.1 PARTS DIAGRAMS

SL 20-115 Modulating Boiler - Parts assembly

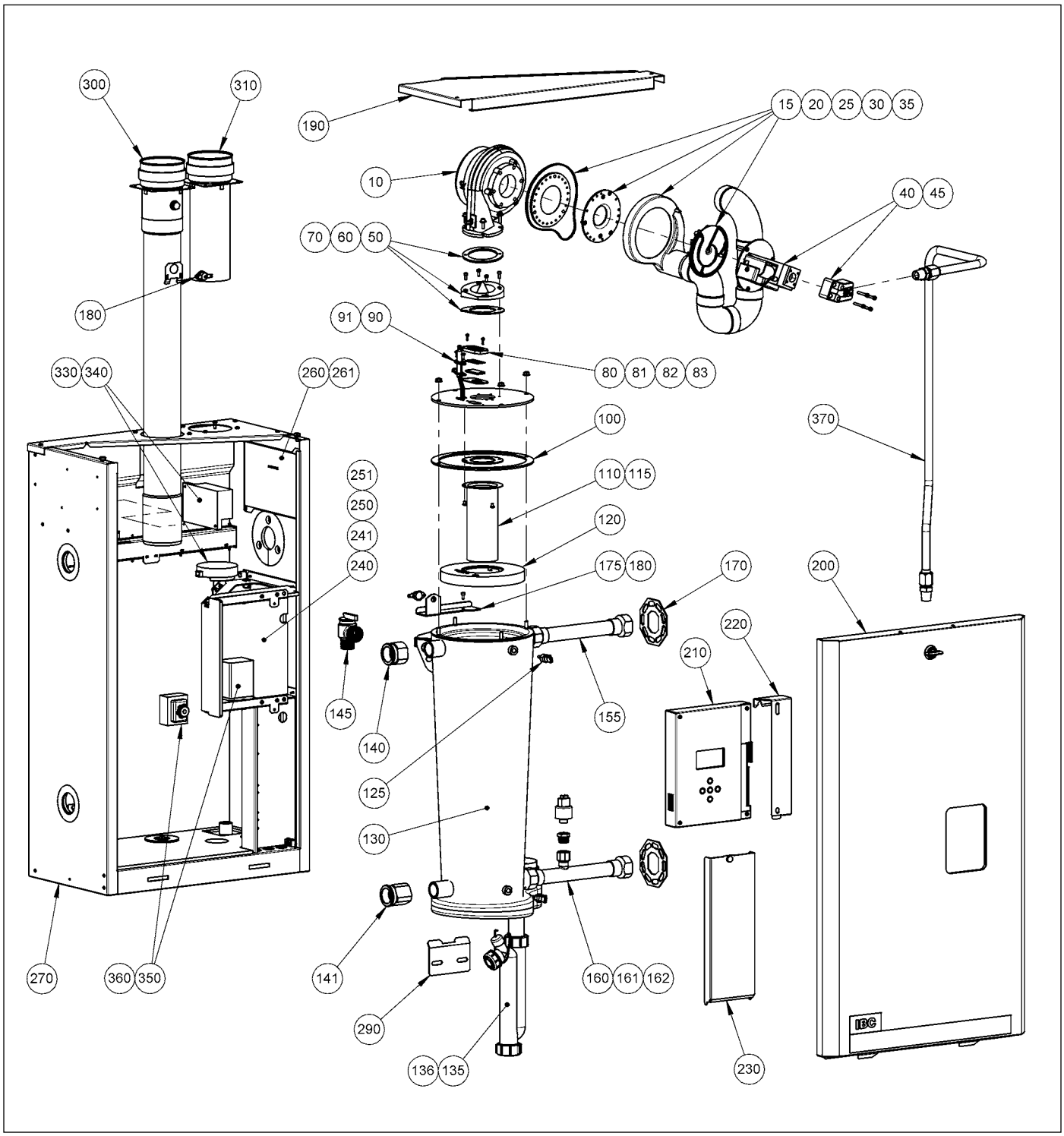


Diagram 6.1-1: Boiler assembly parts

Diagram 6.1-3: Intake Air Filter Assembly, IBC Part #SC-100A (Filter Element Alone is IBC Part #P-102A)

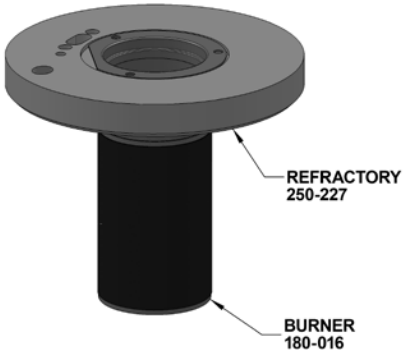


Diagram 6.1-4: Propane Burner Kit, IBC Part #P-103A

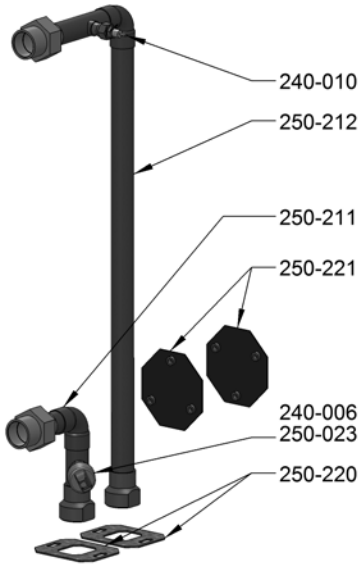


Diagram 6.1-5: Bottom Piping Option (Entire Piping Assembly is IBC Part #P-104A)

ITEM	PART NO.	DESCRIPTION	QTY
10	240-027	FAN	1
15	180-017	AIR INTAKE HOUSING BASE	1
20	180-010	FAN ADAPTER PLATE	1
25	180-018	AIR INTAKE HOUSING COVER	1
30	500-030	AIR INTAKE TUBE	1
35	180-014	AIR INTAKE SWIRL PLATE	1
40	180-008	GAS VALVE	1
45	250-174	GAS VALVE INLET BLOCK	1
50	250-224	FAN COUPLER GASKET	1
60	250-235	FAN COUPLER	1
70	250-194	FAN GASKET	1
80	250-057	SIGHT GLASS FRAME	1
81	250-058	SIGHT GLASS LOWER GASKET	1
82	250-059	SIGHT GLASS	1
83	250-060	SIGHT GLASS UPPER GASKET	1
90	240-002	IGNITOR	1
91	250-050	IGNITOR GASKET	1
100	250-192	GASKET, HEAT EXCHANGER LID	1
110	180-015 180-016	BURNER, NATURAL GAS ONLY BURNER, PROPANE OR NATURAL GAS	1
115	250-193	BURNER GASKET	1
120	250-189	HEAT EXCHANGER REFRACTORY, NATURAL GAS	1
125	240-009	TEMPERATURE SENSOR	2
130	250-184	HEAT EXCHANGER	1
135	180-013	CONDENSATE TRAP	1
136	250-103	HOOK, CONDENSATE TRAP	1
140	250-226	OUTLET COUPLER	1
141	250-225	INLET COUPLER	1
145	180-005	PRESSURE RELIEF VALVE, 3/4" NPT, 30 p.s.i.	1
155	250-196	OUTLET PIPE	1
160	250-204	INLET PIPE	1
161	250-023	SENSOR BUSHING	1
162	240-006	RETURN WATER PRESSURE SENSOR	1
170	250-191	INLET/OUTLET FLANGE	2
175	250-179	HEAT EXCHANGER CLAMP	1
180	204-030	TEMPERATURE SWITCH	2
190	250-171	CABINET ACCESS COVER	1
200	500-016	DOOR ASSEMBLY	1
210	500-001	CONTROLLER ASSEMBLY	1
220	250-039	CONTROLLER SIDE COVER	1
230	250-041	WIRING BOX COVER	1
240	250-177	CONTROLLER REAR COVER	1
241	250-207	REAR COVER INSULATION	1
250	250-188	CONTROLLER LEFT COVER	1
251	250-206	CONTROLLER LEFT COVER INSULATION	1
260	250-187	RATING LABEL PLATE	1
261	80-083	RATING LABEL	1
270	500-015	CABINET ASSEMBLY	1
290	250-223	HEAT EXCHANGER POSITIONING BRACKET	1
300	250-182	EXHAUST DUCT	1
310	250-181	INTAKE DUCT	1
330	240-004B	IGNITION MODULE (Alternate: Capable Control 240-049)	1
340	240-003	FAN PRESSURE SENSOR	1
350	240-005	LOW WATER CUT-OFF MODULE (OPTIONAL)	1
360	240-008	TRANSFORMER	1
370	250-210	GAS PIPE	1

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

6.2 WIRING DIAGRAMS

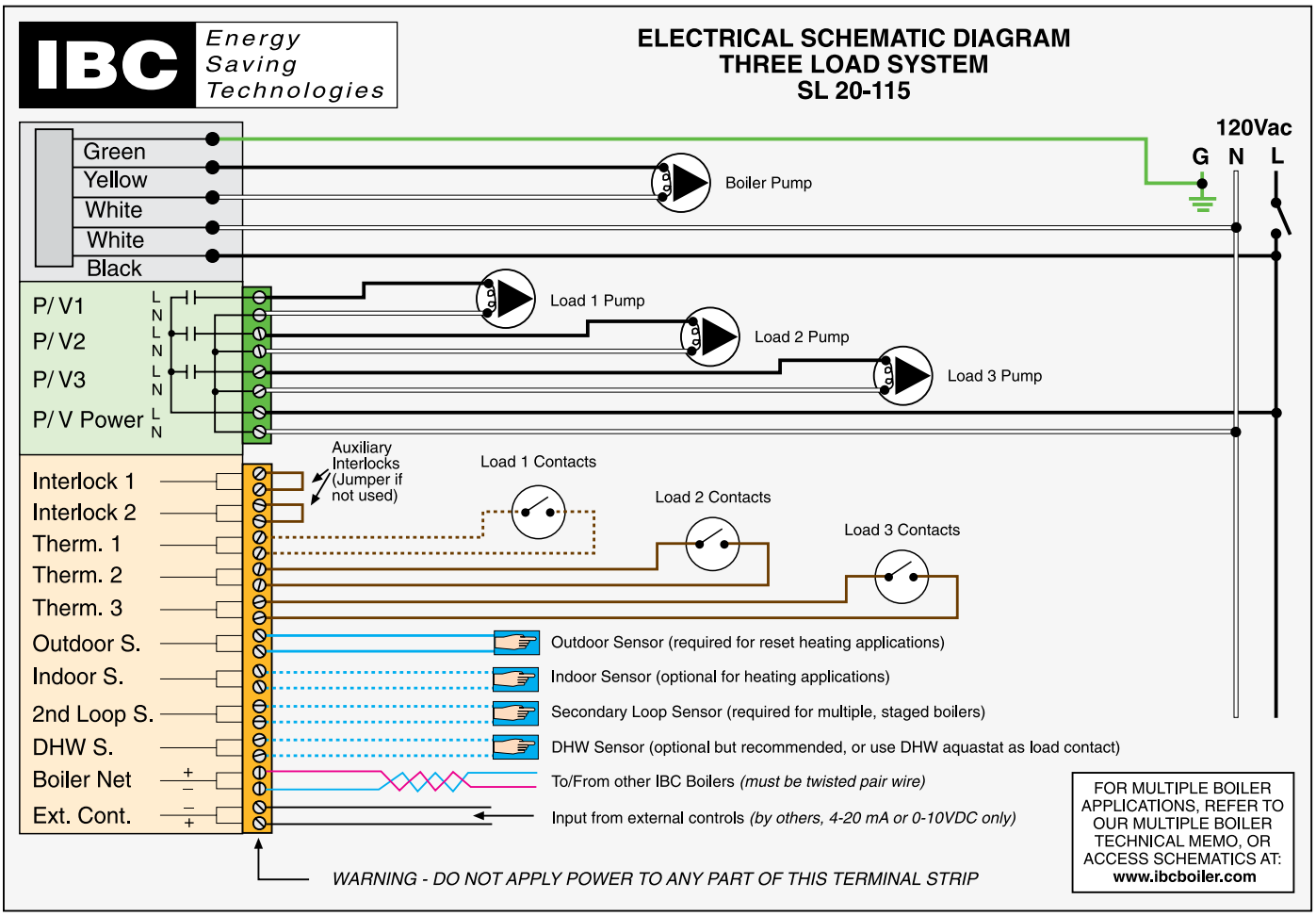


Diagram 6.2-1: Pictorial wiring diagram

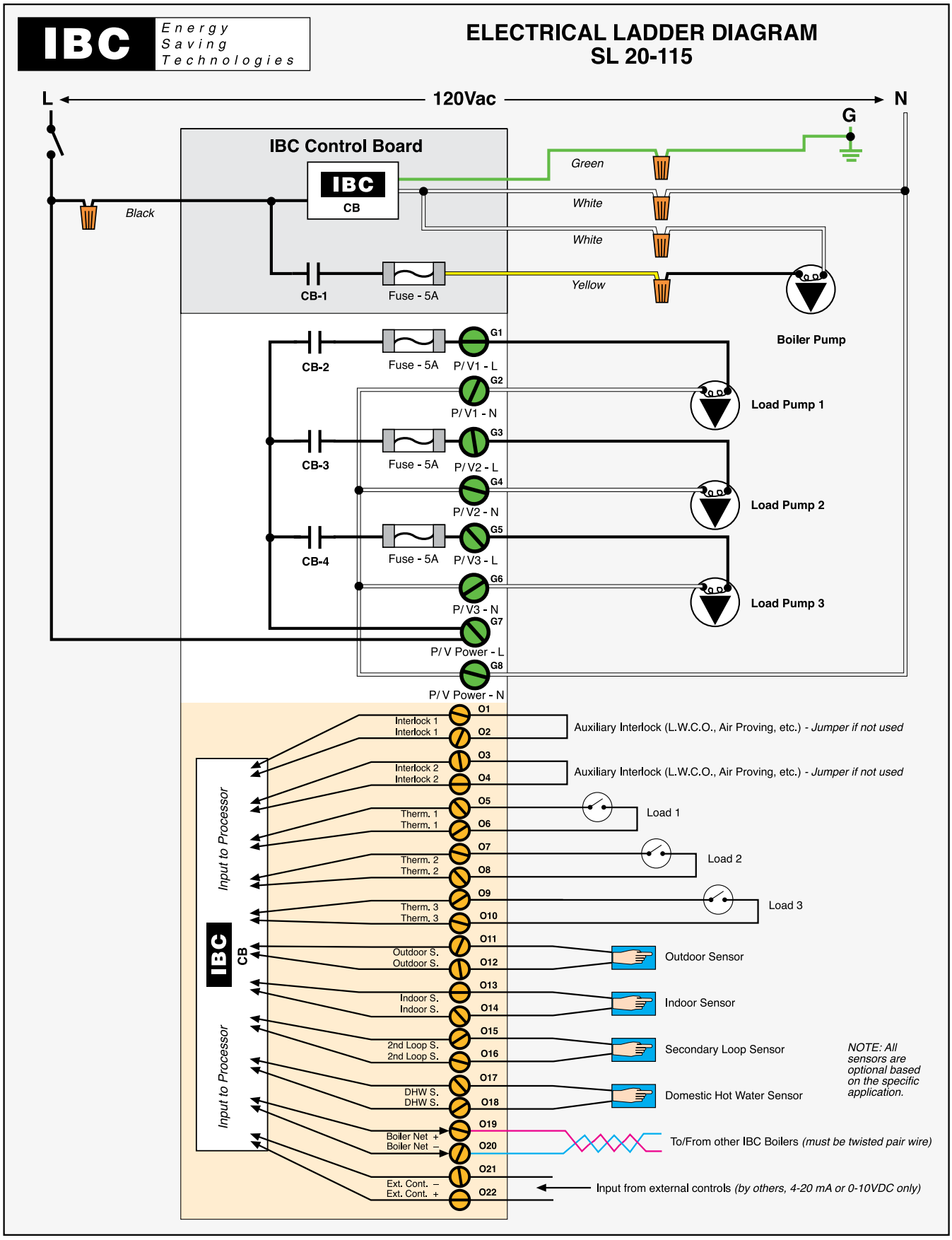


Diagram 6.2-2: Ladder wiring diagram

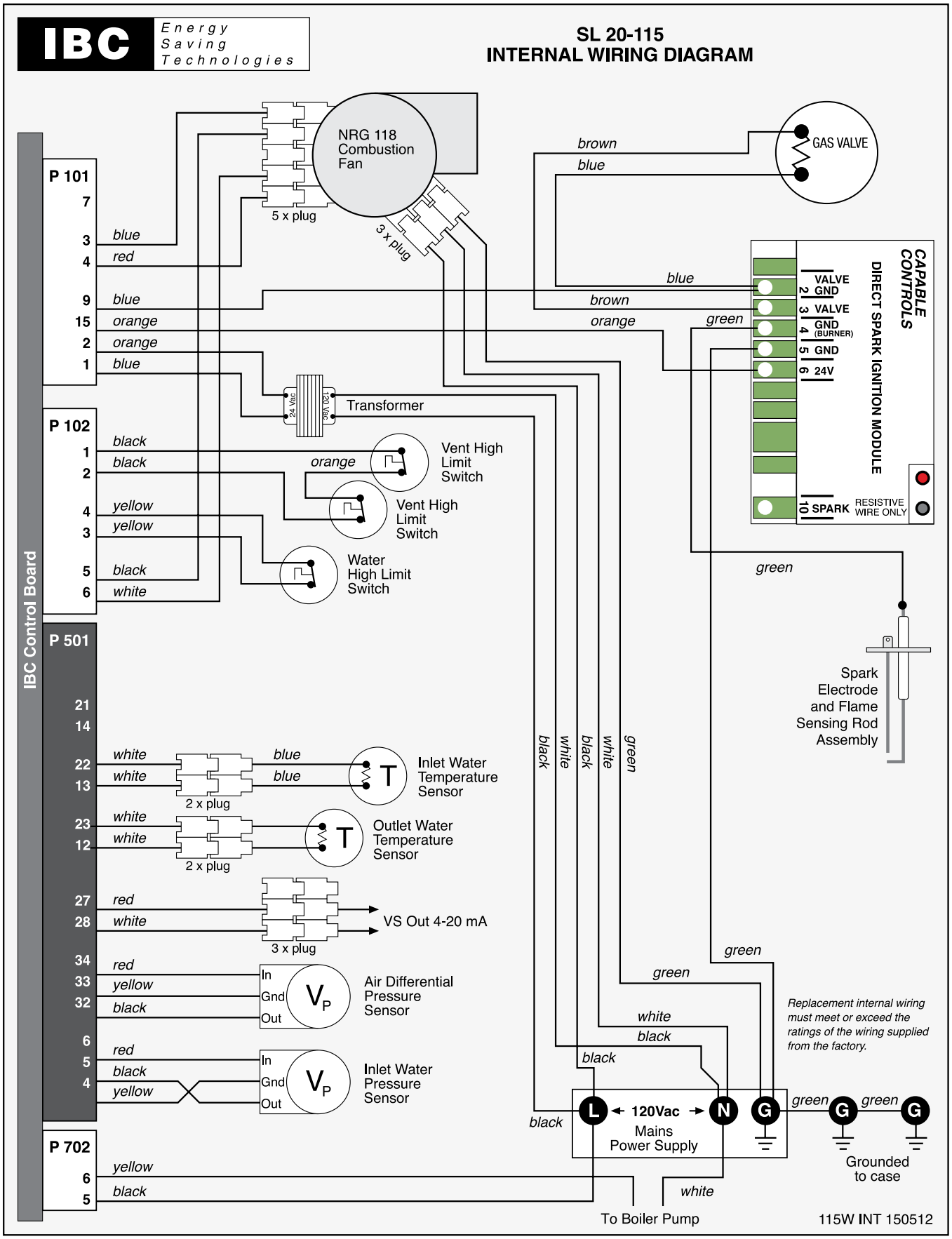


Diagram 6.2-3: Internal wiring diagram

6.3 SEQUENCE OF OPERATION

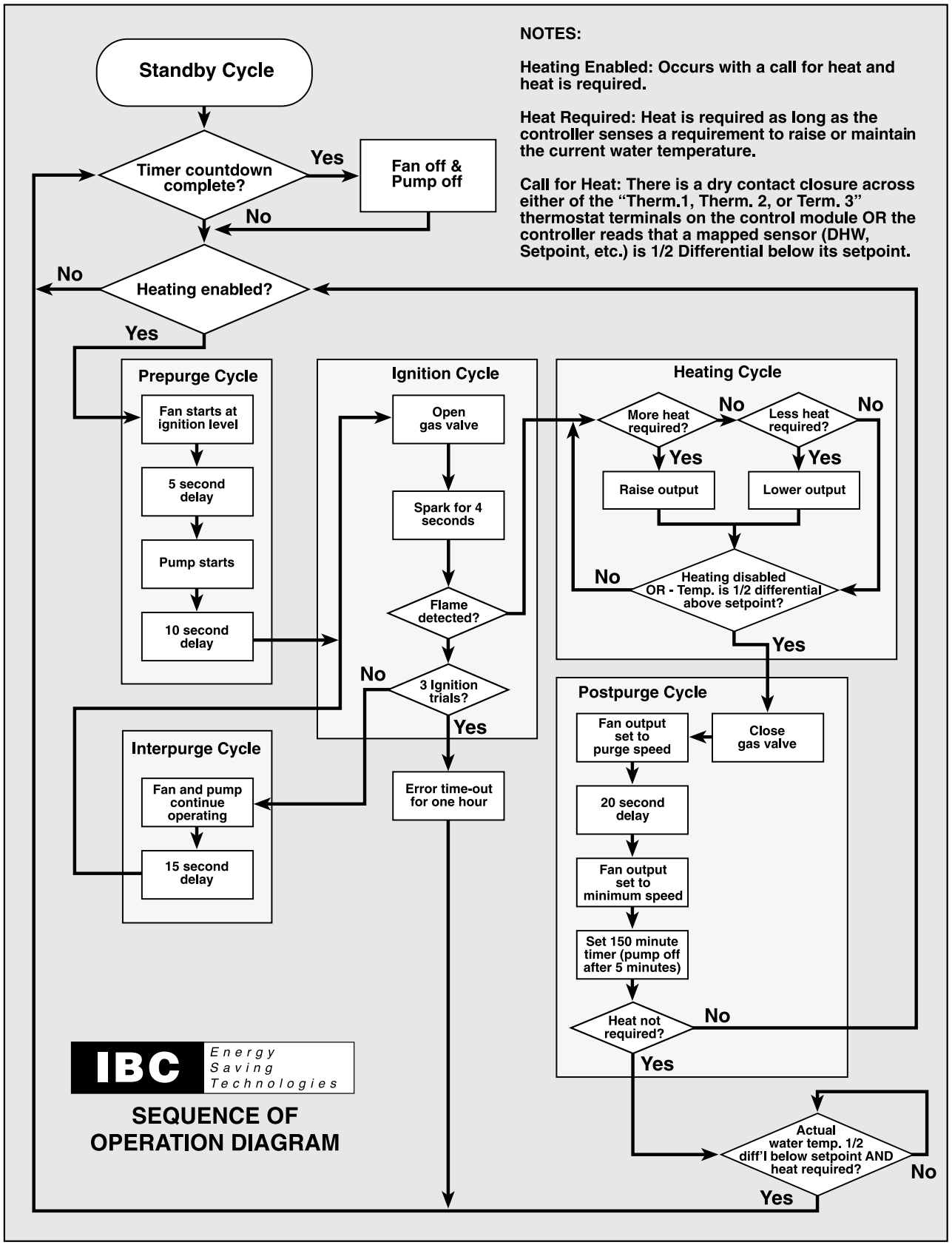


Diagram 6.3: Sequence of operation diagram

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 (go to *Installer Setup - - Pump Purge - - On,* and operate pumps until air has been ejected)

☐ 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 _____ µA - Low fire _____ µA

☐ Standby readings from IBC display screen - (remove all heat calls) - Outdoor Temperature _____ Tank Temperature _____ Outlet Temperature _____ Inlet Pressure _____ Heat Output _____

☐ Load Status Screen readings - Load 1 _____ Load 2 _____ Load 3 _____

☐ From Installer Setup Menu (scroll down) - Altitude _____ Prim. Pump Purge Time _____

Multiboiler Config. _____ (go to *Installer Setup - - enter* - this setting should be "Off" ***except*** for Master Boiler)

☐ Advanced Diagnostic Menu readings - boiler in Standby - (remove all heat calls)

Outdoor Temperature _____ Inlet Pressure _____ Flow Rate _____

Fan Speed _____ Required Pressure _____ Fan Pressure _____

☐ 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 - recommended, but optional (<u>required</u> for fuel conversion):

CO_2 _____ % O_2 _____ % 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

_____

SERVICE RECORD

DATE	LICENSED CONTRACTOR	DESCRIPTION OF WORK DONE

NOTES

As referenced on page 2-7 of this manual, the following message is relevant to users in the USA:

IMPORTANT

This Boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating.
- This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.
- This boiler is equipped with a tankless coil (not applicable to IBC's SL boilers).

US installers should contact IBC for any further information required.

REVISION HISTORY

R1 (DEC 2010) Initial release

R2 (SEPT 2012) Polypropylene venting, fuel mixture Table 8 and US Energy Act disclosures added

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