ABSOLUTE

Spire

Gas-Fired Condensing Hot Water Boiler

Installation, Operation & Maintenance Manual

Models; SP500, SP800, SP1000, SP1500, SP2000

SP3000, SP4000, SP5000, SP6000, SP8000 MBH

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ASME H

GAS-FIRED LISTED GAS-FIRED LISTED GAS-FIRED LISTED

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

- Do not store or use gasoline or other flammable vapors and liquids 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 neighbor's 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.

Innovative Industrial Inc.
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Installation, Operation and Maintenance

Safety

WARNING:

Before you operate this boiler, read this manual carefully and take extra precautions to all safety and warning symbols or important items. The operating manual is part of the documentation sent along with the boiler. The installer is required to explain the operation of the heating system and boiler operation instructions to the owner.

NOTICE:

Please read this manual carefully and retain a copy for future reference. Improper installation, adjustment, alteration or service and maintenance can cause injury, loss of life or property damage. Refer to this manual for assistance or additional information or consult a qualified installer, service agency or the gas supplier.

CAUTION

Before you install and operate this boiler, please read this manual carefully in its entirety. If for whatever reason you find instructions are unclear, please do not hesitate to contact us as shown below. Please read all safety and warnings symbols. The installations and service manual is a part of the documentation along with the boiler. The installer is to explain the function of the boiler and heating system to the end user, before the boiler goes into full service.

Notice: In the interests of progress, the information in this installation, operation and service manual is subject to change without prior notice from Innovative Industrial Inc.

Contents

1. Instructions

1.1 Requirements for installations in the state of Massachusetts

Boiler Installations within the Commonwealth of Massachusetts must conform to the following requirements:

- Boiler must be installed by a plumber or a gas fitter who is licensed within the Commonwealth of Massachusetts.
- Prior to unit operation, the complete gas train and all connections must be leak tested using a non-corrosive soap.
- The vent termination must be located a minimum of 4 feet above grade level. If side-wall venting is used, the installation must conform to the following requirements **extracted from 248 CMR 5.08 (2):**

(a) For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. INSTALLATION OF CARBON MONOXIDE DETECTORS: At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

2. APPROVED CARBON MONOXIDE DETECTORS: *Each carbon monoxide detector as required in* accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. SIGNAGE: A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS". (Continued)**

Continued

4. INSPECTION: The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) EXEMPTIONS: The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Section 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and

2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED. When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and

2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED. When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and

2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

……[End of Extracted Information From 248 CMR 5.08 (2)]……

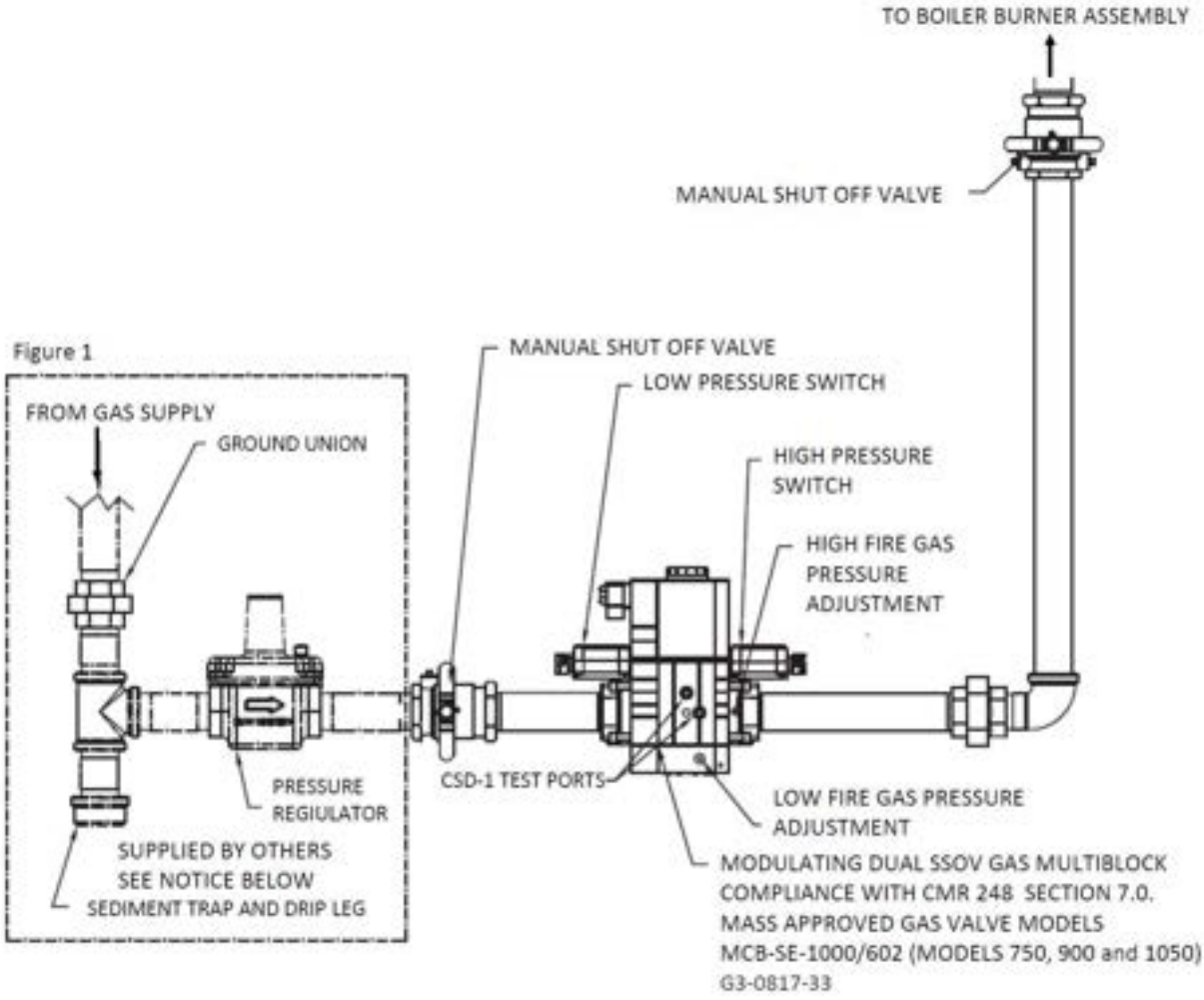


Figure 1

NOTICE

- A lockup style regulator, supplied by others, must be installed, see Figure 1, if gas pressure exceeds (14 in WC). The regulator, when installed as shown, must be installed at a distance of at least 10 pipe diameters from the boiler main gas valve. All boilers are calibrated and factory test fired at (7 in ± 22) WC.
- A minimum of (3.5 in WC) and maximum of (14 in WC) must be maintained to the inlet of the boiler gas train not to exceed a maximum of (1 in WC) drop when firing from minimum input to full load of the gas supply line and all the appliances running.
- Always use a wrench on the gas valve body when making gas connections to it. Never over-tighten the piping entering the gas valve body or gas valve failure may result!

ALSO REFER TO CHAPTER 6.0 PAGES 55 TO 60 FOR GAS PIPING ADDITIONAL INFORMATION.

1.2 Symbols

The following symbols are used in this document to emphasize certain instructions. This is in order to increase your personal safety and to safeguard the technical reliability of the boiler.

	CAUTION	Indicates a potentially hazardous situation which, if ignored, may result in minor injury or product/ property damage.
	WARNING	Indicates a potentially hazardous situation which, if ignored, can result in danger, serious injury or substantial product/property damage.
	DANGER	Indicates the presence of a hazardous situation which, if ignored, will result in **death, serious injury** or substantial product/property damage.
	READ	Indicates recommendations made by **EnerPro Boilers** for the installers which help to ensure optimum operation and longevity of the equipment.

Professional licensed heating contractor

The assembly, installation, adjustment, service and maintenance of this boiler must be performed by a professional licensed heating contractor.

Boiler Documentation

Make sure to read all documentation related to the product before starting the installation. The product documentation should be stored near the boiler where it can be accessed for future reference.

Advice for the owner

When the installation has been completed, the heating contractor has to familiarize the operator/owner with the installed equipment as well as any safety precautions and requirements, and shut-down procedures. The heating contractor also needs to inform the operator/owner of the need for professional annual servicing of the boiler prior to the heating season.

Contaminated air

Chemicals can contaminate the air and cause by-products during the combustion process. These by-products are poisonous to the occupants and very destructive to Absolute Spire Boilers.

Carbon monoxide

Flue products can flow into living spaces if improperly installed, adjusted, serviced or maintained. The flue gases contain carbon monoxide which is poisonous.

Fresh air

Adequate ventilation and combustion air must be provided for the equipment as it requires fresh air for safe operation. Make sure the equipment is installed ensuring an adequate supply of fresh air.

Boiler venting

Always operate the boiler with an installed vent system. Carbon monoxide poisoning can be caused by an improperly installed vent system. All combustion products must be vented safely to the outdoors.

Warranty

The information in this manual and any other related manuals must be read and proper procedures followed. The warranty is rendered null and void if the procedures are not followed as prescribed.

Some products may not be exactly as illustrated. Information contained herein is deemed as accurate as possible. Clarification of material supply, pipe sizing, thread type, and typographical errors should be noted as soon as possible. Dimensions have been converted from the Metric standard. Fractional rounding may affect dimensional tolerances.

1.3 General Safety Notes

Installers and operational personnel must at all times observe all safety regulations. The following warnings and cautions are general and must be given the same attention as specific precautions included in these instructions.

The installations must conform to the requirements of their authority having jurisdiction or, in the absences of such requirements, with the National Fuel Gas Code ANSI Z223.1/NFPA 54 and / or Natural Gas and Propane Installation Code, CAN/CSA B149.1

Where required by the authority having jurisdiction, the installation must conform to the Standards for Control and Safety Devices for Automatically Fired Boiler, ANSI/ASME CSD1

Product is CSD-1 compliant. Authorities having jurisdiction should be contacted before installations begin.

DANGER

Flue gas products contain carbon monoxide gas which can cause nausea or asphyxiation, resulting in severe personnel injury or death!

WARNING

The boiler is connected to 120 VAC 1ph and and/or 230 VAC 3 ph. An improper installation or attempts to repair electrical components or controls may result in life threatening situation. Always disconnect main service to boiler before servicing.

WARNING

Only properly qualified personnel that hold all necessary licenses shall work on the installation and service of this boiler. Uses of unlicensed or untrained service technicians are strictly prohibits from installing or service this boiler

WARNING

Do not touch the boiler; hot surfaces can be a burn hazard.

WARNING

Pressure hazard! Annually test safety relief valve for proper operation. Do not operate boiler with faulty relief valve.

WARNING

The boiler must not be installed on carpet.

WARNING

Do not stand on top of this boiler, or place items on top of the boiler.

WARNING

The boiler must not be modified or fitted with non OEM spare parts without the express written approval of Innovative Industrial Inc.

WARNING

If you smell gas, turn the boiler off immediately, by shutting off the gas supply downstream of the boiler. Do not try to light or operate any appliances, evacuate all people. Do not touch any electric switch; do not use any phone in the building. If you cannot reach your gas supplier, call the fire department, using a phone outside the building.

WARNING

Lifting hazards! Use properly rated lifting equipment to lift and position the boiler.

WARNING

Pressure hazard! Hot fluids. Install isolation valves on boiler water inlet and outlet. Make sure isolation valves are closed before servicing boiler.

1.4 Lighting Instructions

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.
C. Use only your hand to turn the lever operated manual gas shut-off valves. If the lever handle will not turn by hand, call a qualified service technician or the gas supplier.
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.

WHAT TO DO IF YOU SMELL GAS

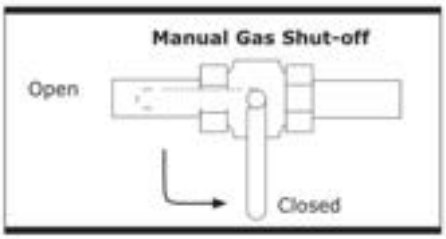
- **Do not try to light any appliance.**
- **Do not touch any electric switch; do not use phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

Operating instructions

1. STOP! Read the safety information above this label.
2. Set the thermostat or other operating control to the lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Close the main gas shut-off valve.
6. Wait five(5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Open main gas shut-off valve.
8. Turn on all electric power to the appliance.
9. Set the thermostat of other operating control to desired setting.
10. If the appliance will not operate, follow the instructions "TO TURN OFF GAS TO APPLIANCE" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set thermostat or other operating control to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed,
3. Close the Main Gas Shut-off Valve.



2. About ABSOLUTE *Spire* Series Boilers

2.1 *Spire* Series

The Absolute Spire Series hydronic heating condensing boilers is a combination of more than 35 years of Noth American and European engineering experience in condensing boiler technology. It utilizes a durable stainless steel heat exchanger engineered and designed in Europe. The stainless steel provides a robust corrosion resistant heat exchanger that allows for ultra high efficiencies with the added benefit of a small, lightweight boiler footprint. The heat exchanger also provides additional efficiency from large water ways, reducing the pressure drop through the boiler! We are so confident in our heat exchanger; we provide industry leading warranty.

The Precise combustion control of the Absolute Spire Series Boilers optimizes O_2 and CO_2 levels maximizing condensation while minimizing NOx and CO emissions. The water-cooled combustion chamber hosts a knitted fibre premix burner. Combined this allows for high efficiency and up to 40:1 turndown. Virtually eliminating short cycling of the boiler.

The Absolute Spire series incorporates industry trusted Honeywell Sola controls. The Sola and user-friendly touch screen offers quick and easy set-up, monitoring and diagnostics of your boiler. Multiple boiler configuration (up to eight boilers), remote monitoring, fault history, trend analysis, boiler status, DHW priority and communication via 3-wire RS-485 ModBus protocol are all part of the package.

The standard control package allows for external On/Off of local remote switch. The built in digital display shows normal operating fault indications and allow actual and set values to be read and adjusted,

The intelligent, advanced boiler control continuously monitors the boiler operating conditions, varying the heat output to suit the system load. The control is able to react to external "negative" influences in the rest of the system (flow rate, air/gas supply problems) maintaining boiler output for as long as possible without resorting to a lock out condition. At worst the boiler will reduce its output and/or shut down (shut off mode) awaiting the "negative" conditions to return to normal before starting.

Boiler features:

- The Sola controller has 4-20 mA, or mod-bus interface
- And controls cannot override the standard flame safety controls. External controls or command can modulate the boiler as required by the BMS.
- All Absolute Spire boilers are fully test fired after assembly to ensure the boiler and controls comply with our strict quality policy.
- The packaged boiler is constructed and approved according to the following standards
    - ANSI Z21.13/CSA 4.9 -2014
    - CGA CAN-3.1
    - ASME Section IV
    - CRN for each Canadian Province (where applicable)
    - Electrical according to CSA 22.2 No 0.M91 & NEC/NFPA 70
    - Gas Vent Category II & IV – use vent type BH
    - CSD-1 compliant
    - Consult factory for other certifications of qualifications.

2.2 Boiler Operating Principles

Combustion air is drawn into the inlet connection from the plant room. On the inlet side of the fan is a specially designed chamber which takes gas from the multi-block and mixes it in the correct proportions with the

incoming air. This mixing system ensures that the correct gas/air ratio is delivered to the pre-mix burner at all times.

Depending on demand (under the dictates of flow/return sensor and other external/internal control inputs) the Honeywell Sola control varies the speed of the air supply fan which alters the volume of air/gas mixture that is delivered to the combustion chamber. The resultant controlled mixture is delivered to the premix burner.

This mixture is initially ignited by the ignition probe and the ionization rod monitors the state of the flame. Should the flame be unstable or not ignite within the pre-set safety time trial the control will lockout after 3 attempts and the boiler will require manual intervention to reset the boiler. The display will indicate the lockout fault code confirming the reason for the failure.

The products of combustion in the form of hot flue gases are forced through the heat exchanger transferring their heat to the system water. The flue gas temperature is reduced to approximately 9-14 °F above the temperature of the system return water. It is then discharged via the condensate collector to the flue gas outlet connection to system vent.

If the flue gas temperature falls below the dew point of 131 °F, water vapor (created during the combustion process) will begin to condense in the boiler, transferring its latent heat into the system water, thereby increasing the output of the boiler with-out increasing the gas consumption. Condensation formed within the boiler and flue system is discharged from the boiler with-out increasing gas consumption. Condensation formed within the boiler and flue system is discharged from the boiler to an external drain.

3. Technical Data

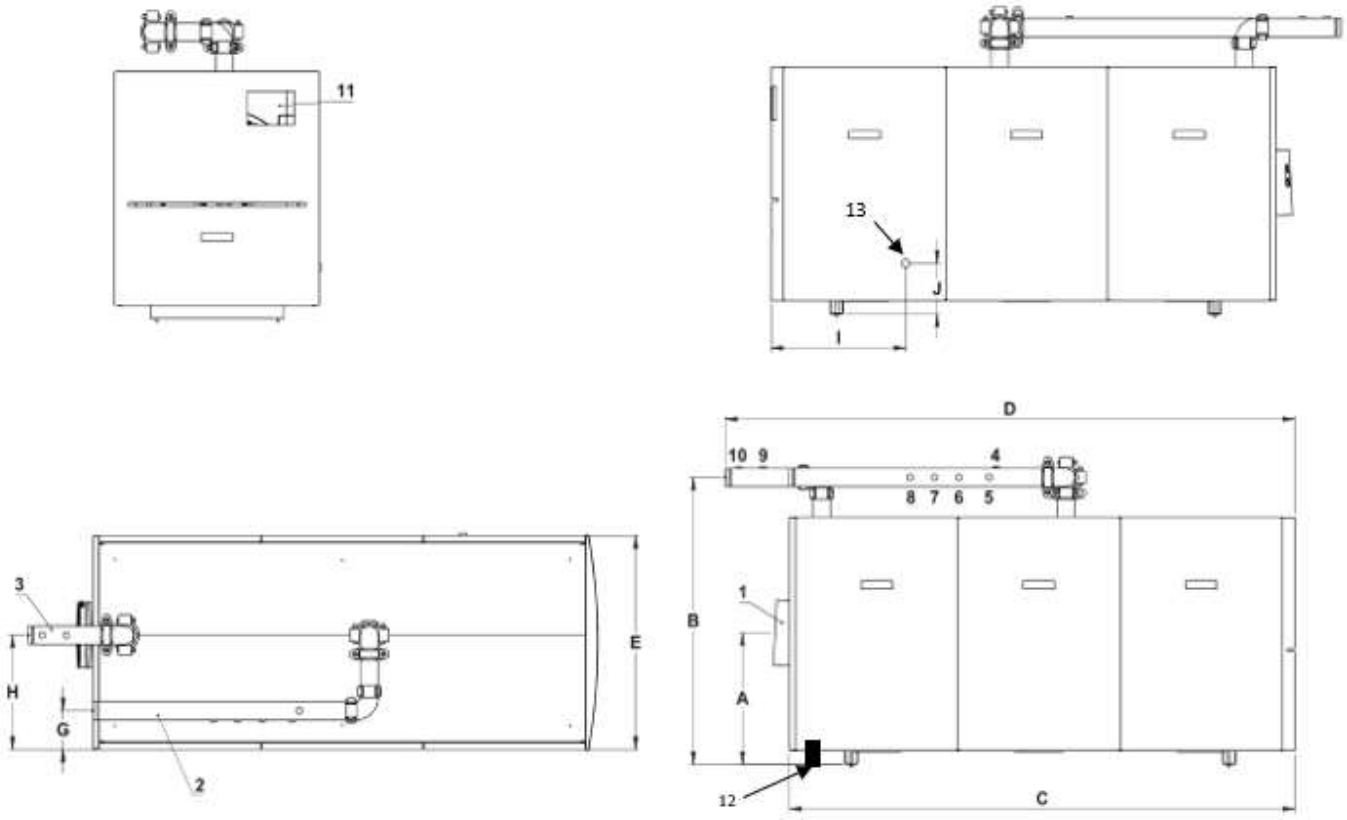
3.1 Data Sheet 500 through 2000 MBTU

ABS SPIRE Model		500	800	1000	1500	2000
Performance Data	units					
Maximum gas input	MBH (KW)	470(138)	800(234)	1000(293)	1500(440)	2000(586)
Minimum gas input	MBH (KW)	47(13.8)	80(23.4)	100(29.3)	150(44)	200(58.6)
Rated heat output AHRI at 180°F supply/80°F return	MBH (KW)	454(133)	787(231)	974(285)	1467(430)	1956(573)
Minimum heat output	MBH (KW)	45.4(13)	78.7(23.1)	97.4(28.5)	146.7(43)	195.6(57.3)
Natural gas rated thermal efficiency	%	96.5	98.4	97.4	97.8	97.8
Firing sequence - turndown ratio		Full Modulation - 10:1				
General Data						
Boiler category		Condensing				
Heat exchanger construction		Stainless steel				
Maximum allowable working pressure MAWP	PSIG (Bar)	160 (11)				
Water connection	Inches	2	2	2	2	2-1/2
Water content	Gallons (Liter)	4.7(17.8)	8(30.3)	9.5(36)	12.9(48.8)	16.2(61.3)
Boiler operating control		Honeywell Sola R910A				
Touch screen		Honeywell 7"S7999D1006				
Shipping weight	lbs.(Kg)	413(188)	467(212)	500(227)	555(252)	955(252)
Operating weight	lbs.(Kg)	452(205)	534(243)	579(263)	662(301)	1090(495)
Operational Data						
Typical flow rate at 36°F ΔT and max rated output	GPM (lpm)	25(94.6)	40(151.4)	50(189.3)	75.2(284.7)	100.3(380)
Water pressure drop at 36°F ΔT and typical flow rate	ft. H_2O (mbar)	3.35(100.1)	3.68(110)	4.18(124.9)	5.3(158.4)	6(179.3)
Maximum flow rate	GPM (lpm)	46.5(176)	74.5(282)	93(352)	140(530)	187(708)
Minimum flow rate at ignition	GPM (lpm)	5(18.9)	7.5(28.3)	9.5(36)	14(53)	20(76)
Maximum supply temperature at 22 psi minimum	°F(°C)	200(95)				
Normal operating temperature range	°F(°C)	68(20) - 194(90)				
Maximum pressure loss in vent (sealed combustion)	Inch W.C. (mbar)	+0.2(0.5)				
Maximum pressure loss (combustion air duct)	Inch W.C. (mbar)	-0.22(0.55)				
Vent / Gas Connection Sizes						
Flue gas vent diameter (Nominal)	Inches	4"	6"	6"	8"	8"
Required combustion air CSA B-149- Forced Draft	CFM (LPS)	103(48.6)	165(77.9)	206(97.2)	309(145.8)	412(194.4)
Gas inlet diameter (Nominal)	Inches (mm)	1"	1"	1"	1-1/2"	2"
Gas inlet pressure range	Inch W.C. (mbar)	4-14(8.8-34.8)				
Venting category		II, IV				
Venting material	Approved UL 1978/ULC 636 - AL-294C, Polypropylene, CPVC					
Electrical Data						
Electrical main supply	V/P/H	120VAC/1P/15A			240VAC/1P/15A	
IP-IEC NEMA protection	Rating	IP20 - NEMA type I				

3.2 Data Sheet 3000 through 8000 MBTU

ABS SPIRE Model		3000	4000	5000	6000	8000
Performance Data	units					
Maximum gas input	MBH (KW)	3000(879)	4000(1172)	5000(1465)	6000(1758)	8000(2344)
Minimum gas input	MBH (KW)	300(87.9)	400(117.2)	500(146.5)	600(175.8)	800(234.4)
Rated heat output AHRI at 180°F supply/80°F return	MBH (KW)	2943(862)	3884(1138)	4860(1424)	5850(1714)	7808(2288)
Minimum heat output	MBH (KW)	294.3(86.2)	388.4(113.8)	486(142.4)	585(171.4)	780.8(228.8)
Natural gas rated thermal efficiency	%	98.1	97.1	97.2	97.5	97.6
Firing sequence - turndown ratio		Full Modulation - 10:1				
General Data						
Boiler category		Condensing				
Heat exchanger construction		Stainless steel				
Maximum allowable working pressure MAWP	PSIG (Bar)	160 (11)				
Water connection	Inches	2-1/2	4	4	4	4
Water content	Gallons (Liter)	27(102.2)	35(132.4)	35(132.4)	60(227.1)	60(227.1)
Boiler operating control		Honeywell Sola R910A				
Touch screen		Honeywell 7"S7999D1006				
Shipping weight	lbs.(Kg)	1077(490)	2133(970)	2133(970)	2316(1053)	2316(1053)
Operating weight	lbs.(Kg)	1302(592)	2424(1102)	2424(1102)	2816(1280)	2816(1280)
Operational Data						
Typical flow rate at 36°F ΔT and max rated output	GPM (lpm)	150.4(569.3)	200.5(759)	250(946)	300.8(1138.7)	401.1(1518.3)
Water pressure drop at 36°F ΔT and typical flow rate	ft. H_2O (mbar)	6.5(194.3)	6.8(203.2)	8.4(251)	10(298.9)	17.8(532)
Maximum flow rate	GPM (lpm)	280(1060)	373(1412)	466(1764)	559.5(2118)	746(2824)
Minimum flow rate at ignition	GPM (lpm)	28(106)	37(140)	46.5(176)	56(212)	75(284)
Maximum supply temperature at 22 psi minimum	°F(°C)	200(95)				
Normal operating temperature range	°F(°C)	68(20) - 194(90)				
Maximum pressure loss in vent (sealed combustion)	Inch W.C. (mbar)	+0.2(0.5)				
Maximum pressure loss (combustion air duct)	Inch W.C. (mbar)	-0.22(0.55)				
Vent / Gas Connection Sizes						
Flue gas vent diameter (Nominal)	Inches	10"	12"	12"	14"	14"
Required combustion air CSA B-149- Forced Draft	CFM (LPS)	619(292.1)	825(389.4)	1032(487)	1238(584.3)	1650(778.7)
Gas inlet diameter	Inches (mm)	2"	2"	2-1/2"	2-1/2"	2-1/2"
Gas inlet pressure range	Inch W.C. (mbar)	4-14(8.8-34.8)				
Venting category		II, IV				
Venting material	Approved UL 1978/ULC 636 - AL-294C, Polypropylene, CPVC					
Electrical Data						
Electrical main supply	V/P/H	480 VAC/3P/15A				
IP-IEC NEMA protection	Rating	IP20 - NEMA type I				

3.3 Boiler Layout



ABS SPIRE Model		500	800	1000	1500	2000	3000	4000	5000	6000	8000
A	inch	14	14	14	14	22	22	28	28	28	28
B	inch	31	31	31	31	39	39	55	55	55	55
C	inch	46	46	53	60	70	76	96	110	110	128
D	inch	52	52	60	74	78	80	102	122	122	130
E	inch	22	22	22	22	28	28	44	44	44	44
G	inch	6	6	6	6	6	6	6	6	6	6
H	inch	11	11	11	11	14	14	24	24	24	24
I	inch	20	20	22	22	28	28	28	28	28	36
J	inch	6	6	6	6	2	2	4	4	4	4

Item		Item	
1	Boiler Exhaust Connection (Nominal)	8	High Temperature Cut Off
2	Boiler Water Outlet (Supply)	9	Inlet Temperature
3	Boiler Water Inlet (Return)	10	Flow Switch
4	Pressure Relief Valve	11	Touch Screen
5	Low Water Cut Off	12	Condensate Drain
6	Outlet Temperature	13	Gas Connection
7	Pressure and Temperature Gauge		

3.4 Specifications

- Fully assembled stainless steel water tube boiler.
- Premix burner, stainless steel cylindrical mesh burner for precise air-fuel mixture, stable flame and heat insulation.
- Fully condensing boiler.
- ASME approved design with CRN for each Canadian province (where applicable).
- Precise air fuel ration through firing range allows for high turn downs up to 40:1.
- Boilers come with complete with a digital combination flame safe-guard and a boiler control, with comprehensive operating, service and fault diagnostic capabilities.
- Fully modulating firing capabilities, 4-20 mA.
- Capable of BMS control, 4-20 mA.
- Local-remote switch optional.
- Available for conventional chimney, direct vent and sealed combustion venting installations.
- Fully factory pressure and fire tested.
- Distinctive powder coated enamel steel.
- Removable casing.
- Rigid steel boiler frame.
- Certified by UL for US and Canadian markets.
- High combustion and thermal efficiencies.
- Proven water flow requirements for safety.
- No minimum temperature requirements.
- Max 160 PSI (11 bar) system water operating pressure.
- ASME certified safety relief valve.
- Pressure and Temperature gauge.
- Low Water Cut Off.
- Lead lag cascade optional.
- BAC Net compatible optional.
- Communication gateway optional.
- CSD-1 compliant.

3.5 Ordering Options

- Available inputs, ten models:
  - 500, 800, 1000, 1500, 2000, 3000, 4000, 5000, 6000, 8000 MBTU.
- Turn down rations:
  - Standard 10:1.
  - High turn down up to 40:1 optional.
- Optional Controls:
  - Standard Honeywell Sola Control with touch screen display.

  - Optional Siemens LMV3 for high turn down.
  - Large touch screen up to 21 inches.
  - Local remote switch.
  - Communication gateway.
  - DHW sensor.
  - Outdoor sensor.
  - Annunciation LEDs and audible alarms.
- Other Options:
  - Condensate neutralization kit.
  - Condensate pump.
  - Heat exchanger service kits.
  - Seismic anchors.
  - Air filter strongly recommended.

3.6 Pressure relief valve requirements

  - 30 PSI is standard.

Model	Pressure				
	30 psi	50 psi	100 psi	125 psi	150 psi
SP500	10604-05	10604-10	10604-20	10604-25	10604-34
SP800	10604-05	10604-10	10604-20	10604-25	10604-34
SP1000	10605-05	10604-10	10604-20	10604-25	10604-34
SP1500	10606-05	10605-10	10604-20	10604-25	10604-34
SP2000	10606-05	10606-10	10604-20	10604-25	10604-34
SP3000	10607-05	10606-10	10605-20	10605-25	10604-34
SP4000	10608-05	10607-10	10606-20	10605-25	10605-34
SP5000	10608-05	10608-10	10606-20	10606-25	10605-34
SP6000	10618-05	10608-10	10606-20	10606-25	10606-34
SP8000	-	10618-10	10607-20	10607-25	10606-34

4 Installation:

4.1 General Installation Instructions

Notes:

All gas appliances must, by law including, this boiler be installed by a competent trained and/or licensed gas heating technician, or gas supplier. It is in your own interest and that of safety to ensure that the local law is complied with. The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or Natural Gas and Propane Installation Code, CAN/CSA B149.1.

Where required by the authority having jurisdiction, the installation must conform to the standard for Control and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD1.

In Addition to the above, this boiler must be installed in compliance with:

- National and local building codes
- CSA and NEC electrical codes
- Any and all other applicable standards and codes.

WARNING

All Absolute SPIRE boilers are UL certified, and must not be modified or installed in any way contrary to the "Installation, Operation and Maintenance Manual".

4.2 Delivery and Installation

The Absolute SPIRE boiler is supplied fully assembled, plastic wrapped and crated on a pallet. The Unit should be completely inspected for evidence of shipping damage and shipping completeness at time of receipt from the carrier and BEFORE the shipping invoice is signed. The carrier MUST be notified immediately if any damage is detected.

Boilers up to Spire 3000 model will fit through the most standard doors (Minimum door opening width 34.5”). Once the boiler is moved into final location check that there are no loose components on the boiler.

4.2.1 Site Preparation

The following information should be carefully considered when making site selection:

- Electrical Requirements
  - Spire models 500 through 1000 require 120 VAC Single Phase
  - Spire models 1500 and 2000 require 240 VAC Single Phase
  - Spire models 3000 through 8000 require 480 VAC 3 Phase

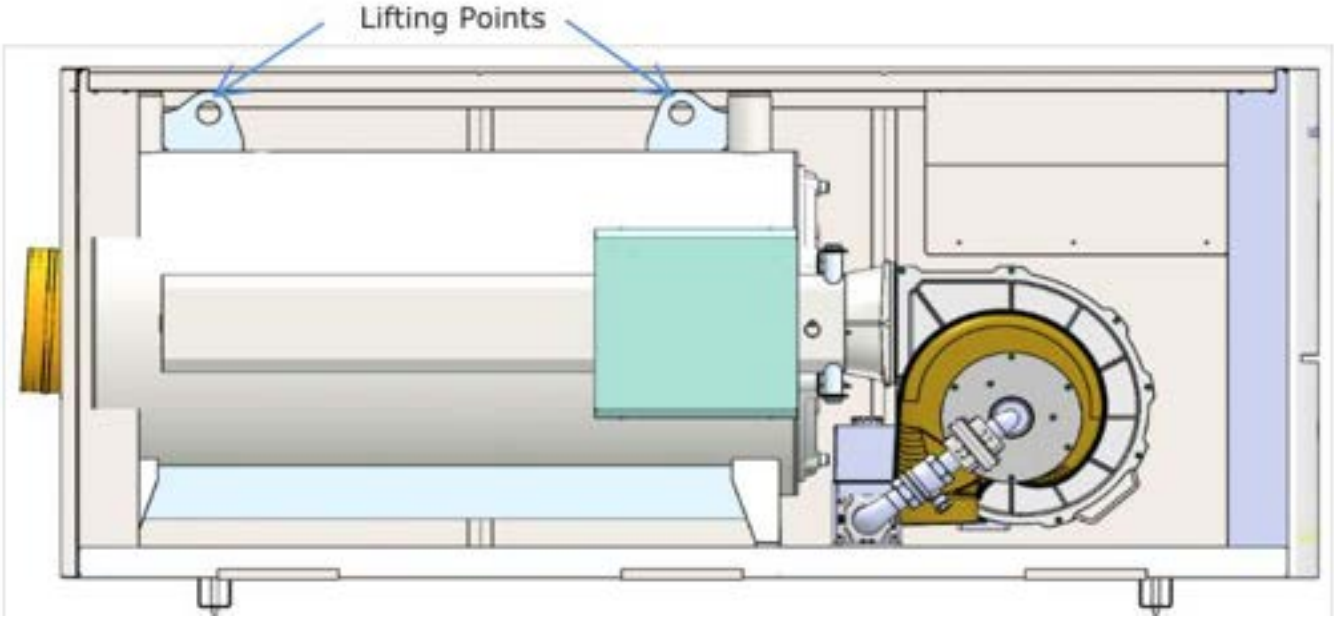
- Natural Gas
  - Access to natural gas with minimum line pressure of 4” W.C. and maximum 14” W.C.
- Combustion Air Supply and Exhaust Venting
  - Minimize vent lengths (5 ft. minimum for exhaust vent).
  - Maximum flue vent frictional loss 0.20” W.C.
  - Maximum combustion air duct loss of 0.22” W.C.
  - Combustion air and dilution as per local codes.
- Access to drain for condensate.
- All gas piping, water piping and electrical conduit and cable must be arranged in a manner that does not interfere with the removals of any panels or limit the access to service or maintenance of the unit.
- For multiple boiler installations, it is critical to plan the positioning of each unit in advance. Adequate space must be allowed for pre-connections, and future service and maintenance requirements. All piping must include ample provisions for thermal expansion.
- If lead lag confirmations are to be utilized, it is important to identify the lead boiler and place this boiler in the area that allows the control to be easy access for both operator and service personnel.

- The water quality is crucial to the performance and longevity of this boiler. Ensure water quality is to the specifications outlined in the water quality manual or warranty will be voided. Contact factory for further clarification.

	WARNING
Always keep the area around the boiler free and clear of all combustible materials and flammable vapors or liquids. Ensure there are no flammable items stored in the vicinity of the boiler.	
	WARNING
The boiler shall be installed such that the gas ignition system components are protected from water (dripping, Spraying, rain, etc.) during appliance operation and service (circulator replacement, condensate trap, control Replacement, etc.)	

4.2.2 Hoisting the Boiler

The boiler is designed to be hoisted if required using two points on top of the heat exchanger accessible when the top cover is removed. Ensure the slings are secured using a clevis at each lifting point. Reference the technical data sheet for the weight of the specific model being lifted. Ensure no personnel stands underneath the boiler as it is hoisted.



4.2.3 Setting the Boiler in Place

4.3 Flue Gas Discharge and Combustion Air Supply

The Absolute Spire boiler is suitable for both conventional room-supplied or sealed combustion. It is listed as a 100% sealed combustion boiler. Sealed combustion terminals should comply with the local and national codes. Pipe work in the flue gas discharge system should have a minimum slope towards the boiler of ¼" per foot. The venting must be properly secured to the building as per the vent manufacturer's instructions. The venting must be properly supported to prevent sagging and accumulation of condensate. Where necessary the venting system should have a means provided for drainage of condensate. The combustion air supply system should slope towards the supply opening and may require a drain point at the low point. Care should be taken when locating flue exit positions as a vapor plume will be visible when the boiler is operational (flue gas temperature will be less than 170 F (77C) resulting in the water vapor condensing out on contact with the air).

All vent installations shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

4.4 Venting

All vent installations shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

4.4.1 Venting Categories

The Absolute Spire line of boilers is dual certified as Category II or IV appliances, as defined in ANSI Z21.13/CSA 4.9, latest edition.

Vent installations shall be in accordance with NFPA 54/ANSI Z223.1, The National Fuel Gas Code, or CAN/CSA-B149.1, the Natural Gas and Propane Installation Code, or applicable provisions of the local building codes.

4.4.2 Vent Sizing

The vent must be sized in accordance with the AHREA Systems and Equipment handbook, Chapter 30 or according to the vent manufacturer's recommendations. The venting shall be sized by a chimney venting specialist or professional engineer using methods of vent calculations that are acceptable to the National and local codes having jurisdiction. When using manufactured venting systems, consult your vent supplier for correct sizing and structural support requirements. See the table 4.1 for vent design parameters.

For category II installations, ensure the flue venting system is designed to maintain a negative exhaust pressure between -0.1” W.C. and -0.5” W.C.

For Category IV installations, ensure the flue venting system is designed to maintain a slightly positive exhaust pressure which must be in between 0.01” W.C. and 0.20” W.C.

Table 4.1

model	combustion air required	Combustion air size	flue vent size **	vent length (min)	Vent and combustion air duct length (max)	90 elbow Equivalent Length 1.5CLR **	45 Elbow Equivalent Length 1.5CLR **
size	CFM	inch / mm	inch / mm	ft / m	ft / m	ft	ft
500	103	4/101	4/101	5/1.5	100/30.5	6	3
800	165	4/101	6/152	5/1.5	100/30.5	12	6
1000	206	4/101	6/152	5/1.5	100/30.5	12	6
1500	309	8/203	8/203	5/1.5	100/30.5	13	7
2000	412	8/203	8/203	5/1.5	100/30.5	13	7
3000	619	8/203	10/254	5/1.5	100/30.5	15	8
4000	825	8/203	12/305	5/1.5	100/30.5	20	10
6000	1238	N/A	14/355	5/1.5	100/30.5	25	13
8000	1650	N/A	14/355	5/1.5	100/30.5	25	13
flue vent size ** corresponds to Equivalent length 90 & 45 with 1.5 Center line radius							

4.4.3 Venting Materials

CPVC Venting

US: CPVC pipe conforming to ASTM F441. Sch 80 fittings conforming to ASTM F439. Joints are to be sealed with solvent conforming ASTM 493.

Canada: CPVC pipe, fittings and sealant listed and labelled to ULC S636 Standard for Type BH Venting Systems.

Polypropylene

US: Polypropylene must be listed either UL-1738 or ULC-S636 depending on local requirements. Consult local boiler codes for more information.

Canada: Polypropylene must be listed to ULC-S636.

Stainless Steel Venting

US and Canada: AL29-4C Stainless Steel Venting.

WARNING

Use of Cellular core PVC (ASTM F891), cellular core CPVC, Radel (polypheonalsulfone) in venting systems is prohibited.

WARNING

Use of Type "B" Vents in venting system is prohibited.

4.4.4 Flue Vent Connection to Boiler

The Absolute Spire boilers are supplied with a female DuraVent FasNSeal style connection on the flue exhaust vent. Spire models 500, 800 and 1000 are supplied with outlets sized for Schedule 80 CPVC. Models 1500 through 8000 are sized for DuraVent FasNSeal Stainless steel pipe. See Table 4.2 for sizes and adapters for various connection options.

The vent collar is supplied with a ¼" test port for a combustion probe. Ensure the test port is sealed after combustion analysis.

The boiler is not designed to support the weight of the venting. Ensure vent is properly supported.

Table 4.2

Nominal Outlet (in)	Supplied Outlet	Duravent FasNSeal (Single Wall SS) Adapter	Novaflex Z vent adapters
4"	Sched 80 CPVC	FSA-4PVCS-4FNSFB	2SVSTTA04.5
6"	Sched 80 CPVC	FSA-6PVCS-6FNSFB	2SVSTTA06
6"	Sched 80 CPVC	FSA-6PVCS-6FNSFB	2SVSTTA06
8"	Duravent FasNSeal	as supplied	2SVSAFNS08
8"	Duravent FasNSeal	as supplied	2SVSAFNS08
10"	Duravent FasNSeal	as supplied	2SVSAFNS10
12"	Duravent FasNSeal	as supplied	2SVSAFNS12
14"	Duravent FasNSeal	as supplied	2SVSAFN14
14"	Duravent FasNSeal	as supplied	2SVSAFN14
14"	Duravent FasNSeal	as supplied	2SVSAFN14

WARNING

The flue gas vent pipe must be airtight and watertight. Horizontal sections of the venting must slope downward towards the boiler minimum 1/4" per linear foot [12inch] and adequate vent support must be provided.

4.4.5 Venting for Multiple Boilers – Retrofitting

!!! **DANGER**

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. Any improper interconnection of venting systems may result in leakage of flue gases into the occupied space.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restrictions, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances 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.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1.

4.4.6 Combustion Air Supply Requirements

All supply vent installations shall be in accordance with the section "Air for Combustion and Ventilation" of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or Clause 8.2, 8.3 and 8.4 of Natural Gas and Propane Installation Code, CAN/CSA B149.1, and/or applicable provisions of the local building codes.

The boiler requires a clean, fresh and adequate supply of combustion air, free of chlorine, halogenated hydrocarbons, or other chemicals that can be hazardous when used in gas combustion fired equipment. Failure to provide sufficient combustion air supply will result in carbon monoxide (CO) production that could lead to personal injury including loss of life or damage to the boiler and property. Not obstructing the flow of combustion and ventilation air.

Room air combustion supply must maintain a minimum fresh air inlet of 30,000 BTU/Hr of total burner input. The area must be free of any restrictions such as louvers, or screens. See local gas codes for more information. Table 4.1 lists supply air requirements.

It is strongly recommended install an air filter on boiler air inlet if using boiler room supplied air. This is optional and must be purchased.

WARNING

Motorized louvers shall be interlocked with the appliance so that they are proven open prior to the main burner ignition and operation

4.4.6 Vent Termination

All vent terminations shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

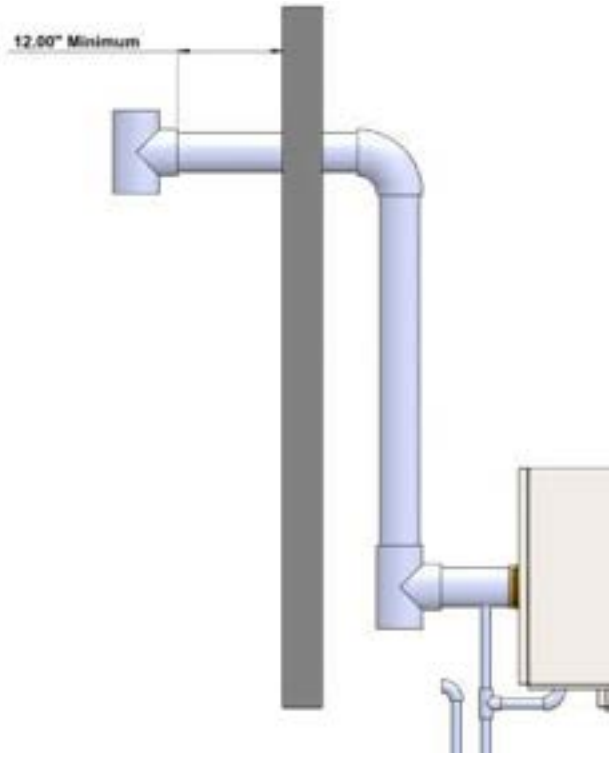
All exhaust vertical terminations must be finished with a finishing cone with tapered end, with a bird/rodent screen. All sidewall exhaust systems must be finished with a tee termination. All combustions air inlet terminations must be facing down with a debris/bird/rodent screen. All terminations shall be arranged to avoid the directions of prevailing winds and prevent the accumulation of flue gas condensation.

WARNING

In all installations avoid vent termination locations where excessive debris or snow could accumulate leading to blocking of vent terminals or where prevailing winds and rain could enter the vent terminal creating additional resistance to the venting system.

Avoid installing vent terminals where the building exterior could be tarnished from flue gases, a shield or another location should be considered.

For side wall vents terminals shall not be less than 12 inches from the wall surface.

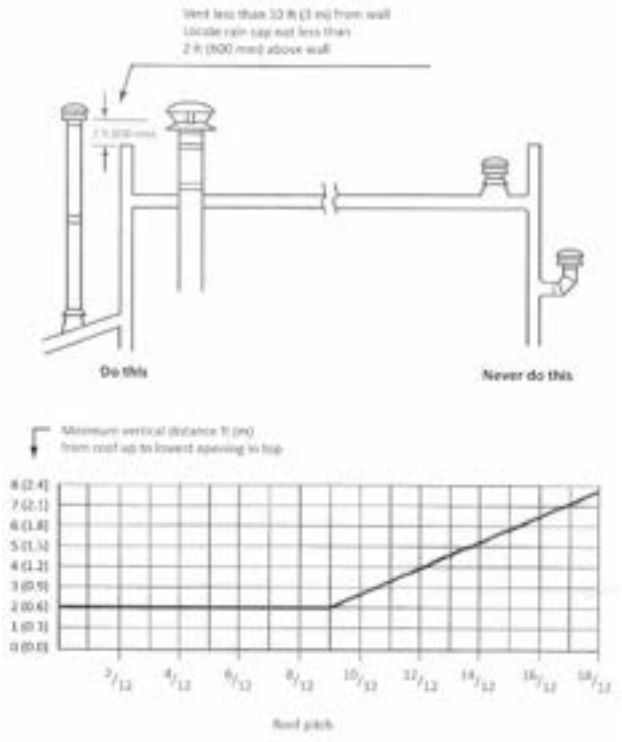


All vent terminations should be installed in compliance with ANSI Z21.13/CSA 4.9, Accordingly a vent shall not terminate:

a) where it could cause hazardous frost or ice accumulations on adjacent property surfaces;
b) less than 7ft above a paved sidewalk or a paved driveway that is located on public property;
c) within 6ft of a mechanical air-supply inlet to any building;
d) above a regulator within 3ft horizontally of the vertical centreline of the regulator vent outlet to a maximum vertical distance of 15ft;
e) see Natural Gas and Propane installation code ANSI Z21.13/CSA 4.9;
f) less the 1ft above grade;
g) within 3ft of a window or door that can be opened in any building, of any nonmechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance;
h) underneath a veranda, porch, or deck unless
    i. the veranda, porch or deck is fully open on a minimum of two sides beneath the floor; and

ii. the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 1ft.

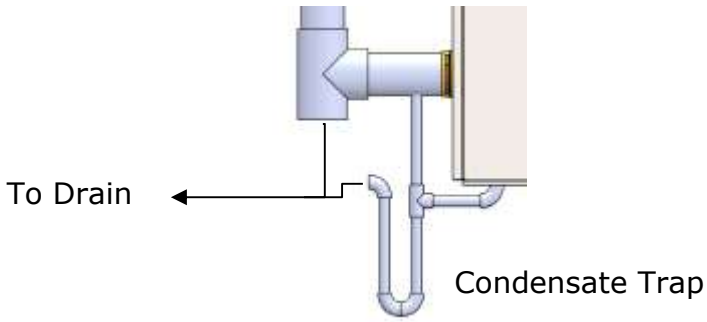
Through the roof vents shall extend a minimum of 3 feet above the roof surface, or at least 2 feet above the highest part of any structure within 10 feet of the vent.



4.5 Condensate Drain Connection and Trap

The Absolute Spire boiler is fitted with a barbed drain port. The drain port and a drain on the venting close to the boiler should be separated from the drain with a condensate trap as in figure 4.5. Only us synthetic material for the connecting pipework because of the acidity of the condensate (ph 2-5) and allow a minimum 1.2 inch fall per 3 feet length, to ensure a good gravity siphon flow. Fill the siphon with clean water before firing the boiler. Discharge the condensate into a drain. Consult local codes. A condensate neutralizer may be required by local code, and should always be used if the drain system is cast ion material.

Figure 4.5



4.6 Water Connection

The Absolute Spire boiler is supplied with Victaulic water connections. See Data Sheets in sections 3.1 and 3.2 for sizes of your model. It is advisable to install a shut off valve for both the supply and return to allow removal of the boiler in the future. All water connections should comply with national and local code requirements. The boiler shall not be used as a pipe anchor.

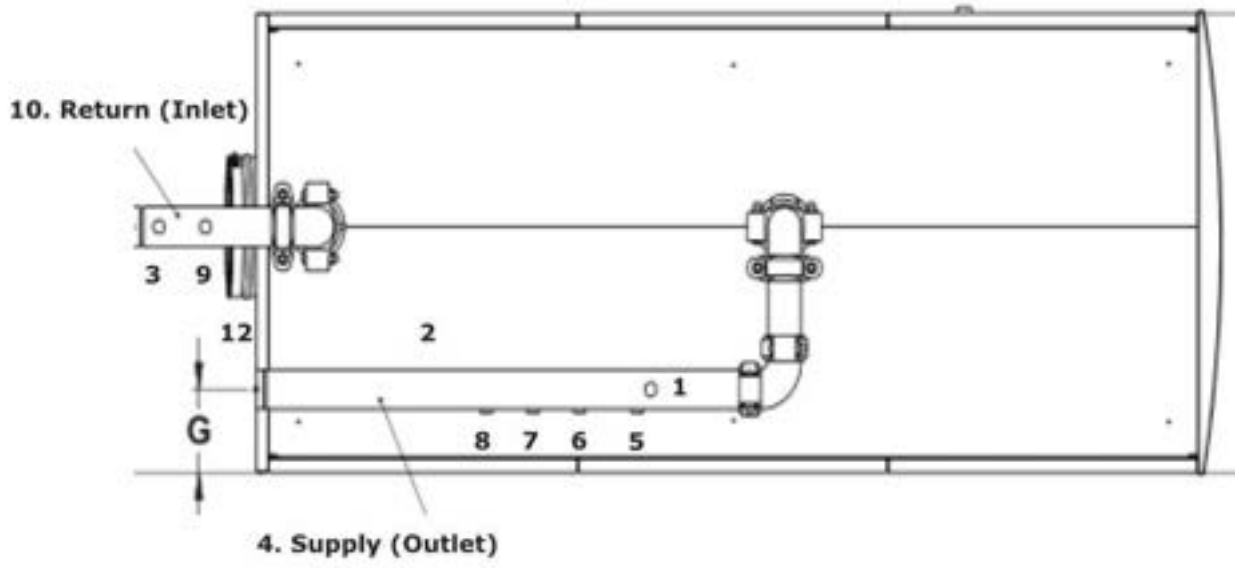
4.6.1 Water Manifolds

Supply Connection Manifold

1.Pressure Relief Valve
2.Air Vent
4.Boiler Supply Manifold
5.NTC Temperature Sensor
6.Low Water Cut Off (LWCO)
7.Temperature and Pressure Gauge
8.Aquastat (Manual Reset)

Return Connection Manifold

3. Flow Switch
9. NTC Temperature Sensor
10. Boiler Return Manifold



4.6.2 Water Pressure

The boiler has a maximum working pressure (MAWP) of 160 psi. For proper function a minimum pressure of 12 psi should be maintained.

4.6.3 Safety Valve

A safety relief valve NB certified with V or HV symbol as supplied must be installed on the boiler supply piping without any obstructions. The spindle of the relief valve

must be vertical. The relief valve discharge must be piped to an acceptable drain at a safe point of discharge. Reducing couplings or other restrictions are not permitted in the discharge line.

4.6.4 Water Treatment

The heat exchanger is manufactured from stainless steel which will provide many years of excellent service, if maintained properly. All heat exchangers require proper water conditions to remain efficient and function properly. Failure to do so will lead to premature failures within the heat exchanger. The system should be filled with mains, cold water (this will usually have a ph of between 7 and 8). Pressurized installations with a boiler/system content ratio of 1:10 or less should not require water treatment, provided the following conditions appl:

1. The system is flushed thoroughly to remove all fluxes and debris and filled completely once.
2. Make up water is limited to 5% per annum.
3. The hardness of the water shall conform to water quality document requirements (supplied with boiler)
4. All scale deposits will reduce the efficiency of the boiler and should be prevented, however provided the above is complied with any scale produced will not be too detrimental to the boiler efficiency wand will not reduce the anticipated life expectancy of the boiler.

Suitable chemicals and their uses should be discussed with a specialist water treatment company before carrying out any work. The specifications of the system and the manufacturers recommendations must be taken into account, along with the age and condition of the entire system. New systems should be flushed thoroughly to remove any traces of debris, flux, grease or metal swarf generated during installation and assembly of a new system.

For old systems to ensure any black metallic iron oxide sludge and their corrosive residues are removed, again by power flushing, ensuring the entire system is drained and completely clean of all possible debris.

4.6.5 Water Flow

See the Technical Data Sheets in section 3 for maximum and minimum water flow requirements. Incorrect flow may cause eventual damage or premature boiler failure that may not be covered under the warranty.

Proper flow rates may be achieved through a combination of primary and secondary flow loops. Multiple zones and pumps may result in different flow rates at different times. Consideration must be given to all possible conditions and their consequences. The flow rate published for all boiler models are applicable at 100% firing rate.

4.6.6 Frost Protection

The boiler must be installed in a frost free area to prevent freezing of the condensate drain.

If the boiler is decommissioned or stored for an extended period of time, where temperatures can reach below 38 F, the boiler needs to be:

1. Drained.
2. Deactivated.
3. Electrical power must be disconnected.

When the boiler is to be placed back into service, a qualified service technician must be assigned to reconnect the boiler and recommission the unit.

5 Electrical

5.1 General

The Absolute Spire boiler is supplied with an electronic flame ionization safety control, as standard equipment. A specially designed microprocessor is at the heart of the system. The boiler is pre-wired as shown in the wiring diagram. All external connections can be made using the supplied connectors. Each boiler must be fuse protected for a single phase power source 120-240/1/60 @ 15 A or a 3 phase source 480/3/60 @ 20A.

5.2 Main Power Voltage

The boilers require electrical power as per chart below.

The boilers are sensitive to line/neutral and therefore has a facility to ensure that line and neutral are correctly connected. If the line and neutral are crossed, the Sola control unit will alert/hold the boiler until polarity has been corrected.

Ensure earth ground is provided and correctly bonded. The ground must be bonded to the back panel of the control area.

Model	Ametek fan rated voltage	EBM fan rated voltage	Ametek Max Motor Amps	EBM Max Motor Amps	supply voltage	control voltage
500	120-240	230v 50/60Hz 1	10a	N/A	120/240	120 60Hz 1
800	120v	230v 50/60Hz 1	10a	1.8a	120/240	120 60Hz 1
1000	240v	230v 50/60Hz 1	10a	1.8a	120/240	120 60Hz 1
1500	120v	230v 50/60Hz 1	10a	4.2a	120/240	120 60Hz 1
2000	240v	120v 50/60Hz 1	10a	13a	120/240	120 60Hz 1
3000	120v- 240v	230v 50/60Hz 3	10a	6.9a	120/240	120 60Hz 1
4000	120v	230v 50/60Hz 3	10a	6.9a	120/240	120 60Hz 1
6000	240v	408v 50/60HZ 3	10a	7a	240/480	120 60Hz 1
8000	N/A	408v 50/60HZ 3	10a	7a	240/480	120 60Hz 1

5.2 Control unit

5.2.1 Sola Model R7910A-1027
Voltage: 120Vac 60Hz +10% -15%
Safety time is 3 seconds
Control voltage: 24Vdc

5.2.2 Honeywell Sola R7910A 1027 control (sheet 1-12)
Honeywell sola control with touch screen 57999D 1006 Display

5.3 Control Unit

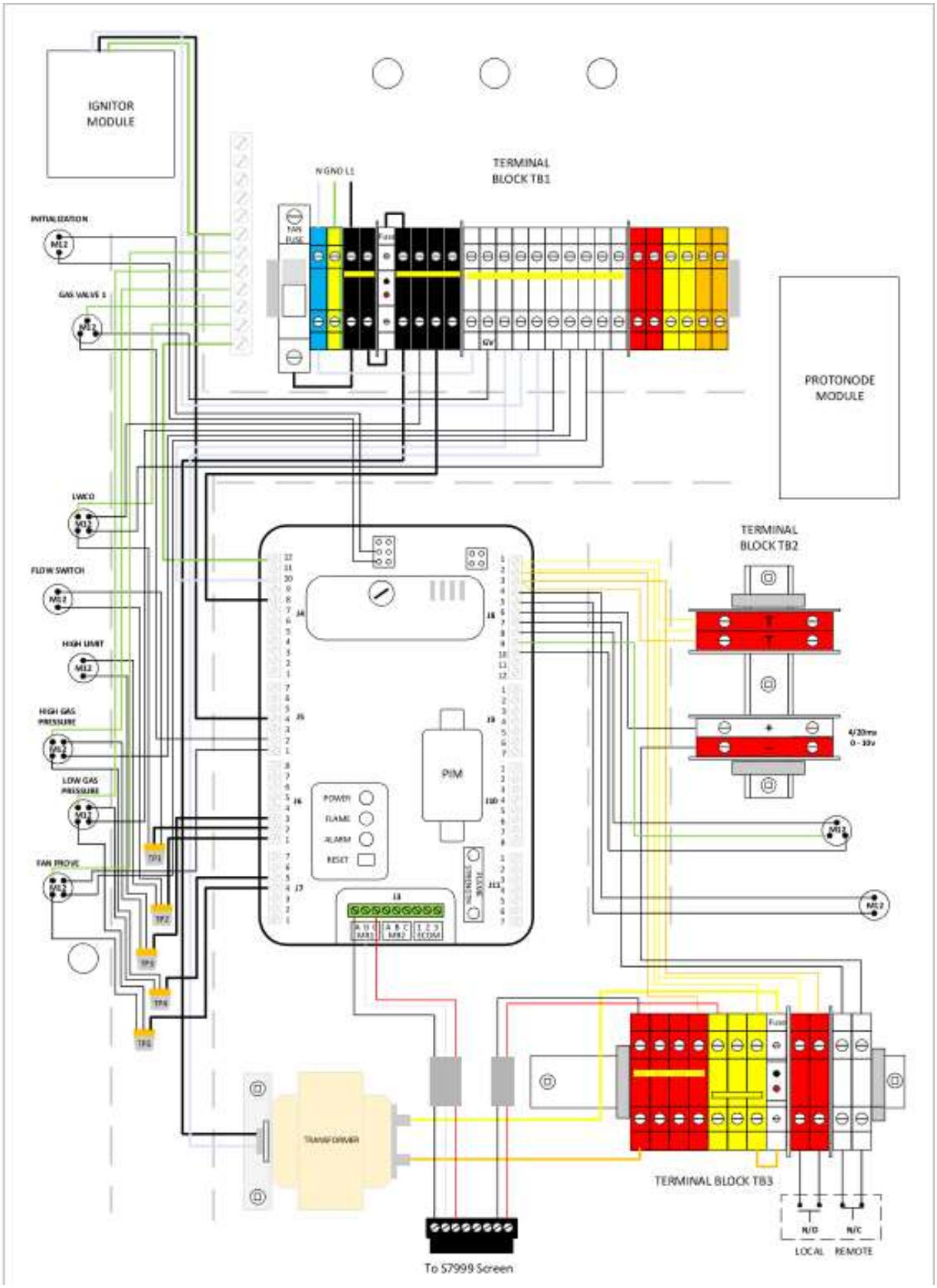
5.3.1 Sola Model R7910A-1027

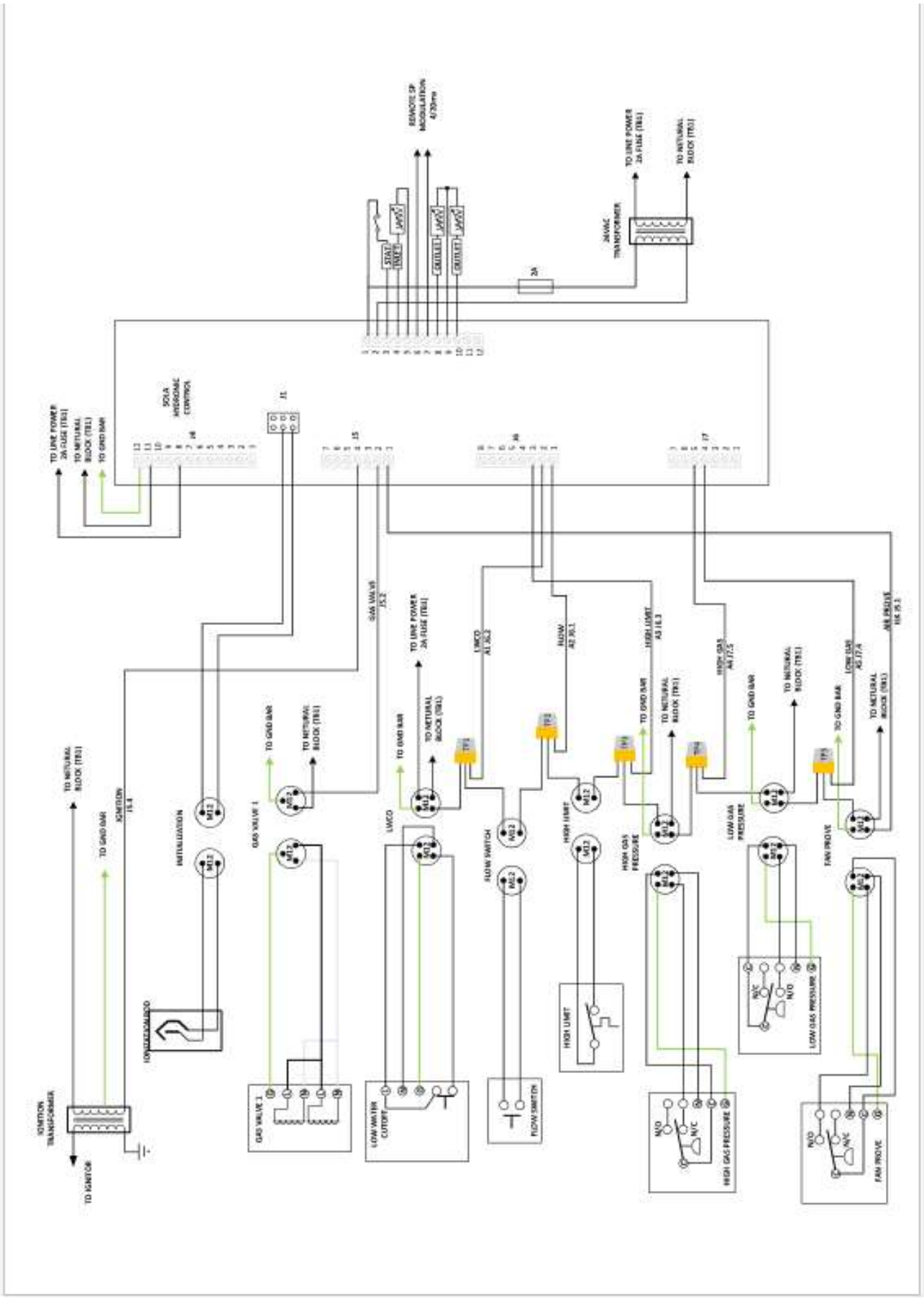
Voltage: 120V AC 60Hz +10%/-15%

Safety time is 3 seconds

Control voltage: 24 Volt AC

5.4 Electrical Schematics




REMOTE SP MODULATION 4/20ma
TO LINE POWER 2A FUSE (TB1)
TO NEUTRAL BLOCK (TB1)
24VAC TRANSFORMER
2A
STAT
SCOLA MASTER CONTROL
J1
TO GND BAR
GAS VALVE
LWCO
FLOW
HIGH LIMIT
HIGH GAS PRESSURE
LOW GAS PRESSURE
FAN PROVE
IGNITION
INITIALIZATION
IGNITION TRANSFORMER
TO IGNITOR
GAS VALVE 1
LOW WATER CUTOFF
FLOW SWITCH
N/C
N/O
COM

5.4 Limit Controls

5.4.1 Temperature Control

The Absolute Spire boilers are equipped with an electronic temperature limit control based on supply and return water temperature sensor outputs. The flow temperature is adjusted between 68 and 200F.

5.4.2 Low Water Level Protection (LWCO)

The boilers are equipped with low water protection based on temperature differences between supply and return. When the temperature difference is 45 F or greater the boiler will modulate down so that it remains operational as long as possible. At a difference of 72 F the boiler is at part load. If the difference reaches 81 F the boiler will shut down.

The boiler has been approved and was found to be in compliance with LWCO protection, provided the factory preset high limit and flow temperatures are not altered and the modulating controls are used and no minimum flow rate is required the Sola control system will monitor these conditions and reduce the boiler output, finally shutting down until flow conditions improve. As a result, the boiler is virtually unaffected by low water flow. Although boiler flow and content protection is provided, it does not safeguard the entire heating system, additional low water content and temperature safety controls maybe needed in certain jurisdictions. In the event the low level is too low a red light will flash on the low water cut off. To reset this device the technician needs to press the light.

The limit device also has a test button, when this button is pressed down the control shuts the boiler down. To reset this again the operator needs to reset the device by pressing the reset button (red).

5.4.3 High Limit Protection

The high limit temperature protection device switches off and locks out the boiler when the supply temperature exceeds the maximum set point temperature.

5.4.4 Air Pressure Switch

This device proves to the control the blower motor is on, and that airflow is flowing into the boiler. The adjustment screw is located on the back of the device. This should only be adjusted by a qualified technician. No adjustment in the field is required, as the boiler was test fired in the factory before shipment.

5.4.5 High Gas Pressure Switch (HGP)

The boiler is equipped with a gas pressure switch that is mounted directly on the air intake housing. The gas pressure switch is preset at the factory and should not be adjusted.

5.4.6 Low Gas Pressure Switch (LGP)

The boiler is equipped with a low gas pressure switch that is mounted directly on the mono block of the gas valve. The gas pressure switch is preset at the factory and should be checked per commissioning.

6 Gas Connection

6.1 Gas Connection

The Absolute Spire boiler is suitable for use with Natural Gas only. The gas connection is at the front right side of the boiler. The boiler is fitted with a gas filter which is mounted within the monoblock gas valve as standard to prevent dirt from contaminating the gas valve or burner assembly. An isolating main gas valve (Supplied by other) must be installed in the vicinity of the boiler, upstream of the automatic gas valve.

- A main gas shutoff valve must be connected to the boiler, and must be readily accessible and within hands reach.
- When connecting the gas line ensure to use 2 sets of pipe wrenches to connect to the service. Do not apply the tightening load to the gas line itself, as damage can occur to the gas valve.
- A sediment trap must be installed upstream of the main gas shutoff valve.
- The boiler fuel train does not require venting to the atmosphere, consult their documentation.
- Install a sediment trap (drip leg) and a union connection ahead of any primary manual shutoff valve. Gas piping should be installed in accordance with the National Fuel Gas Code ANSI Z223.1 latest edition and any other local codes which may apply; in Canada see CAN/CSA-B149.1, latest edition. In the commonwealth of Massachusetts, the gas valve must be T handle type.
- The boiler and gas line piping connection should be pressure tested and must be checked for leaks before being placed into service. Test with inert gas or compressed air.
- The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at pressure in excess of ½ psi. The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at pressures equal to or less than ½ psi.
- Use of soap and water can cause corrosion of metallic parts, ensure these compounds are rinsed and wiped off after testing.

6.1.2 Gas Line Piping to Boiler

Ensure pipe sizing capability follows the recommended values based on an overall length of pipe from the meter plus the equivalent lengths of all fittings. Approximate sizing may be based on 1 cubic foot per hour of natural gas supply per 1,000 BTU per hour of input rating. For example a 1,000,000 BTU input boiler would require 1000 cubic feet per hour of natural gas.

Nominal Iron Pipe Size (inches)	Internal Diameter (Inches)	Equivalent Length		Maximum Capacity in Cubic Feet of Natural Gas per Hour Pressure Drop of 0.5 inch Water Column/Equivalent of Pipe (in feet)						
		90 El (feet)	Tee (feet)	20	40	60	80	100	150	200
1/2	0.622	1.55	3.1	120	85	66	57	50	40	35
3/4	0.824	2.06	4.12	250	170	138	118	103	84	72
1	1.049	2.62	5.24	465	320	260	220	195	160	135
1-1/4	1.380	3.45	6.9	950	660	530	460	400	325	280
1-1/2	1.610	4.02	8.04	14600	990	810	690	620	500	430
2	2.067	5.17	10.3	2750	1900	1520	1300	1150	950	800
2-1/2	2.469	6.16	12.3	4350	3000	2400	2050	1850	1500	1280
3	3.088	7.67	15.3	7700	5300	4300	3700	3250	2650	2280
4	4.026	10.1	20.2	15000	10900	8800	8800	6700	5500	4600

6.2 Gas Pressures

The boiler has been factory test fired and adjusted for proper combustion. The boiler's main gas valve is certified and can accept a maximum inlet pressure up to ½ psi or 14" W.C. A minimum gas pressure of 4" W.C. at the gas filter inlet test point when the boiler is operating at maximum output must be supplied. Pressure below this level can result in lockouts for "Low Gas Pressure".

6.3 Gas/Air Ratio Control

The boiler has a pressure differential gas/air ratio control. The gas/air ratio control maintains the correct balance of gas and air quantities to the burner at a constant level under variable loads. This ensures clean and reliable combustion and high part load efficiency across the entire load range. Minimum airflow is monitored before a start by an air pressure sensor.

6.4 Gas Valve Adjustment

The gas valves are located directly underneath the pre-mix blower assembly. The gas valve is mounted on an adjustable stand that fully supports the gas valve.

Check the combustion using a calibrated combustion analyzer and adjust the fuel air ratio of the valve being used according to the procedure below. The proper ranges are listed in a table in section 7.3.

To adjust high fire:

Require tools: Flat head screwdriver and combustion analyzer.

Start the boiler and observe the proper operating parameters for the system. Set the boiler to high fire, to achieve maximum firing rate of the boiler. Check combustion readings using the combustion analyzer. If combustion readings are not within the specified range, adjust as follows:

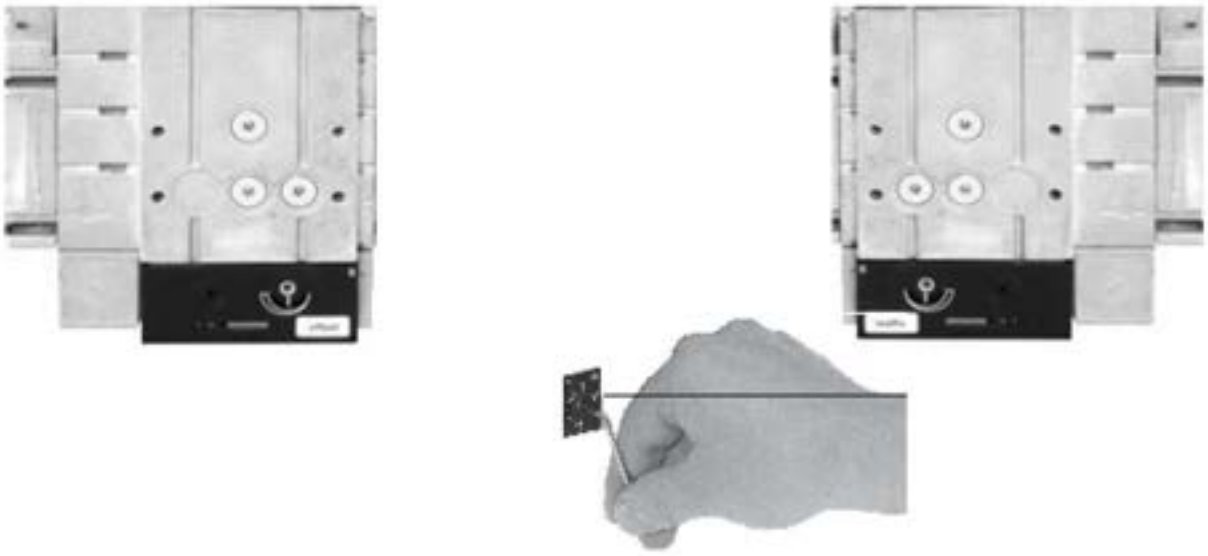
1. Open the right-side panel of the boiler.
2. Locate the Karl Dungs gas valve.
3. Adjust the orifice adjustment screw located on the downstream side of the gas valve to either increase or decrease gas flow as required.

To adjust low fire:

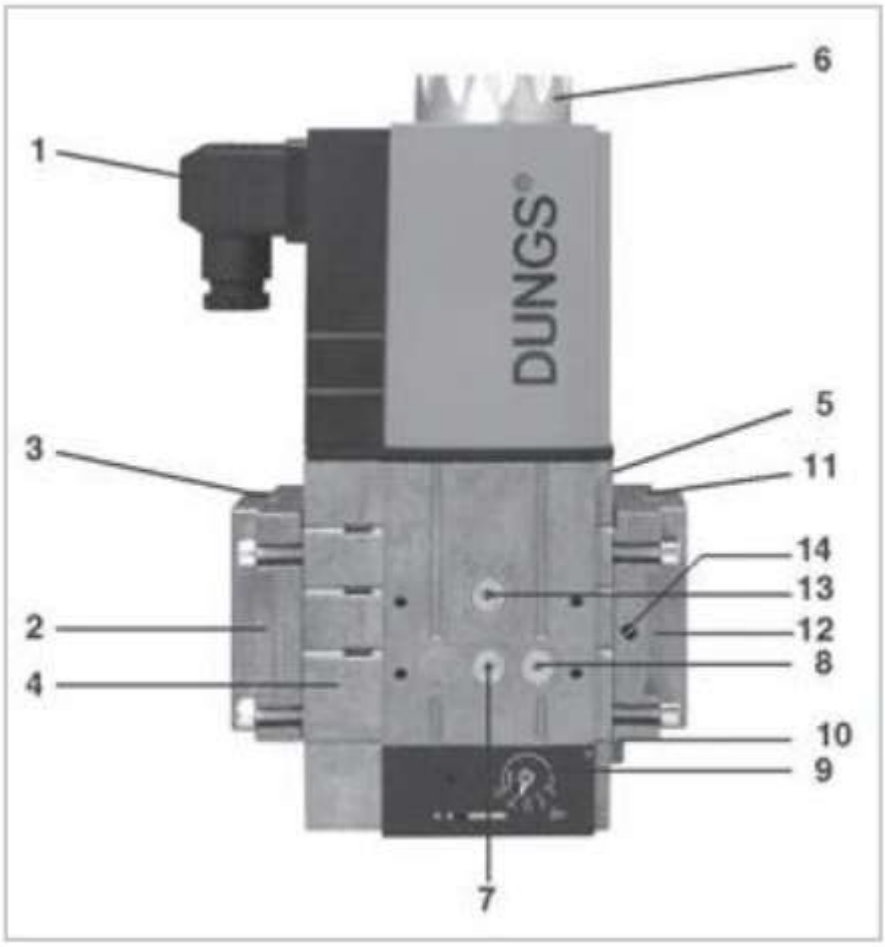
Required tools: 2.5 mm hex wrench and combustion analyzer.

Start the boiler and observe proper setting of the system. Set the boiler to low fire to achieve the minimum firing rate of the boiler. Check the combustion readings on the combustion analyzer. If the combustion readings are not within the range specified, adjust as follows:

1. Open the right-side panel of the boiler.
2. Locate the Karl Dungs gas valve.
3. Turn the offset screw, located in the bottom center of the side of the valve to either increase or decrease the gas flow as required.



6.5 Gas Valve Description



1. Electrical DIN Connector	8. Test Port Connection #3
2. Upstream Flange	9. Regulator Outlet Pressure Adjustment
3. G 1/8 Inlet Test Port	10.Vent-Less Regulator
4. Filter	11.Downstream Flange
5. Valve Body	12.Test Port Connection #1
6. Coil	13.Offset Adjustment Cover
7. Test Port Connection #2	

7 Commissioning

7.1 Pre-operational Checks

1. Check power supply to ensure fuse and service disconnect provided as required by local code or authorities having jurisdiction.
2. Check gas connection to boiler and check for gas leaks, purge gas according to local codes or authorities having jurisdiction.

3. Check gas supply pressure on inlet of gas valve test point ID#3, a test port with plug has been provided, loosen set screw and connect a manometer and confirm greater than 4" W.C. gas pressure is measured.
4. Check flue and air vent connections.
5. Ensure boiler is fully filled with water and all air is purged, the boiler pressure shall be at least 11 psig.
6. Check pumps for correct flow capacity and flow direction.
7. Ensure relief valve is properly connected, sized and piped to nearby drain.
8. Fill condensate P-trap assembly, if PH neutralizer used, ensure no obstruction.
9. Check water connections to the system are correct and isolation valves are open.
10. Check to ensure boiler drain connection is provided.
11. Ensure boiler has been installed and properly mounted to the boiler pad provided, anchoring of the boiler per local codes.
12. Ensure required service area has been provided around the boiler as recommended.

7.2 Safety and Lighting Instructions

1. Turn ON main power supply.
2. Turn OFF firing valve.
3. Open the main gas valve.
4. Check for gas connection leaks.
5. Ensure the boiler is open to the system, pumps ON and adequate flow is provided through boiler.
6. Adjust the boiler controls to heat demands.
7. The boiler should check interlocks, start purge and pre-ventilation purge.
8. The boiler will automatically go into the ignition phase, after 2 attempts to fire it will shut down for ignition/flame failure. The touch screen will display the message below.

9. Reset the control.
10. Open the firing valve.

11. Check the ignition quality and flame stability and flame signal. The minimum flame signal should be at least 5 umA/V, normally the flame signal should range from 8 to 32 umA/V.

7.3 Combustion Setting and Adjustment

Check and if necessary correct the boiler for gas/air ratio set-up. Follow the instructions in section 6.4 to adjust the air/gas ratio to the values listed in the table below.

Chart 8 Combustion Tolerance Chart

Emission	Unit	Range	Part Load (20%)	Full Load (100%)
CO_2	%	6-9.5	8.0	9.0
O_2 ppm	%	8.0-4.0	7.0	5.0
CO_2	ppm	<100		

8.1 Shut Down Procedure

1. Allow the boiler to turn off on its own once the temperature satisfies or by removing the call for heat to the boiler.
2. Once the boiler completes a successful "Post-Purge" and "Post Pump", it will return to standby.
3. Once in standby, turn off the boiler using the switch on the back of the boiler.
4. Close all manual gas valves.
5. Turn off the electrical disconnect to the boiler.

8.2 Emergency Shut-off

In case of emergency, immediately shut off the gas supply at the inlet to the boiler.

9 Commissioning Report

Absolute SPIRE Series Boiler Start-up Form

Location Information

Project Name				Start-up Date:	
Address				Start-up Tech.	
City/Town		Prov/State		Equipment Installer Contact Info.	
Country		Postal/Zip Code			

Equipment Information

Boiler Model		Serial #		CRN #	
Boiler/Burner Control			Serial # & SW		
Premix burner		Type		Motor Voltage	
Fuel Train				Size	
Firing Rate Control			BAS/BMS Control		
Boiler Pump				Voltage	
Relief Valve			Size	CRN #	
LWCO					
Vent Type		Size Ø		Height or Length	
Air Supply				Air filter	

Settings & Recordings

Fuel Type: Natural Gas | Propane

Note: Propane (LP) not available on Gas14 boilers

	Min	Max	Unit
Air Setting - Index			RPM
Static Gas Pressure			In. w.c.
Dynamic Gas Supply			In. w.c.
Δp Manifold pressure			In. w.c.
Vent Pressure			In. w.c.
Δp Gas filter (optional)			In. w.c.
Return/Supply Temp.			

	MIN	MAX
CO_2 %		
O_2 %		
CO ppm		
NO_x ppm		
Flame Signal		
Flue Temp.		
Ambient		

Firing Input Range	Unit
Min Rate	
Max Rate	

Gross Combustion Efficiency %	High fire (Full-load)	
	Low fire (Part-load)	

Safety & System Checks

	Setting	Tested
Safety Hi-Limit		
Hi-Limit (Internal)		
Operating Limit		
Firing Controller		

	Setting	Tested
LWCO control		
Low Fuel Pressure sw.		
High Fuel Pressure sw.		
Air pressure sw.		

	Setting	Tested
Vent Switch		
Lockout		
TFI		
FRT		

	Setting	Tested
Fuel Train Leakage Test		
Local Remote switch function		
Boiler pressure		
P-Trap filled		

Analyzer Print outs

Other Checks/ Site Notes

Electrical Checks	
Volts L & Gnd.	
Volts N & Gnd.	
Amps @ High fire	

Safety Limit Cut-out test		
External safety limit function test (Model)	Set @ F/C	Cut-out F/C

Specific Site Note:

Code or installation violations or system deficiencies:

Boiler Installation By:

Company and Installer Name	Contractor #	Certificate #	Signature

Installer certifies that the boiler/unit(s) mentioned in this report has been installed according to I.O manual provided and to all applicable national and local codes having jurisdiction.

ATTENTION Installer, for proper warranty entitlement please submit only completed startup forms along with a boiler/system water quality report.

10 Maintenance

10.1 General Maintenance

If during the annual inspection combustion results indicate that the boiler is no longer operating at the optimum level additional maintenance should be carried out as follows:

- The Spire boiler and its components do not contain any crystalline silica.

WARNING

Electrical Shock Hazard:
Please label all wires prior to disconnecting when servicing the boiler. Wirring errors can cause improper operation and dangerous conditions. Verify boiler operation after servicing.

WARNING

All service and maintenance must be completed by a trained and qualified service technician.

WARNING

Keep the boiler area clear and free from combustible materials, gasoline and other flammable vapor and liquids.

Please ensure that the gas supply and main power supply is isolated before any maintenance work is carried out on the boiler. Care should taken when stripping the boiler for maintenance making sure that all parts, nuts, washers and gaskets, etc. are kept safe, clean and dry for re-assembly. Following maintenance/cleaning, the boiler should be re-assembled in the reverse order re-placing gaskets and joints where found necessary. All general cleaning should be carried out with compressed air, a soft brush or damp cloth to avoid damaging components. (Solvents must not be used). For better access to blower, gas train and combustion chamber remove side panels by lifting lift off of the locators.

10.2 Cleaning the Blower

Use compressed air or a synthetic brush to clean the fan, be careful no to disturb the balance clips on the vanes.

10.3 Cleaning the Combustion Chamber

Access to the combustion chamber is gained through a door on the front of the heat exchanger.

On models SP500, SP800, SP1000 and SP1500:

- first remove the blower and gas train assembly and burner and place them to the side.
- then remove the 6 socket head bolts around the outside of the door and place the door to the side

On models SP2000, SP3000, SP4000, SP5000, SP6000, and SP8000:

- the door is hinged on a sliding arm and can be opened with the blower in place.
- Remove the control panel and hang it on the blower
- Remove the gas valve and place it to the side.
- Remove the 8 sockets head screws holding the door in place.
- Slide the door straight back until the burner clears the front of the boiler and then rotate is out of the way

The combustion chamber can now be accessed from the right side. Wash the heat exchanger with clean water. If badly contaminated

clean with a small stiff bristle brush. Care should be taken when using water in the boiler casing to avoid getting electrical controls wet.

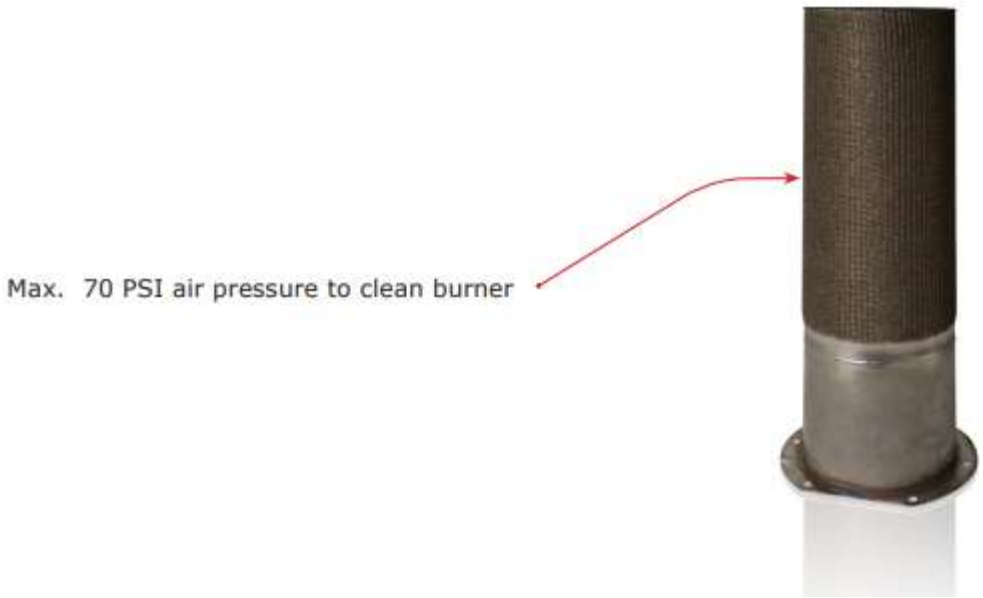
10.4 Cleaning the Burner Assembly

To remove the burner follow the steps in 9.3 used to access the combustion chamber. With door pulled out remove the blower from the door. The burner can now be removed.

Upon removal inspect the burner wire mesh and tube for damage. If the burner is in good condition, clean by using compressed air only. Between 30 and 70 psi with the nozzle positioned a minimum of 3/8" away from the face of the burner.

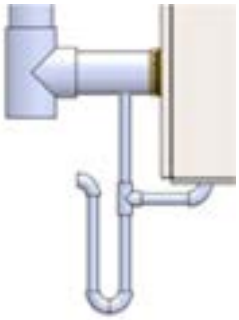
If there is any damage to the mesh or tube, the burner must be replaced.

Re-install the burner by reversing the step used to remove it.



10.5 Cleaning the Siphon

Remove the complete siphon located at the back of the boiler underneath the vent breach. Clean a refill with fresh water before reinstalling.



10.6 Cleaning/replacing the Ignition and Ionization Rod

The ignition and flame ionization rods are located on the right side of the combustion chamber door. To service remove the two retaining screws on the electrode assembly. Examine them for wear and dirt. Clean and re-gap the electrode to 1/8”. If in good condition refit using a new gasket if necessary. Replace electrode if necessary, using the supplied screws and gasket. Verify earth connection is in good condition and in contact with the door. Refit the safety bracket.

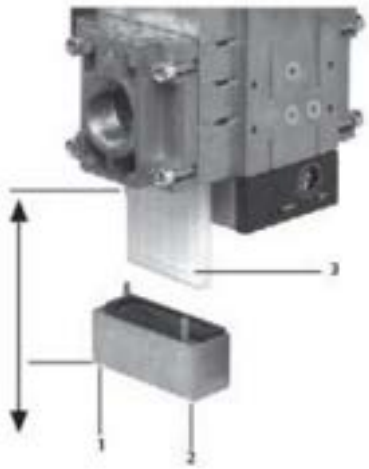
10.7 Natural Gas Filter Maintenance and Replacement

The filter shall be replaced under any of the following conditions:

1. The filter has been in service for more than a year.
2. The pressure difference between connections 1 and is greater than 2” w.c.
3. The pressure difference between connections 1 and 2 is more than twice as high as last inspection.

Filter replacement procedure:

1. Interrupt upstream gas supply by closing the manual shutoff valve.
2. Remove screws 1-2.
3. Change filter insert 3
4. Tighten screws 1-2 to 44 in-lbs
5. Open the manual shutoff valve.
6. Perform leakage and function test with a maximum pressure of 5 psi



Space requirements for fitting filter:

MBC-1000-...: at least 6 inches
MBC-2500-...: at least 6 & 3/4 inches

10.8 Sight Glass Cleaning

Remove the 4 retaining screws on the inspection glass holder, clean and replace.

Re-assemble the boiler by reversing the steps in 9.3 to access the combustion chamber. Check all gaskets and replace if necessary. Ensure all cables are routed correctly using existing clips and ties were possible without contacting the heat exchanger.