

KN SERIES PLUS+

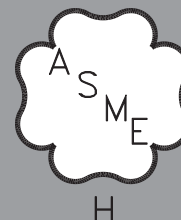


Boiler Manual Installation and Operation Instructions

Cast Iron Condensing Boilers
KN-Series Plus
**KN6+, KN10+, KN16+, KN20+,
KN26+, KN30+ and KN40+**



Also read and follow:
KN Control Manual



WARNING This manual is intended only for use by a qualified heating installer/technician. Read and follow this manual, all supplements and related instructional information provided with the boiler. Install, start and service the boiler only in the sequence and methods given in these instructions. Failure to do so can result in severe personal injury, death or substantial property damage.

WARNING **Do not use the boiler during construction.** Construction dust and particulate, particularly drywall dust, will cause contamination of the burner, resulting in possible severe personal injury, death or substantial property damage. The boiler can only be operated with a dust-free air supply. Follow the instruction manual procedures to duct air to the boiler air intake. If the boiler has been contaminated by operation with contaminated air, follow the instruction manual guidelines to clean, repair or replace the boiler if necessary.

CAUTION Affix these instructions near to the boiler/water heater. Instruct the building owner to retain the instructions for future use by a qualified service technician, and to follow all guidelines in the User's Information Manual. Dimensions are in INCHES (IN), FEET (FT), MILLIMETERS [mm] or METERS [m].

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

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 phone outside of the building. 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.

WARNING Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort

Ne pas entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les intructions du fournisseur.
- Si vous ne purvez rejoindre le fournisseur, appelez le service des incendies.

L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.

WARNING Failure to properly vent this unit can cause excessive amounts of carbon monoxide resulting in severe personal injury or death!

CAUTION Do not use automotive anti-freeze in the boiler waterways. If the use of anti-freeze is necessary an anti-freeze specifically formulated for hydronic heating systems must be used or damage to the boiler may occur voiding the warranty!

DESIGNED AND TESTED ACCORDING TO A.S.M.E. BOILER AND PRESSURE VESSEL CODE, SECTION IV FOR A MAXIMUM ALLOWABLE WORKING PRESSURE OF 100 PSI, 700 kPa WATER.

INSTALLER, THESE INSTRUCTIONS TO BE AFFIXED ADJACENT TO THE BOILER / WATER HEATER.

CONSUMER, RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE PURPOSES.

CONTENTS

Before Your Start	page 2
Ratings & Capacities	page 3
Location	page 3
Combustion Air & Ventilation	page 3
Venting Guidelines.....	page 5
Common Vent Systems	page 15
Outdoor Venting	page 16
General Piping Requirements	page 17
Heating System Piping	page 18
Domestic Water Supply Piping	page 21
Condensate Piping	page 23
Gas Supply Piping	page 23
Electrical Wiring.....	page 24
Boiler Operation.....	page 25
Operating Instructions	page 25
Sequence of Operation.....	page 28
Ignition Troubleshooting	page 30
Checking & Adjustment	page 31
Diagnostics	page 32
Maintenance	page 33
Pressure Switches.....	page 34
Wiring	page 35
Start-Up	page 36
Repair Parts.....	page 38
Warranty	page 46

BEFORE YOU START

This manual covers the application, installation, operation and maintenance of a KN-Series Plus boiler.

To obtain the safe, dependable, efficient operation and long life for which this boiler was designed, these instructions must be read, understood and followed.

The KN+ boiler series has been design certified by CSA for use with natural gas under the latest revision of ANSI-Z21.13/CSA 4.9, Gas-Fired Hot Water Boilers and CAN1-3.1, Industrial and Commercial Gas Fired Packaged Boilers. Each unit has been constructed and hydrostatically tested for a maximum working pressure of 100 psi, 700 kPa, in accordance with Section IV of the A.S.M.E. Boiler and Pressure Vessel Code.

All aspects of the boiler 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-latest revision. Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

In Canada, the installation must be in accordance with the requirements of CSA B149.1 or .2, Installation Code for Gas Burning Appliances and Equipment.

The owner should maintain a record of all service work performed with the date and a description of the work done. Include the name of the service organization for future reference.

Direct all questions to your Advanced Thermal Hydronics distributor or contact the Advanced Thermal Hydronics Customer Service Department at: 260 North Elm Street, Westfield, MA 01085. Always include the model and serial numbers from the rating plate of the boiler in question.

RATINGS & CAPACITIES

Before installing the KN+ boiler check the rating plate to ensure that the unit has been sized properly for the job. Also ensure that the unit has been set up for the type of gas available at the installation site. Other important considerations are the availability of an adequate electrical supply, fresh air for combustion and a suitable vent system.

BOILER LOCATION

1. This boiler is suitable for indoor/outdoor installations. Locate the boiler in an area that provides good access to the unit. Servicing may require the removal of jacket panels. Allow the minimum clearances between adjacent construction and the boiler as listed in Table 1.

NOTICE Service clearances are not mandatory, but are recommended to ensure ease of service should it be required.

Table 1 - Clearances

	Clearance to Combustibles		Service Clearance	
	in	mm	in	mm
Top	6	153	24	610
Back	6	153	24	610
Left Side	6	153	24	610
Right Side	6	153	24	610
Front	6	153	36	914
Flue	6	153		

2. An optimum site will be level, central to the piping system, close to a chimney or outside wall and have adequate fresh air for combustion. Ensure that the unit is level from front to back and from side to side. Use metal shims if leveling is required. Electrical and electronic components must be protected from exposure to water during operation and maintenance. DO NOT install this boiler in a location that would subject any of the gas ignition and other electronic components to direct contact with water or excessive moisture during operation or servicing.
3. Ensure that the floor is structurally sound and will support the weight of the boiler.

NOTICE The KN+ may be installed directly on combustible flooring, but never on carpeting.

4. Locate the boiler in an area that will prevent water damage to adjacent construction should a leak occur or during routine maintenance.
5. **DO NOT** place this boiler in a location that would restrict the introduction of combustion air into the unit or subject it to a negative pressure unless the combustion air is piped from the outside, see the COMBUSTION AIR & VENTILATION section.
6. **NEVER** place this boiler in a location that would subject it to temperatures at or near freezing.

WARNING Never store combustible materials, gasoline or any product containing flammable vapors or liquids in the vicinity of the boiler. Failure to comply with this warning can result in an explosion or fire causing extensive property damage, severe personal injury or death!

COMBUSTION AIR & VENTILATION

WARNING This boiler must be supplied with combustion air in accordance with Section 9.3, Air for Combustion & Ventilation, of the latest revision of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and all applicable local building codes. Canadian installations must comply with CSA B149.1 or .2 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes. Failure to provide adequate combustion air for this boiler/water heater can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

To operate properly and safely this boiler requires a continuous supply of air for combustion. **NEVER** store objects on or around the boiler!

CAUTION Combustion air contaminated with fluorocarbons or other halogenated compounds such as cleaning solvents and refrigerants will result in the formation of acids in the combustion chamber. These acids will cause premature failure of the boiler voiding the warranty!

CAUTION If the boiler is operated while the building is under construction it must be protected from wood, concrete, sheet rock and other types of dust. Failure to properly protect the unit from construction dust will damage the unit voiding the warranty!

Buildings will require the installation of a fresh air duct or other means of providing make-up air if the intake air option isn't used. Any building utilizing other gas burning appliances, a fireplace, wood stove or any type of exhaust fan must be checked for adequate combustion air when all of these devices are in operation at one time. Sizing of an outside air duct must be done to meet the requirements of all such devices.

WARNING Never operate the KN+ in an environment subjected to a negative pressure unless it is Direct Vented. Failure to comply with this warning can result in excessive levels of carbon monoxide causing severe personal injury or death!

All Air From Inside The Building

If the boiler is to be located in a confined space the minimum clearances listed in Table 1 must be maintained between it and any combustible construction. When installed in a confined space without the intake air option two permanent openings communicating with an additional room(s) are required. The combined volume of these spaces must have sufficient volume to meet the criteria for an unconfined space. The total air requirements of all gas utilization equipment, fireplaces, wood stoves or any type of exhaust fan must be considered when making this determination. Each opening must have a minimum free area of **1 in²/1000 Btu/hr, 2200 mm²/kW** based on the total input rating of ALL gas utilization equipment in the confined area. Each opening must be no less than **100 in², 64,516 mm²** in size. The upper opening must be within **12 in, 300 mm** of, but not less than **3 in, 80 mm** from, the top of the enclosure. The bottom opening must be within **12 in, 300 mm** of, but not less than **3 in, 80 mm** from, the bottom of the enclosure.

All Air From Outside The Building

When installed in a confined space without the intake air option two permanent openings communicating directly with, or by ducts to, the outdoors or spaces that freely communicate with the outdoors must be present. The upper opening must be within **12 in, 300 mm** of, but not less than **3 in, 80 mm** from, the top of the enclosure. The bottom opening must be within **12 in, 300 mm** of, but not less than **3 in, 80 mm** from, the bottom of the enclosure.

Where directly communicating with the outdoors or communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of **1in²/4000 Btu/hr, 550 mm²/kW** of the total input rating of all of the equipment in the enclosure.

Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of **1 in²/2000 Btu/hr, 1100 mm²/kW** of the total input rating of all of the equipment in the enclosure.

When ducts are used, they must have the same cross-sectional area as the free area of the opening to which they connect.

Table 2 - Make-up Air Duct Sizing

Input (MBH)	Required Cross Sectional Duct Area					
	1/4 in, 6.4 mm Wire Screen		Metal Louvers		Wooden Louvers	
	in ²	cm ²	in ²	cm ²	in ²	cm ²
600	150	967	200	1292	600	3869
1000	250	1612	334	2154	1000	6448
1600	400	2580	533	3439	1600	10,322
2000	500	3224	668	4308	2000	12,896
2600	650	4194	894	5595	2600	16,772
3000	750	4836	1002	6462	3000	19,344
4000	1000	6452	1334	8592	4000	25,808

When calculating the free area necessary to meet the make-up air requirements of the enclosure, consideration must be given to the blockage effects of louvers, grills and screens.

Screens must have a minimum mesh size of **1/4 in, 6.4 mm**. If the free area through a louver or grill is not known ducts should be sized per Table 2.

Direct Intake Air Option - General

This configuration provides combustion air directly to the boiler's air intake using a dedicated pipe when using the direct vent option. Combustion air can be drawn in horizontally through an outside wall or vertically through the roof, see Figures 2, 3, 4 & 5. It must be sized per Table 3.

Single wall galvanized smoke pipe, single wall aluminum pipe, flexible aluminum pipe, PVC or CPVC pipe can be used for the intake air pipe.

Table 3 - Intake Air Pipe Sizing

Model Size	Pipe Diameter	
	in	mm
6+	6	152
10+	6	152
16+	8	203
20+	8	203
26+	8	203
30+	8	203
40+	12	305

NOTICE All joints in metal intake air systems must be secured using corrosion resistant fasteners and sealed using a suitable Silicone caulk. If PVC or CPVC is used, the joints must be cleaned with a suitable solvent and connected using a solvent based PVC cement. The intake air system **MUST** be supported by the building structure not the boiler.

Direct Intake Air Option - Vertical

The maximum equivalent length for the vertical intake air pipe is **100 ft, 36.6 m**. Each 90° mitered elbow and the intake air cap are equal to **10 ft, 3.3 m** of straight pipe. If 90° long sweep elbows are installed use the manufacturers recommended equivalent length.

A listed, nonrestrictive intake air cap must be used. The intake air cap must terminate as shown in Figure 4. The penetration point in the roof must be properly flashed and sealed.

Direct Intake Air Option - Horizontal

The maximum equivalent length for the horizontal intake air pipe is **100 ft, 36.6 m**. Each 90° mitered elbow and the intake air terminal are equal to **10 ft, 3.3 m** of straight pipe. If 90° long sweep elbows are installed use the manufacturers recommended equivalent length.

Horizontal runs that exceed **5 ft, 1.5 m** must be supported at **3 ft, 0.98 m** intervals with overhead hangers. The intake air terminal must terminate as shown in Figures 2, 3 or 5.

GENERAL VENTING GUIDELINES

WARNING The vent installation must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision or applicable provisions of the local building codes. Canadian installations must comply with CSA B149.1 or .2 Installation Code. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

All vent systems must be fully supported by the building structure and not by the boiler. Appropriate thimbles and fire-stops must be used where required.

WARNING Improper installation of common positive pressure vent systems can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

WARNING Boiler shall not be connected to a chimney flue serving a separate appliance, designed to burn solid fuel.

NOTICE A barometric damper or blast gate as required, must be installed if a Category II vertical vent system produces a negative draft in excess of **0.15 in, 3.8 mm WC** at the flue outlet. Size the vent system per local codes and the vent pipe manufacturers requirements, using generally accepted engineering practices).

NOTICE For Category II and IV appliances the vent shall not terminate:

- 1) over public walkways; or
- 2) near soffit vents or crawl spaces or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or
- 3) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

VENT SYSTEM OPTIONS

The KN+ may be vented the following ways:

- 1) **Direct Vent (individual venting only) (page 6 & 7)** - Positive Pressure, Category IV uses a stainless steel vent system certified to UL 1738 for installations in the United States, and a stainless steel vent system certified to ULC S636 for installations in Canada. Combustion air is piped from the outdoors to the blower inlet.
- 2) **Side Wall Vent (individual venting only) (page 13)** - Positive Pressure, Category IV uses a stainless steel vent system certified to UL 1738 for installations in the United States, and a stainless steel vent system certified to ULC S636 for installations in Canada. Combustion air is obtained from the space in which the unit is installed.

WARNING To ensure proper operation, boilers that are sidewall vented and use room air must not be fired less than 25% input.

- 3) **Vertical Vent (individual venting only) (page 13)** - Positive Pressure, Category IV uses a stainless steel vent system certified to UL 1738 for installations in the United States, and a stainless steel vent system certified to ULC S636 for installations in Canada. Combustion air is obtained from the space in which the unit is installed.
- 4) **Vertical Vent (individual venting only) (page 14)** - Negative Pressure, Category II uses stainless steel vent system certified to UL 1738 for installations in the United States, and a stainless steel vent system certified to ULC S636 for installation in Canada. Combustion air is obtained from the space in which the unit is installed.
- 5) **Common Vent (page 15)** - Negative Pressure, Category II uses a stainless steel vent system certified to UL 1738 for installations in the United States, and a stainless steel vent system certified to ULC S636 for installations in Canada.

WARNING Use (Table 4) for the maximum Category (IV) equivalent vent length and the equivalent length per fitting. Table 4 - “Category IV Equivalent Length per Fitting” chart is meant as a guideline for preliminary sizing. If vent length approaches 75% of maximum length listed, an engineered vent system calculation must be performed. Consult factory.

Table 4 - Category IV Maximum Equivalent Vent Length & Equivalent Length per Fitting

Model/Outlet Diameter	K*	6+	10+	16+	
		5"	5"	6"	
Maximum Equivalent Length (Category IV)		100'	100'	100'	
Standard Tee	1.25	25 ft	25 ft	30 ft	
Boot Tee	0.65	15 ft	15 ft	15 ft	
Cap - Low Res (UL)	0.50	10 ft	10 ft	15 ft	
45° w/Bird Screen	0.40	10 ft	10 ft	10 ft	
Elbow - 90°	0.38	10 ft	10 ft	10 ft	
Elbow - 45°	0.15	5 ft	5 ft	5 ft	
Model/Outlet Diameter	K*	20+	26+	30+	40+
		6"	8"	8"	10"
Maximum Equivalent Length (Category IV)		100'	100'	100'	100'
Standard Tee	1.25	30 ft	35 ft	35 ft	40 ft
Boot Tee	0.65	15 ft	15 ft	15 ft	20 ft
Cap - Low Res (UL)	0.50	15 ft	15 ft	15 ft	15 ft
45° w/Bird Screen	0.40	10 ft	10 ft	10 ft	15 ft
Elbow - 90°	0.38	10 ft	10 ft	10 ft	15 ft
Elbow - 45°	0.15	5 ft	5 ft	5 ft	7 ft
*Equivalent lengths based on K factors and (5X) pipe diameters straight length between fittings.					

DIRECT VENT POSITIVE PRESSURE, CATEGORY IV

In this configuration the boiler blower is used to push the flue products to the outdoors while drawing combustion air from the outdoors. The Direct Intake Air Option instructions under the COMBUSTION AIR & VENTILATION section must be followed!

Horizontal Direct Vent Systems - Figures 2 & 3

The vent materials used in positive pressure vent systems must be certified to UL 1738 for installations in the United States, ULC S636 for installations in Canada.

To maximize the performance of single wall sheet metal vent systems locate 90° elbows as far from the boiler as possible and from one another. For best results, horizontal vent systems should be as short and straight as possible.

The vent system must be both gas and water tight. All seams and joints in metal pipes must be joined and sealed in accordance with the vent system manufacturer's instructions.

When horizontal vent runs exceed **5 ft, 1.5m** they must be supported at **3 ft, 0.98 m** intervals with overhead hangers. If any part of a single wall metal vent system passes through an unheated space it must be insulated with insulation rated for **400°F, 212°C**.

Horizontal vent systems shall terminate at least **4 ft, 1.3 m** below, **4 ft, 1.3 m** horizontally from or **1 ft, 0.23 m** above any door, window or gravity air inlet into any building. It must not terminate less than **4 ft, 1.3 m** horizontally from, and in no case above or below, unless a **4 ft, 1.3 m** horizontal distance is maintained, from electric meters, gas meters, regulators and relief equipment and not less than **7 ft, 2.3 m** above adjacent public walkway. The bottom of the vent terminal(s) shall be located at least **5 ft, 1.5 m** above the air intake terminal(s) unless there is a **5 ft, 1.5 m** distance between them.

Avoid terminal locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases.

When running horizontal combustion air and venting for single or multiple units, exhaust and combustion air terminals must be installed on the same plane (outside wall) in order to prevent pressure differences due to prevailing winds. In cold climates, double-wall or insulated inlet pipe recommended to prevent condensation.

Vertical Direct Vent Systems - see Figure 4

The vent materials used in positive pressure vent systems must be certified to UL 1738 for installations in the United States, ULC S636 for installations in Canada.

If any part of a single wall metal vent system passes through an unheated space it must be insulated with insulation rated for **400°F, 204°C**. Structural penetrations must be made using approved fire-stops.

The top of a vertical vent system must extend at least **5½ ft, 1.8 m** above the roof surface that it passes through, **4 ft, 1.3 m** above the intake air cap, see Figure 4. In addition the vent system must conform to the dimensions shown in Figure 4. The penetration point in the roof must be properly flashed and sealed.

The vent system must be gas tight. All seams and joints in metal pipes must be joined and sealed in accordance with the vent system manufacturer's instructions.

Combination Direct Vent Systems - see Figure 5

The boiler can be vented vertically with the intake air piped horizontally through an outside wall. Follow the instructions in the Direct Intake Air Option - Horizontal Guidelines. Also follow the general instructions in the COMBUSTION AIR & VENTILATION and GENERAL VENTING GUIDELINES sections.

NOTICE For instructions utilizing the non-metallic vent option, see Addendum (82-00613) for PVC and (82-00614 & 82-00615) for Polypropylene.

Table X- Approved Stainless Steel Vent Manufacturers (CAT II/IV)

Make	Model
DuraVent	FasNSeal Vent
M&G DuraVent	DuraSeal Vent
Heatfab	Saf-T Vent
Metal-Fab	CORR/GUARD
Security Chimneys	Secure Seal
Schebler Chimney Systems	e Vent
VAN-PACKER	CS
Z-Flex	Z-Vent
Jeremias	GOV
ICC	VIC

Table Y- Approved Intake/Exhaust Terminations (CAT IV - Sidewall/Horizontal Direct Vent)

Exhaust Termination Hood	Exhaust 90 deg	Exhaust Tee	Exhaust 45 deg	Exhaust Straight

*with bird screen

NOTICE The ATH KN-Series Plus is supplied with a factory installed DuraVent FastNSeal flue outlet adapter. A manufacturers supplied stainless steel transition piece must be used when installed with different vent systems. Do not mix vent systems of different manufacturers. Use only listed vent manufacturers (Table X), terminations (Table Y), and transition adapters (Table Z). The chimney systems manufacturer's installation instructions must be followed.

Table Z - Approved Manufacturers Stainless Steel Boiler Transition Adapters (CAT II/IV)

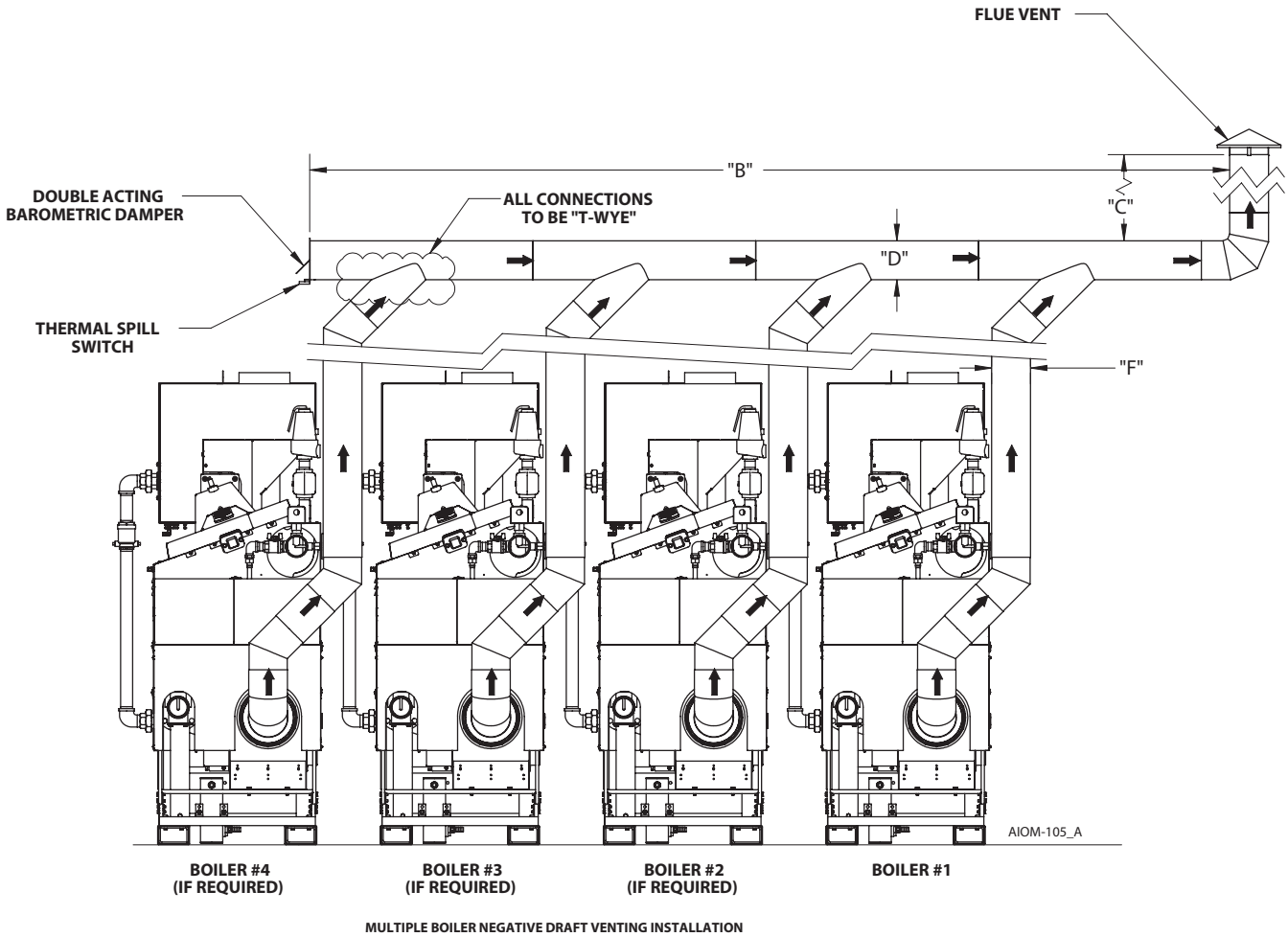
Model Size	DuraVent		M&G DuraVent (DuraSeal)		ICC		Metal-Fab				
	Boiler Adapter*	Flue	Transition Adapter	Flue	Transition Adapter	Flue	Transition Adapter	Flue			
6+	810013226	FasNSeal	DS5FFNSAU DSD5FFNSAUK	DS DSD	HM-5AC HM-5SDA	VIC-SW VIC-DW	5FCSLXL	Corr/Guard			
10+											
16+	810005652								DS6FFNSAU DSD6FFNSAUK	HM-6AC HM-6DSDA	6FCSLXL
20+											
26+	810005651								DS8FFNSAU DSD8FFNSAUK	HM-8AC HM-8DSDA	8FCSLCA
30+											
40+	810013230	DS12FFNSAU DSD10FFNSAUK	HM-10AC HM-10DSDA	10FCSPA2							

Model Size	Heatfab (Saf-T Vent)		Security Chimneys (Secure Seal)		Jeremias			
	Transition Adapter	Flue	Transition Adapter	Flue	Transition Adapter	Flue		
6+	9501MAD	EZ/GC CI Plus	SS5FFNSAU SSD5FFNSAUK	SS SSD	SWKL5-S2D -	DWKL SWKL		
10+								
16+	9601MAD						SS6FFNSAU SSD6FFNSAUK	SWKL6-S2D -
20+								
26+	9801MAD						SS8FFNSAU SSD8FFNSAUK	SWKL8-S2D -
30+								
40+	91001MAD	SS10FFNSAU SSD10FFNSAUK	SWKL10-S2D -					

Model Size	VAN-PACKER		Z-Flex		Schebler Chimney Systems (e-Vent)			
	Transition Adapter	Flue	Transition Adapter	Flue	Transition Adapter	Flue		
6+	C05VLSL/M	CS	2SVSAFNS05	Z-Flex	ESW-UNAK-05R EVD-UNAK-05R	ESW EVD		
10+								
16+	C06VLSL/M						2SVSAFNS06	ESW-UNAK-06R EVD-UNAK-06R
20+								
26+	C08VLSL/M						2SVSAFNS08	ESW-UNAK-08R EVD-UNAK-08R
30+								
40+	C10VLSL/M	2SVSAFNS10	ESW-UNAK-10R EVD-UNAK-10R					

*Factory Installed

Figure 1 - KN-Series Plus Multiple Boiler Common Venting



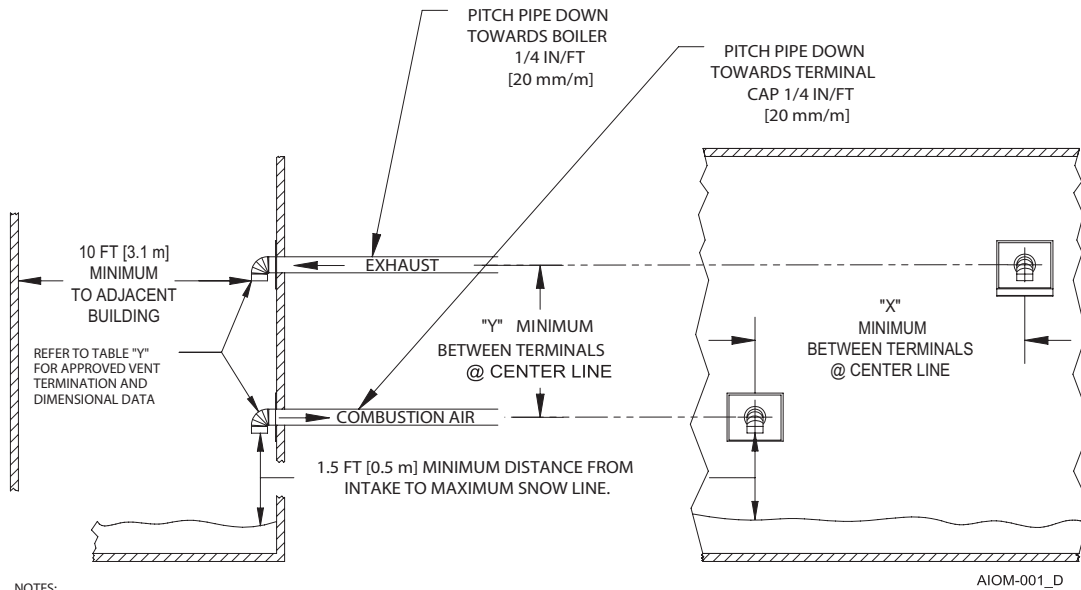
Vertical chimney venting - vertical venting - multiple boiler installations.

It is recommended that the boilers nearest the vertical chimney be fired first when the horizontal distance exceeds 50% of the vertical distance.

When sized for a (CAT II) configuration, a negative pressure of 0.02 to 0.10 inches WC is required in each boiler's riser when all boilers are operating at full input. A barometric damper must be installed as illustrated. [Exception: if the vent system is designed using accepted engineering practices and design calculations prove there is no need for barometric dampers, the barometric dampers may be omitted.] When required by applicable codes, install a thermal spill switch on each barometric damper.

1. Connect each boiler riser to the common vent with a Y connection only.
2. Install an approved vent cap at each vent termination.
3. Dimensions:
 - B = Breeching Length
 - C = Chimney Height
 - D = Breeching Diameter
 - F = Riser Diameter
 - (No smaller than the dimension given in Table 4.)
4. Size the chimney and breeching per local codes and vent pipe manufacturer's recommendations, using generally accepted engineering practices. (Consult factory for vertical heights beyond 100 ft.)

Figure 2 - Horizontal Air Intake and Venting for a Single Direct Vent System



NOTES:
1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILLIMETERS (mm) OR METERS (m) AS SHOWN.

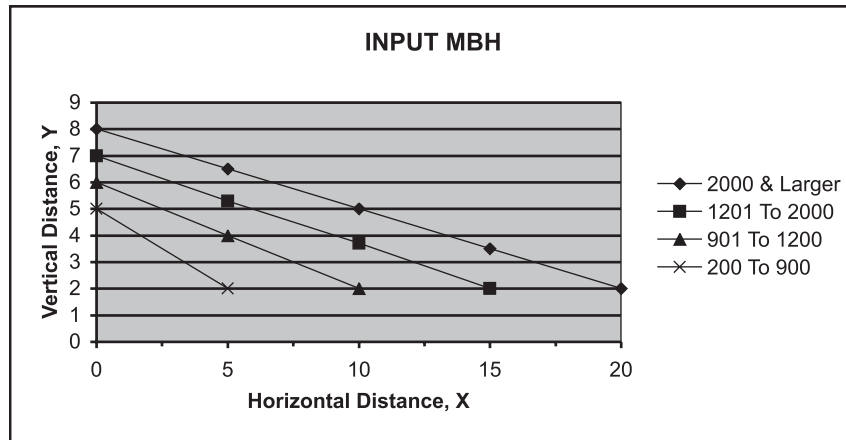
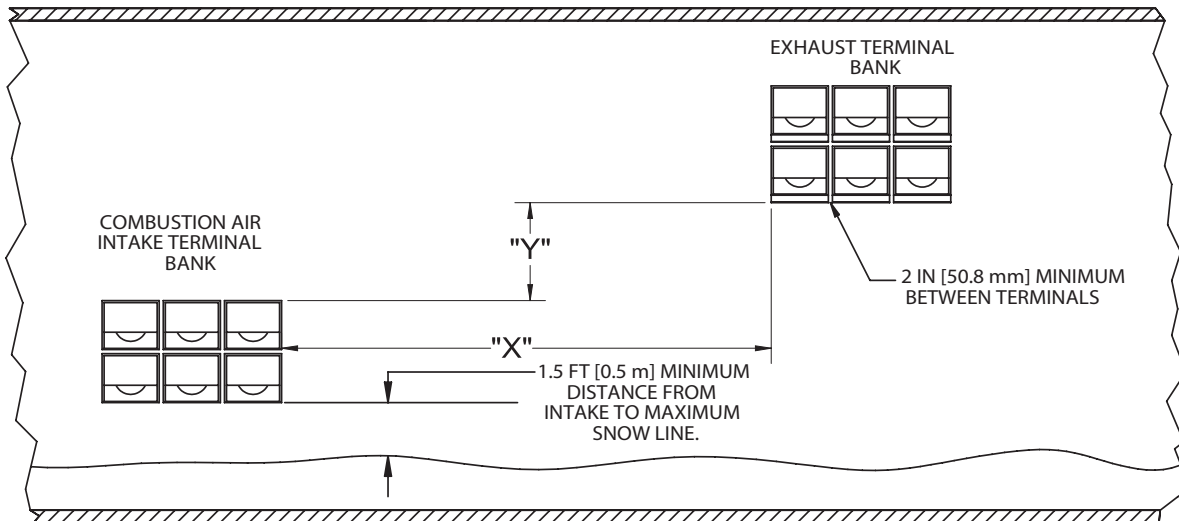


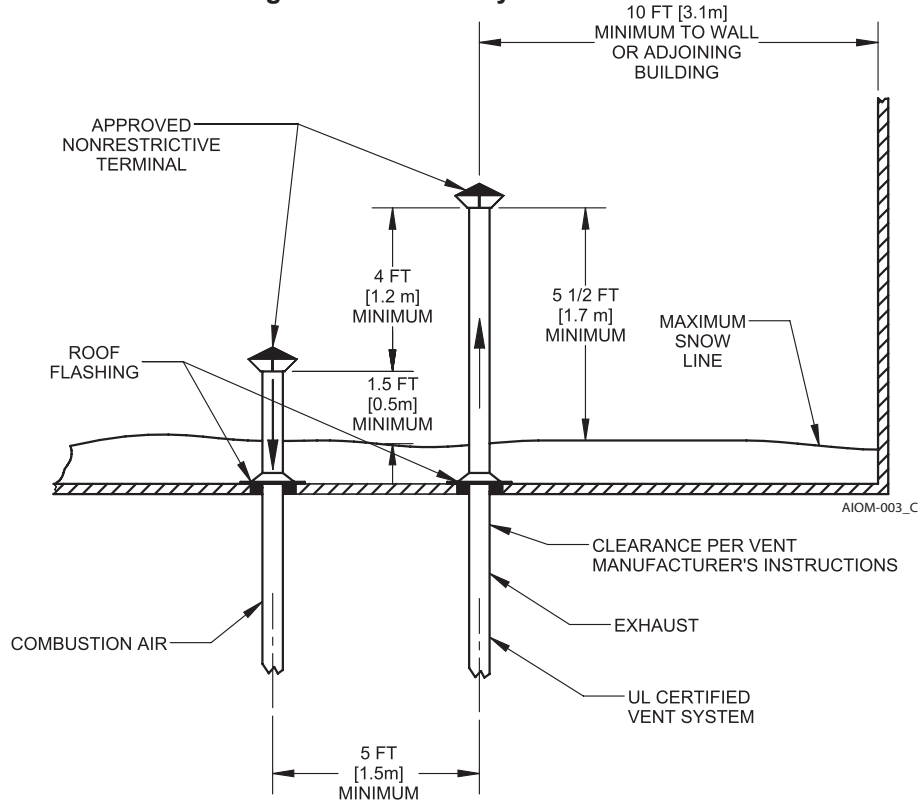
Figure 3 - Horizontal Air Intake and Venting for Multiple Direct Vent Systems



NOTES:
1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILLIMETERS (mm) OR METERS (m) AS SHOWN.

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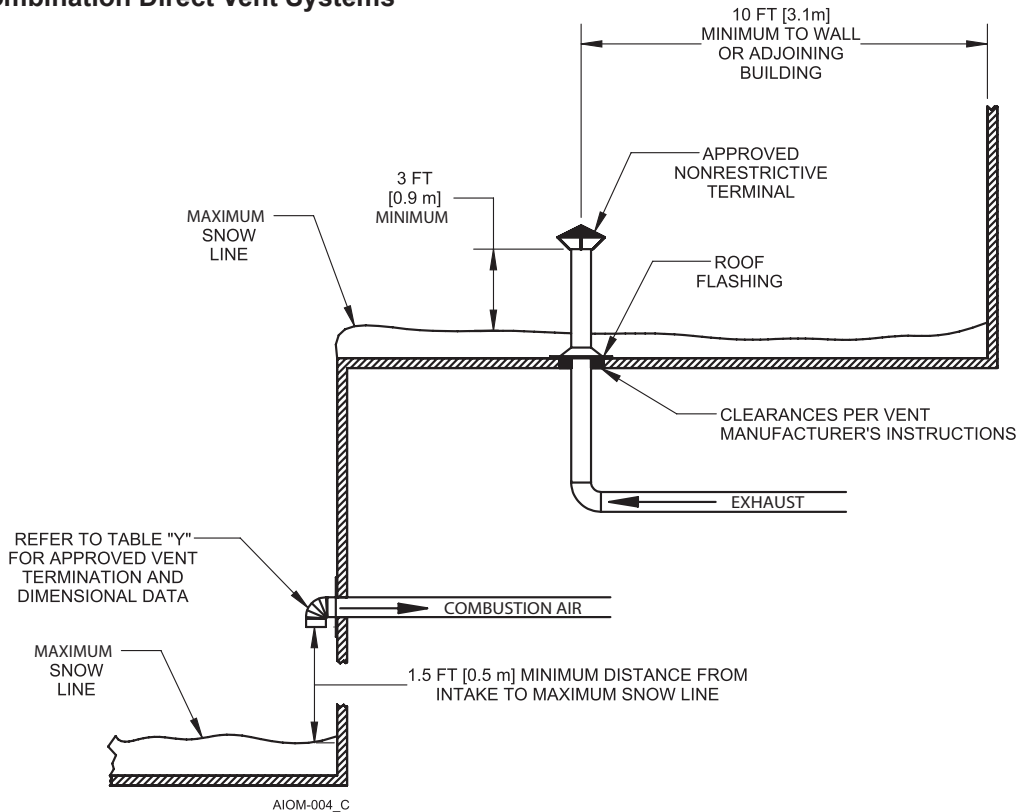
Figure 4 - Vertical Air Intake and Venting for Direct Vent System



NOTES:

1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILIMETERS [mm] OR METERS [m] AS SHOWN.

Figure 5 - Combination Direct Vent Systems



NOTES:

1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILIMETERS [mm] OR METERS [m] AS SHOWN.

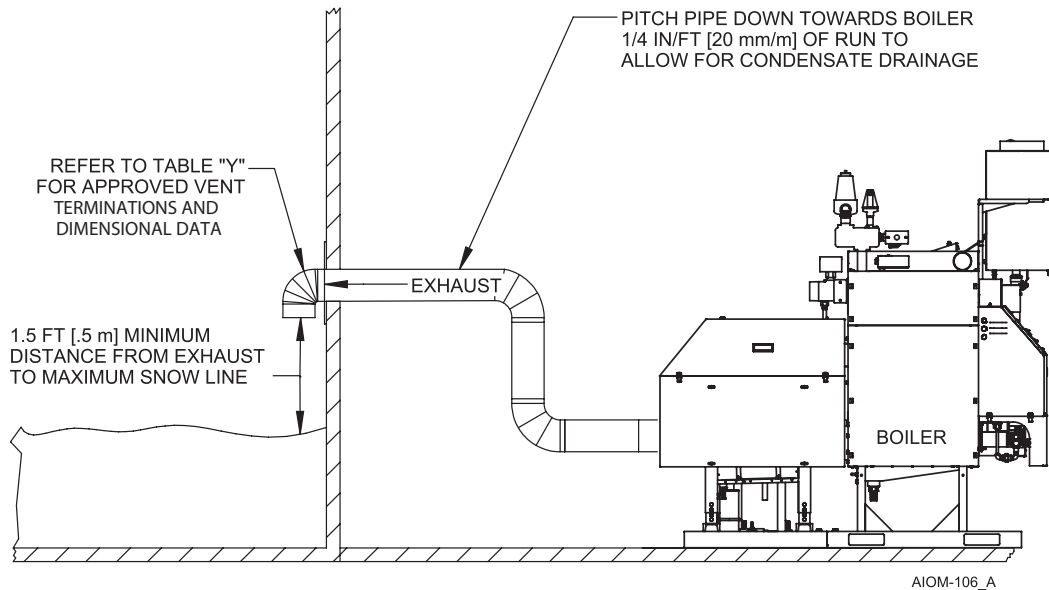
SIDE WALL VENT
POSITIVE PRESSURE, CATEGORY IV

In this configuration the boiler blower is used to push the flue products horizontally to the outdoors, see Figure 6.

WARNING To ensure proper operation, boilers that are vented sidewall and use room air must not fire less than 25% input.

The air for combustion is taken from the space in which the unit is installed. The applicable instructions under the COMBUSTION AIR & VENTILATION section must be followed! The vent guidelines under the Horizontal Direct Vent Systems section must also be followed.

Figure 6 - Side Wall Venting



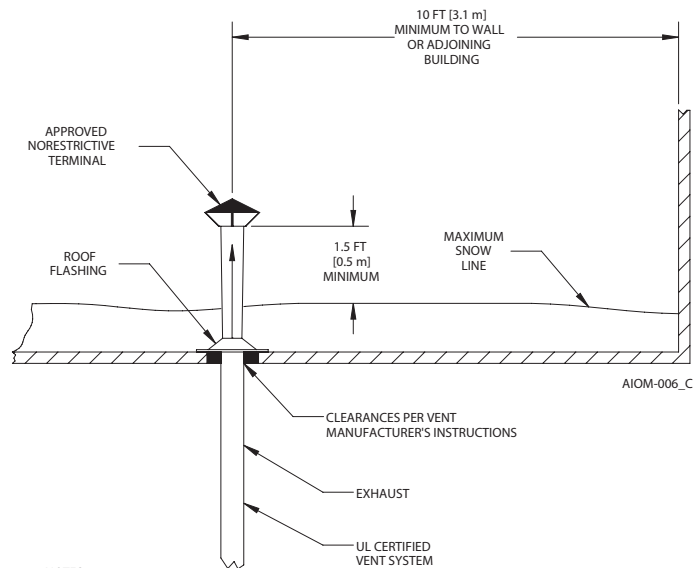
NOTES:

1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILLIMETERS [mm] OR METERS [m] AS SHOWN.

VERTICAL VENT (Recommended)
POSITIVE PRESSURE - CATEGORY IV

In this configuration the boiler blower is used to push the flue products vertically to the outdoors, see Figure 7. The air for combustion is taken from the space in which the unit is installed. The applicable instructions under the COMBUSTION AIR & VENTILATION SECTION must be followed! The vent guidelines under the Vertical Direct Vent Systems section must also be followed.

Figure 7 - Vertical Positive Pressure Venting



NOTES:

1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILLIMETERS [mm] OR METERS [m] AS SHOWN.

VERTICAL VENT (Optional) NEGATIVE PRESSURE - CATEGORY II

The KN+ is listed as a Category II appliance when vented vertically into a listed metal AL294C S.S. chimney system, Figure 8. The chimney system must provide a negative pressure of **0.02 to 0.10 in, 0.51 to 2.5 mm WC** at the boiler flue collar with the unit running.

NOTICE When using a listed metal chimney system the chimney system manufacturer’s instructions must be followed.

WARNING Multiple boiler vent systems must be designed and verified by a qualified professional and stack manufacturer. The vent system must prevent backflow of exhaust gas through idle boilers.

When more than one appliance is connected to the same chimney system the system must be large enough to safely vent the combined output of all of the appliances.

Table 5 lists the equivalent breeching and chimney sizes required for a single boiler installation.

WARNING If an appliance using any type of a mechanical draft system operating under positive pressure is connected to a chimney flue, never connect any other appliances to this flue. Doing so can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

Table 5 - Equivalent Breeching & Chimney Size, Negative Pressure - Single Boiler

Model Size	Breach & Flue Diameter	
	in	mm
6+	6	153
10+	6	153
16+	10	254
20+	10	254
26+	12	305
30+	12	305
40+	12	305

NOTICE These sizes are based on a **20 ft, 6.1 m** chimney height.

Vent Connections

Locate the boiler as close to the chimney system as possible. Use the shortest, straightest vent connector possible for the installation. If horizontal runs exceed **5 ft, 1.5 m** they must be supported at **3 ft, 0.9 m** intervals with overhead hangers. Use the appropriate vent connector of the same diameter as the flue collar to connect the boiler to a listed metal chimney system. Follow the chimney system manufacturer’s instructions for proper assembly.

The vent system should be sloped up toward the chimney at a minimum rate of **1/4 in/ft, 2 cm/m**.

Always provide a minimum clearance of **6 in, 152 mm** between single wall vent pipe and any combustible materials.

WARNING Failure to maintain minimum clearances between vent connectors and any combustible material can result in a fire causing extensive property damage, severe personal injury or death!

Exit cones are favorable when used to increase the velocity of the flue gas exiting the stack and, may also help, in cold climates, to reduce ice build-up. Exit cone terminations must be supplied by others, installed per manufacturer’s instructions, and meet local and federal code.

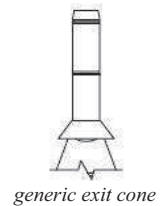
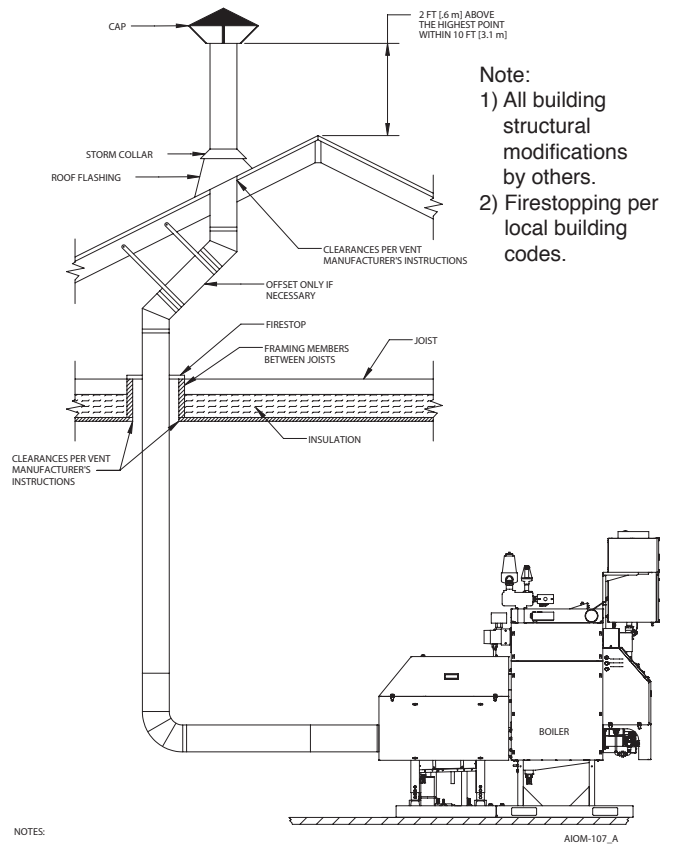


Figure 8 - Vertical Venting with a Metal Chimney System



EXISTING COMMON VENT SYSTEMS

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

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas: système d'évacuation

- a) Seal any unused openings in the common venting system.

Sceller toutes les ouvertures non utilisées du système d'évacuation.

- b) 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.

Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.

- c) 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 exhaust, so they will operate at maximum speed. Do not operate a summer exhaust fan for a boiler installation. Close fireplace dampers.

Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés du système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.

- d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.

- e) 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 condition of use.

Une fois qu'il a été déterminé, selon la méthode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.

- f) 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. 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 Appendix F in the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 and or CSA B149 Installation Codes.

Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CSA-B149. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) des codes d'installation CSA-B149.

OUTDOOR VENTING

When installed outdoors the KN+ must be fitted with the factory supplied outdoor hood, air intake adapter with filter and exhaust terminal, see Figure 8A. Multiple units must be spaced per Figure 8B.

The boiler must be at least 2 ft, .62 m from any door, window or gravity air inlet into any building and at least 3 ft, 1 m from any overhang unless local codes dictate differently.

Avoid locations where wind deflection off of adjacent walls, buildings or shrubbery might cause a downdraft. The unit(s) should be located at least 3 ft, 1 m from structures. Outdoor installations are not recommended in areas where the danger of snow blockage exists.

CAUTION Do not place the boiler in a location that would subject it to runoff from adjacent buildings or damage may occur voiding the warranty!

WARNING The boiler and system must be filled with a glycol mixture not to exceed 50% by volume. All water piping exposed to low temperatures must be insulated.

Figure 8A - Outdoor Venting

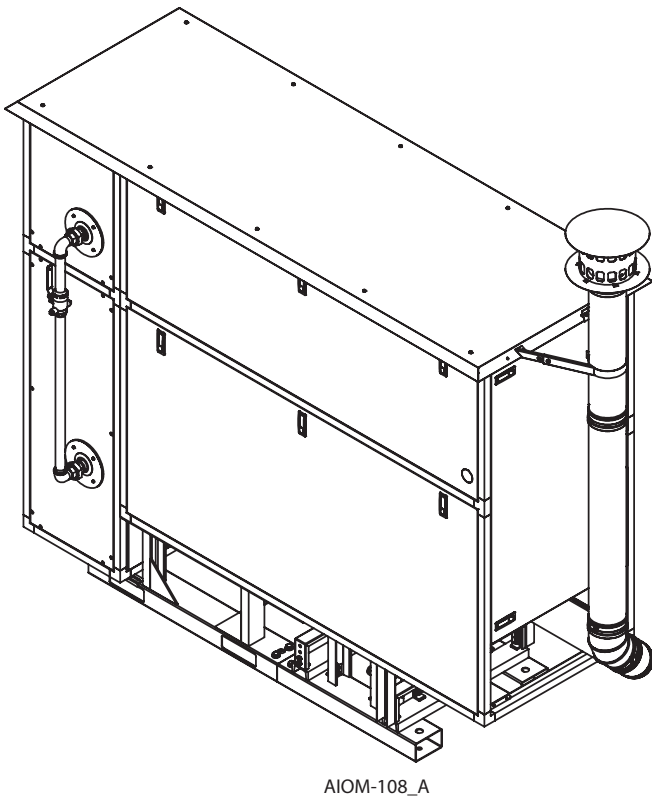
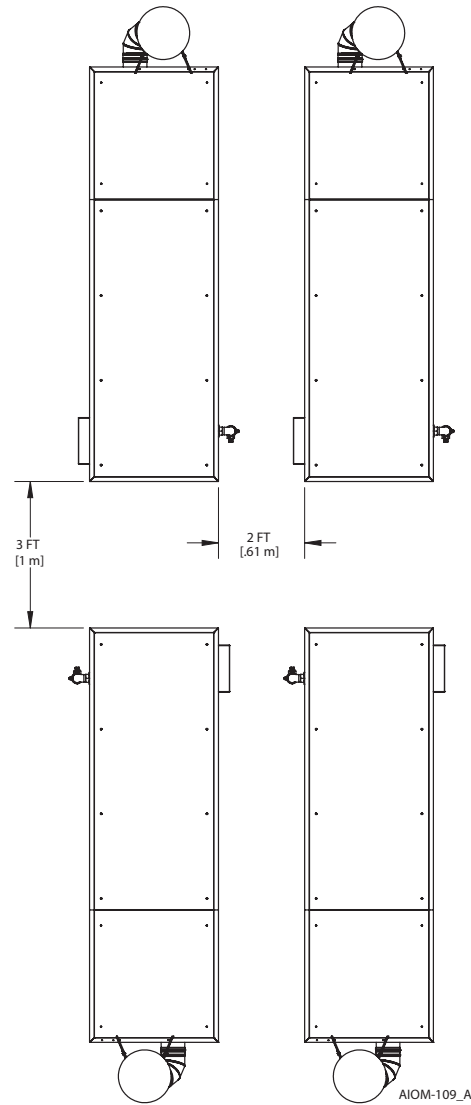


Figure 8B - Multiple Outdoor Units



NOTES:

1. DIMENSIONS ARE IN INCHES (IN), FEET (FT), MILLIMETERS (mm) OR METERS (m) AS SHOWN.

WARNING The KN-Series Plus Boiler is certified for outside installations in temperate climates only.

1. The condensate traps located under the secondary heat exchanger and the vent pipe must be wrapped with heat tape to ensure the traps never drop below 32°F.
2. The vent pipe must be insulated to prevent freezing of condensate in the pipe.
3. The boiler and system must be filled with a polypropylene glycol/water antifreeze mixture not to exceed 50% glycol by volume.
4. All water piping exposed to low temperatures must be insulated.
5. A continuous flow of water through the unit MUST be maintained! The pump responsible for flow through the boiler/water heater must run continuously!

GENERAL PIPING REQUIREMENTS

CAUTION Improper piping of this boiler will void the manufacturer’s warranty and can cause boiler failure resulting in flooding and extensive property damage!

NOTICE Shut off valves and unions should be installed at the inlet and outlet connections of the boiler to provide for isolation of the unit should servicing be necessary.

Relief Valve

Pipe the discharge of the pressure relief valve as shown in Figure 9. Mount on rear section or vertically on supply nipple.

CAUTION Never install any type of valve between the boiler and the relief valve or an explosion causing extensive property damage, severe personal injury or death may occur!

Flow Sensor

The factory mounted SIKA flow sensor, as shown in Figure 9, is wired to prevent the boiler from firing unless there's adequate water flow, (Table 6), through the unit.

NOTICE The SIKA flow sensor sends information to the HeatNet control and displays the water flow information in (gpm). The minimum flow settings are fully adjustable. The boiler will not operate if the (gpm) falls below the minimum value. If the system is using Glycol the % of glycol mixture must be entered. The SIKA Flow sensor is limited to **194°F, 90°C** water temperature. If the return water temperature rises above **194°F, 90°C** the boiler will shut down. For applications requiring System Return temperatures above **194°F, 90°C**, please consult Manufacturer. Reference the HeatNet IOM for menu instructions.

Air Vent

The factory mounted air vent, as shown in Figure 9, is installed to automatically purge unwanted air from the boiler allowing the system to run more effectively.

NOTICE Please note that after installing in a new system or retrofitting an old, close the isolation valve installed upstream of the Air Vent prior to filling the system with water. Once the system has been properly filled open the Air Vent isolation valve for automatic operation. If this is not done, it is entirely possible that the internal float mechanism will become clogged open, causing the air vent to leak.

NOTICE Prevent supply/return nipple from turning during attachment to system piping.

Table 6 - Temperature Rise Table

Model Size	Water Flow Rates (GPM)		
	100%-Input		20%-Input
	Min.*	Max.*	Min.
6+	11.5	57.7	11.5
10+	19.0	95.2	19.0
16+	30.8	153.8	30.8
20+	38.1	190.4	33.2
26+	50.0	250.0	41.5
30+	57.1	285.7	48.4
40+	76.2	381.0	63.9

*Min/Max flow correspond to a (20°F/100°F) Δt at full input, for applications requiring operation above and/or below these parameters, please consult manufacturer.

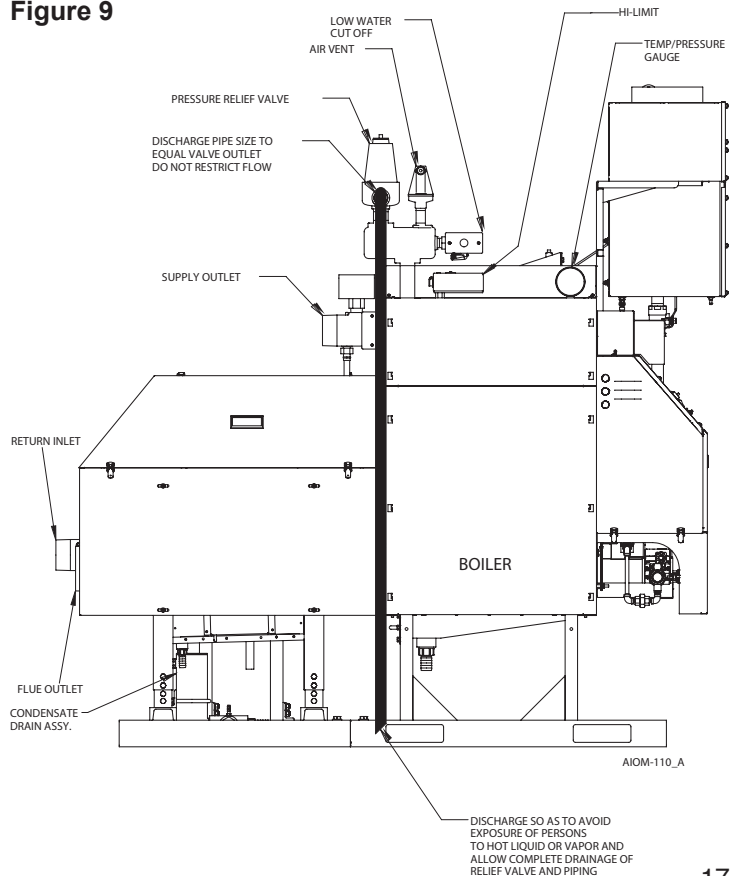
NOTICE In order to maintain boiler capacity, increase flow rates approximately (10%) and pump head (25%) for mixtures up to 50% glycol.

NOTICE Use the following equation to determine the boiler derate capacity when adjustments aren't made. (2012 ASHRAE Systems Handbook)

$$qw = 500 * Q * (p/pw) * Cp * \Delta T$$

Where
 qw = Total heat transfer rate, BTU/h
 Q = flow rate, gpm
 p = fluid density, lb/ft³
 pw = density of water at 60°F, lb/ft³
 Cp = specific heat of fluid, Btu/lb °F
 ΔT = temperature difference, °F

Figure 9



HEATING SYSTEM PIPING

General Piping Requirements

All heating system piping must be installed by a qualified technician in accordance with the latest revision of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

Where required, the piping must comply with ANSI/ASME CSD-1, Standard for Controls and Safety Devices for Automatically Fired Boilers.

All applicable local codes and ordinances must also be followed. A minimum clearance of 1in, 25 mm must be maintained between heating system pipes and all combustible construction. All heating system piping must be supported by suitable hangers, not the boiler. The thermal expansion of the system must be considered when supporting the system. A minimum system pressure of 20 psig, 138 kPa must be maintained at boiler operating conditions. For glycol systems, a minimum system pressure of 30 psig, 207 kPa must be maintained at boiler operating conditions.

Boiler Piping Connections

The supply and return connections should be sized to suit the system, see Table 7.

Table 7 - Supply & Return Pipe Sizing

Model Size	Supply Size	Return Size
6+	3" NPT	3" NPT
10+	3" NPT	3" NPT
16+	3" NPT	3" NPT
20+	3" NPT	3" NPT
26+	4" NPT	4" NPT
30+	4" NPT	4" NPT
40+	4" NPT	4" NPT

CAUTION System Cleaning & Flushing: Prior to commissioning the boiler(s), the piping/system must be cleaned and flushed to prevent contaminants from settling back into the boiler and fouling the heat exchanger.

Isolate the boiler from the system prior to the cleaning process. Fill the system with water, add the cleaning solution and follow the solution manufacturer's instructions. Once clean, refill the system with clean water as specified in the Water Treatment section.

Water Treatment

This boiler was designed to operate in a closed loop heating system. System fill water must not contain more than 500 ppm of total dissolved solids and no greater than 300 ppm hardness. Suspended solids such as

Magnetite, Iron Oxides must be flushed from the system prior to commissioning the boiler(s). The PH level must be within the 6.5-11 range. Where required, the system must be protected by the addition of a corrosion inhibitor per the chemical supplier's instructions.

For systems requiring glycol for freeze protection use a glycol/water mix that prevents foaming. Air entrapped within foam significantly decreases heat transfer and can result in damage to the sections. Products such as DOWFROST, DOWTHERM, UCARTHERM or an equivalent product must be used to ensure proper protection to the boiler.

The water used for dilution of concentrated heat transfer fluids must be distilled, de-ionized, or equivalently clean as stated above. De-ionized water by itself can be aggressive towards many metals, but is perfectly safe when used for dilution of DOWFROST, DOWTHERM or UCARTHERM as specified by the manufacturer.

FAILURE TO ENSURE PROPER WATER QUALITY CAN RESULT IN DAMAGE TO THE BOILER(S) VOIDING THE WARRANTY.

Water Meter

Make-up water introduced into a closed system due to system leaks can negatively affect the long term reliability of the heating system resulting in abnormal boiler water quality. It is recommended that a water meter be installed in the system make-up line. If make-up is recorded, the leaks must be found and repaired.

Pump Requirements

This boiler requires a continuous minimum water flow for proper operation. The system pump must be sized to overcome the head loss of the boiler and the heating system in order to achieve the required temperature rise. If the system contains hydronic antifreeze this must be considered when sizing the pump. The temperature rise across the boiler must never exceed **100°F, 55.6°C**.

Low Water Cutoff

Each KN boiler comes equipped with a factory installed low water cutoff.

Expansion Tank & Air Separator

An expansion tank or other means to control thermal expansion must be installed in the heating system. An expansion tank must be installed close to the boiler on the suction side of the pump. An air scoop and automatic air vent must also be installed to eliminate air trapped in the system.

Reverse Return Piping (RECOMMENDED)

Systems using multiple boilers can also be installed using a reverse return system, Figure 11.

Reverse Return Piping (RECOMMENDED)

Systems using multiple boilers can also be installed using a reverse return system, Figure 11.

Primary/Secondary Piping

Although acceptable, the system is not as cost effective as reverse return piping. Figure 12 shows a typical primary/secondary piping system. A dedicated pump is used to maintain a constant water flow through the boiler. Systems using multiple boilers can be installed using a primary/secondary manifold system, Figure 13.

Piping For Use With Cooling Units

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

When a boiler is connected to a heating coil that may be exposed to refrigerated air from an air handling device, the piping system must be equipped with flow-control valves or some other automatic means of preventing gravity circulation of the boiler water during the cooling cycle.

NOTICE It is essential that following boiler shut off, the boiler pump continue to operate for approximately (5) minutes to dissipate the heat away from the heat exchanger.

Figure 10 - Typical Single Boiler Piping (RECOMMENDED)

(Circulator pump must be sized for minimum water flow rate of boiler, including system pressure drop)

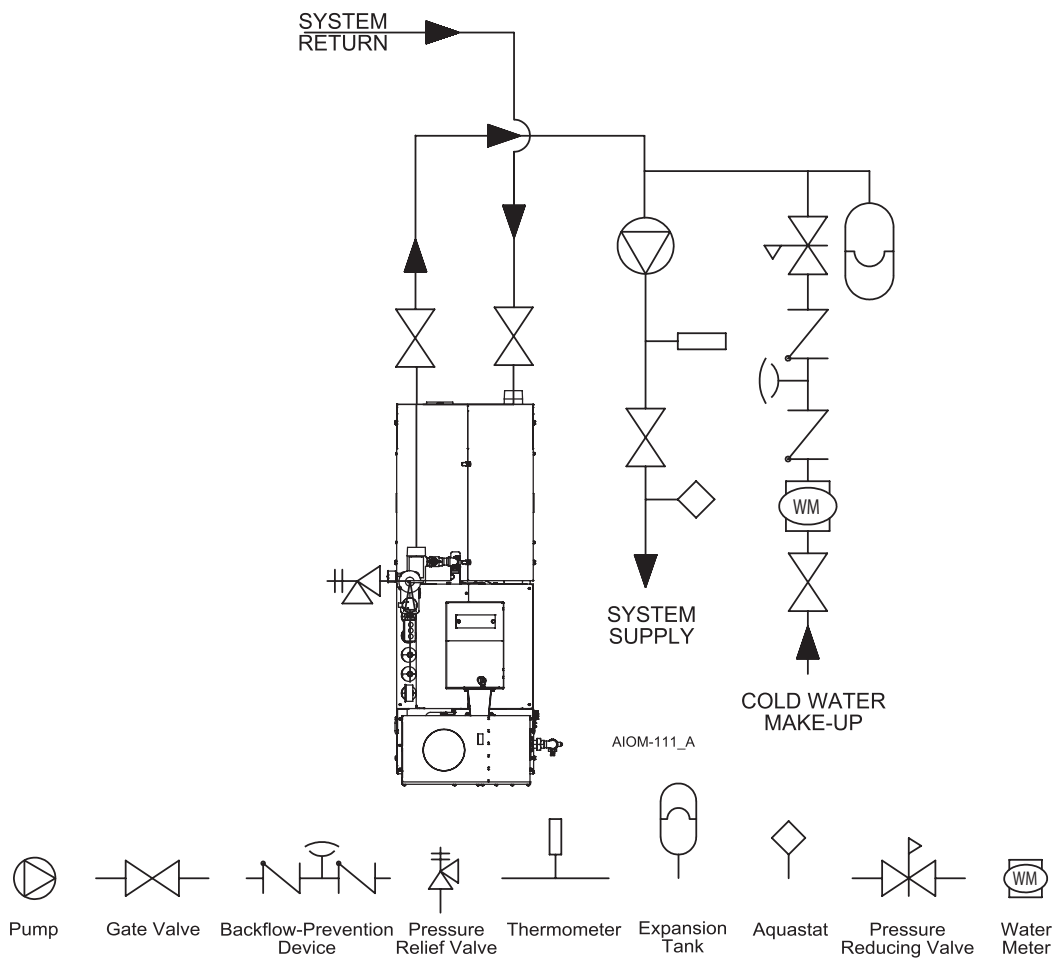
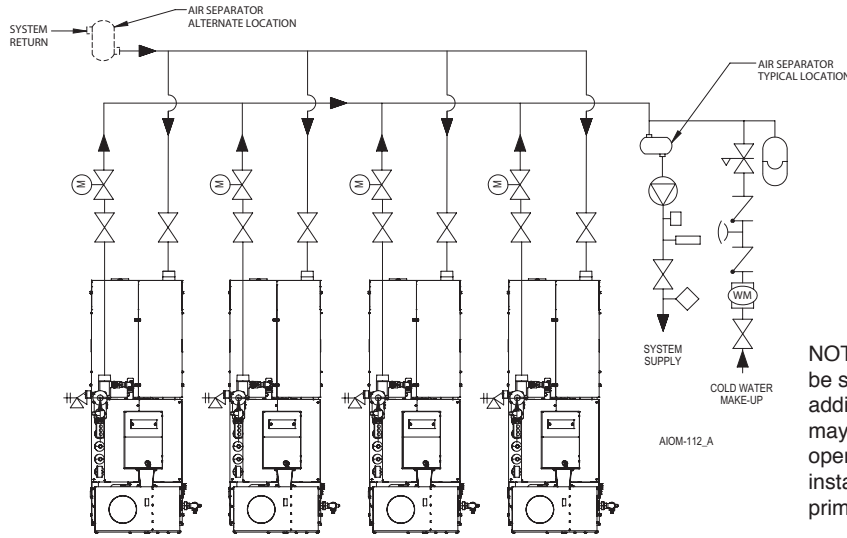


Figure 11 - Typical Multiple Boiler Reverse Return Piping (RECOMMENDED)

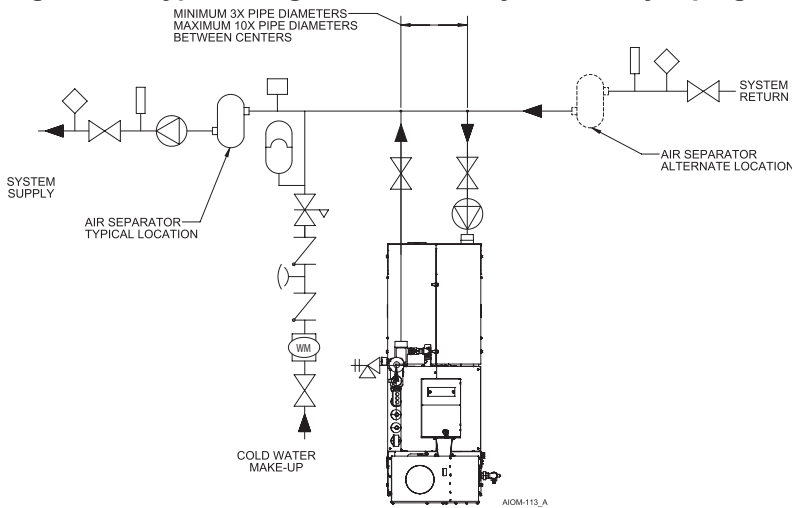
(Careful consideration as to minimum boiler and system water flow rates must be taken. Please consult our local manufacturers representative for assistance.)



NOTE: Not all system valves may be shown. Consult local codes for additional system components which may be necessary. For HeatNet operation, a sensor is required and installed at a minimum of 12" from primary loop tee.

- Motorized Valve
- Pump
- Gate Valve
- Check Valve
- Backflow-Prevention Device
- Pressure Relief Valve
- Thermometer
- Expansion Tank
- Aquastat

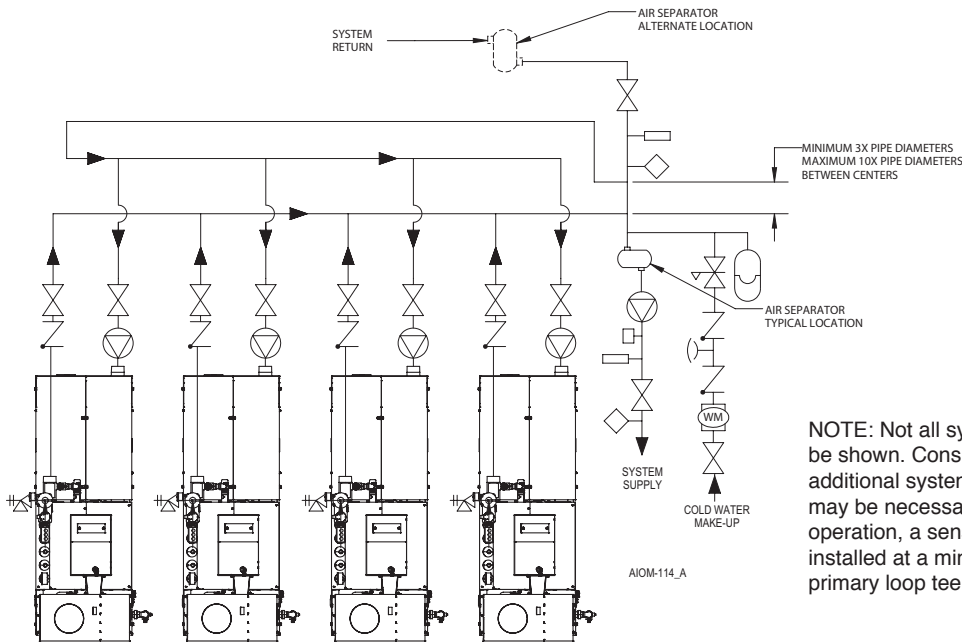
Figure 12 - Typical Single Boiler Primary/Secondary Piping



NOTE: Not all system valves may be shown. Consult local codes for additional system components which may be necessary. For HeatNet operation, a sensor is required and installed at a minimum of 12" from primary loop tee.

- Pressure Reducing Valve
- HeatNet Sensor

Figure 13 - Typical Multiple Boiler Primary/Secondary Piping



NOTE: Not all system valves may be shown. Consult local codes for additional system components which may be necessary. For HeatNet operation, a sensor is required and installed at a minimum of 12" from primary loop tee.

- Tangential type air separator
- Water Meter

DOMESTIC WATER SUPPLY PIPING

CAUTION Proper controls must be used to prevent water supplied for domestic use from exceeding **130°F, 54°C** or a scald injury will occur! When higher water temperatures are required for appliances such as a dishwasher, a mixing valve or some other tempering means must be installed. Households with small children may require water temperatures less than **120°F, 49°C**. Local codes must be complied with!

General Piping Requirements

The KN+ boiler can be used in combination with an indirect tank to provide hot water for domestic use. Piping and components must be suitable for use with potable water. The indirect storage tank must be equipped with a temperature and pressure relief valve that complies with ANSI Z21.22 or CAN-4.4 and CAN-4.6.

NOTICE The storage tank must be located as close to the boiler as possible to prevent excessive head loss which will reduce flow.

Expansion Tank

An expansion tank or other means to control thermal expansion must be installed in the water heating system if back flow prevention devices are installed.

Two typical water heating systems are shown in Figures 14 & 15.

Thermostatic Mixing Valve- Water Above 140°F, 60°C

Water can be stored at temperatures above **140°F, 60°C** provided that a thermostatically controlled mixing valve is used to temper the hot water to an acceptable temperature before it's supplied for domestic use. The mixing valve **MUST** be set to prevent a scald injury from occurring, see the caution against scalding above. Storage of water for domestic use above **140°F, 60°C** will provide an increased quantity of tempered water and help prevent the growth of water born bacteria.

Figure 14 - Typical Single Boiler with Indirect Storage Tank Piping

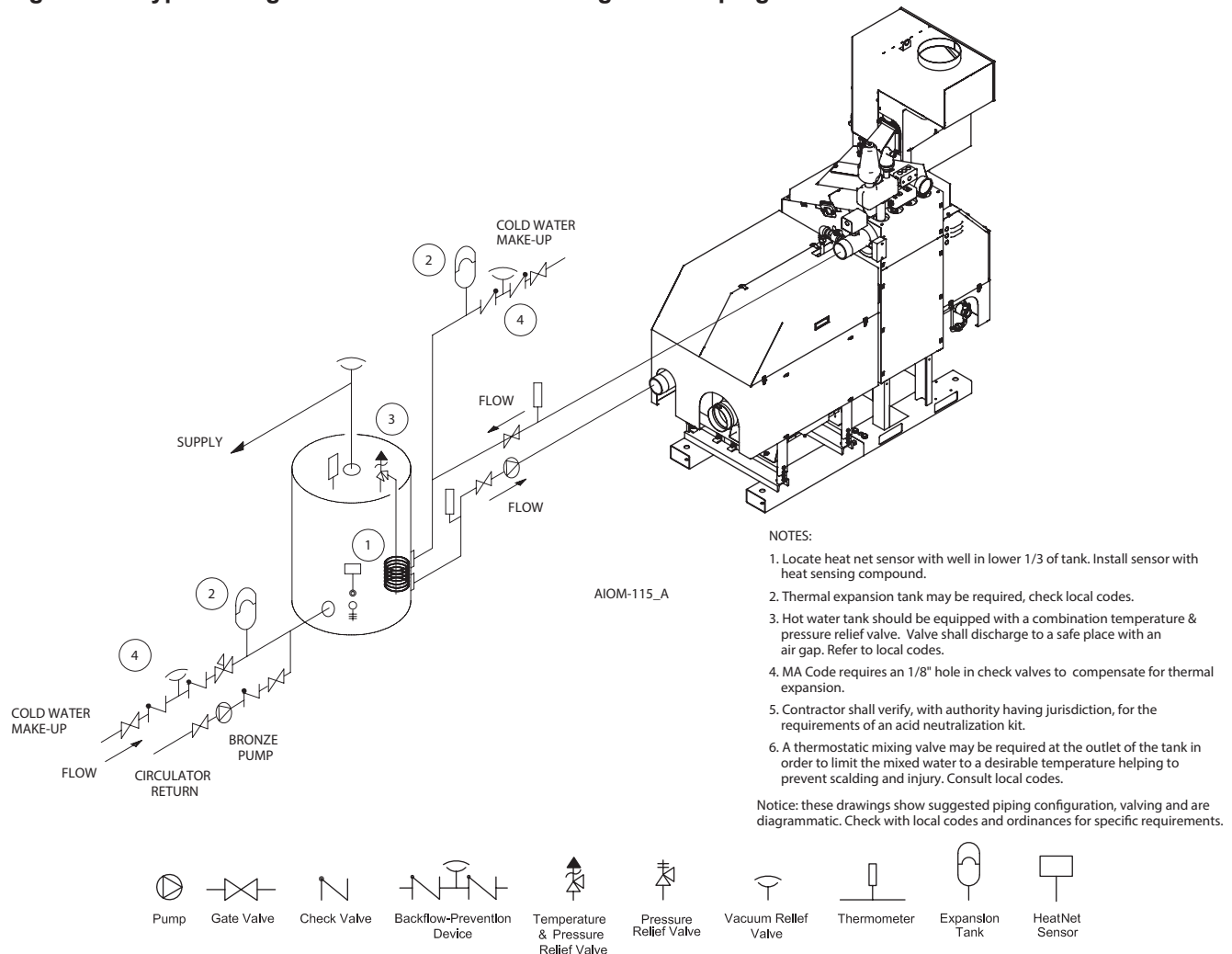
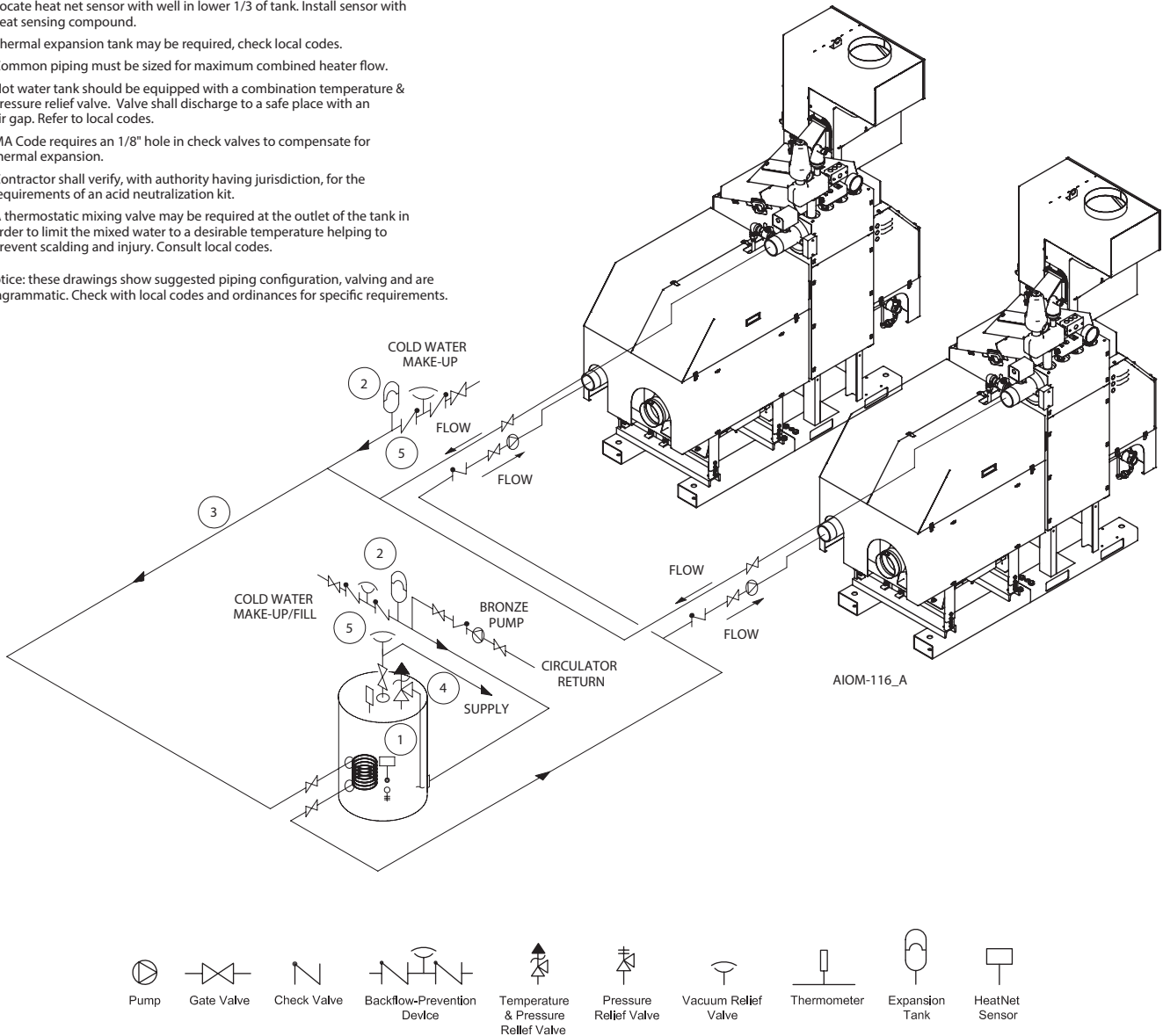


Figure 15 - Typical Multiple Boiler with Indirect Storage Tank Piping

NOTES:

1. Locate heat net sensor with well in lower 1/3 of tank. Install sensor with heat sensing compound.
2. Thermal expansion tank may be required, check local codes.
3. Common piping must be sized for maximum combined heater flow.
4. Hot water tank should be equipped with a combination temperature & pressure relief valve. Valve shall discharge to a safe place with an air gap. Refer to local codes.
5. MA Code requires an 1/8" hole in check valves to compensate for thermal expansion.
6. Contractor shall verify, with authority having jurisdiction, for the requirements of an acid neutralization kit.
7. A thermostatic mixing valve may be required at the outlet of the tank in order to limit the mixed water to a desirable temperature helping to prevent scalding and injury. Consult local codes.

Notice: these drawings show suggested piping configuration, valving and are diagrammatic. Check with local codes and ordinances for specific requirements.

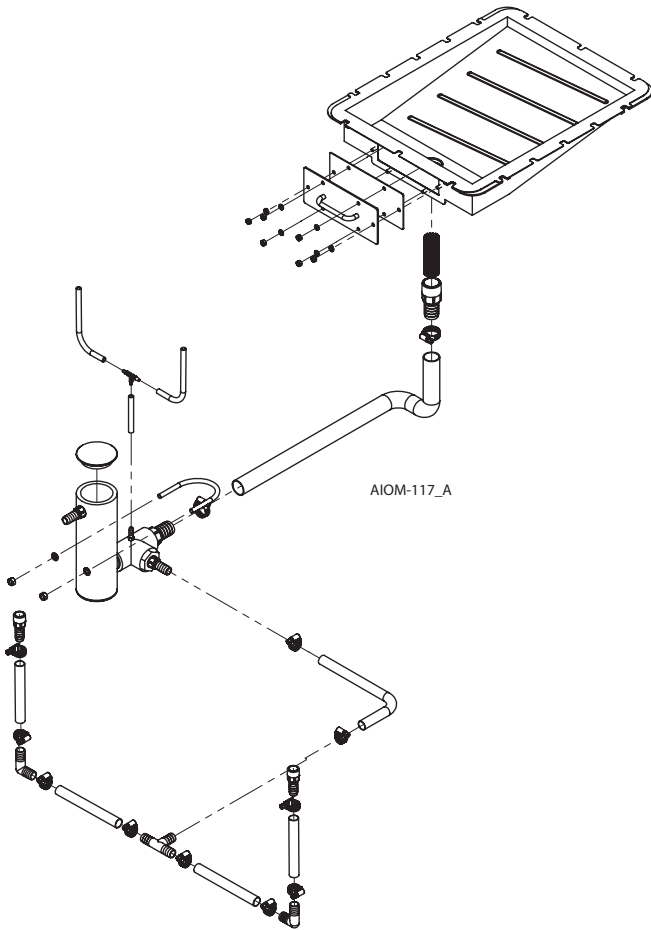


CONDENSATE PIPING

The condensate trap provided with the boiler must be attached to the bottom pan and piped to a suitable floor drain (consult local code) or condensate pump. If a condensate neutralization device is required by local code, it must be positioned prior to boiler room drain. Fill the condensate trap with water, check and maintain water level in trap during operation prior to start-up.

Various condensate neutralizer models and sizes available through JJM Boiler Works, Inc. (jjmboilerworks.com)

Figure 16 - KN-Series Plus Condensate Drain



GAS SUPPLY PIPING

WARNING Check the boiler rating plate to make sure that the boiler is for the type of gas that will be used. If it isn't, do not connect the boiler to the gas supply. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

The KN+ comes from the factory ready to be piped to the gas supply. If for any reason the boiler is not for the type of gas available at the installation site, call your Advanced Thermal Hydronics representative to resolve the problem.

Table 8 should be used to ensure that the gas supply piping is sized properly. If more than one appliance is supplied by the same supply pipe, the piping must be sized based on the maximum possible demand. Do not neglect the pressure drop due to pipe fittings. Table 8 should be used in conjunction with Table 9 to ensure that the gas supply piping has the capacity to meet the demand.

Figure 17 depicts the proper way to connect the boiler to the gas supply piping. The manual shut-off valve **MUST** be installed in the supply piping. It should be installed **5 ft, 1 m** above the floor where required by local codes. Provide a sediment trap at the bottom of the vertical section of the gas supply pipe upstream of the gas controls.

A ground joint union should be installed between the boiler gas controls and the supply piping. Each of these items are needed to ensure long life and ease of servicing. Always use a pipe sealant that is suitable for use with the type of gas (NG/LP) being used.

Table 8 - Gas Pipe Capacity

Maximum pipe capacity in ft ³ /hr based on 0.60 specific gravity gas at a pressure of 0.5 psig or less and a 0.3" WC pressure drop.									
Nominal Iron Pipe Size	Pipe length in feet								
	10	20	30	40	50	60	80	100	150
Maximum gas volume of pipe (ft ³ /hr)									
1"	520	350	285	245	215	195	170	150	120
1¼"	1050	730	590	500	440	400	350	305	250
1½"	1600	1100	890	760	670	610	530	460	380
2"	3050	2100	1650	1450	1270	1150	990	870	710
2½"	4800	3300	2700	2300	2000	1850	1600	1400	1130
3"	8500	5900	4700	4100	3600	3250	2800	2500	2000

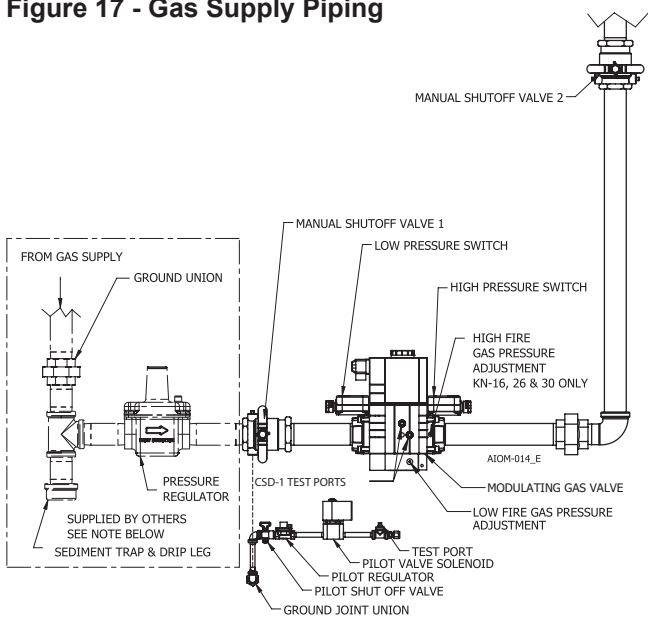
Note: Multiply the gas volume by 0.62 for propane flow capacity in ft³/hr. Multiply the propane flow capacity by 2500 Btu/ft³ to determine the propane Btu/hr capacity for a given pipe size and length.

Table 9 - Equivalent Pipe Length Chart

Nominal Iron Pipe Size	Type of pipe fitting			
	90° Elbow	Tee ¹	Gas Valve ²	Gas Cock ²
	Equivalent pipe length, (ft)			
1"	2.6	5.2	0.6	1.5
1 1/4"	3.5	6.9	0.8	1.9
1 1/2"	4.0	8.0	0.9	2.3
2"	5.2	10.3	1.2	3.0

Notes: 1. For flow through branch.
2. For flow at full open.

Figure 17 - Gas Supply Piping



NOTICE A lockup style regulator, supplied by others, must be installed, see Figure 17, 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 ± 1.0) WC.

NOTICE A minimum of (3 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.

CAUTION 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!

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler. All gas connections MUST be leak tested before putting the boiler into operation.

WARNING Never use an open flame to test for gas leaks. Always use an approved leak detection method. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

CAUTION Gas train must be isolated when purging the gas line prior to commissioning the boiler.

NOTICE The factory supplied Dungs MBC modulating gas valve, see figure 17 incorporates an internal filter that must be inspected and changed at required intervals. Reference the Dungs MBC Installation Instructions – 264541 for detailed instructions.

Whenever the gas supply piping is pressure tested the boiler gas controls must be protected. If the test pressure is equal to, or less than **1/2 psig, 3.5 kPa** isolate the boiler by closing its' manual shut off valve, see Figure 17. If the test pressure is greater than, or equal to **1/2 psig, 3.5 kPa**, disconnect the boiler and its individual shut-off valve.

ELECTRICAL WIRING

Electrical Power Connections

CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing.

ATTENTION. Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.

The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI / NFPA-70. Installation should also conform with CSA C22.1 Canadian Electrical Code Part I if installed in Canada. A separate circuit breaker must be installed per boiler (if required, the optional local pump FLA must be incorporated and sized accordingly). A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Refer to point of connection diagram in back of this manual and the wiring diagram supplied with the boiler for proper wiring connections.

BOILER OPERATION

WARNING Before proceeding read and fully understand the instructions contained in this manual. Do not attempt to operate this boiler if it has not been installed in accordance with the guidelines set forth in this manual. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance. **Do Not interrupt water flow through the boiler.**

En cas de surchauffe ou si l'alimentation en gaz ne s'arrête pas, fermez manuellement le robinet d'arrêt de l'admission de gaz.

Hydronic Heating Boilers (Fill System)

Open the make-up water valve and slowly fill the boiler and all of the radiation with water. Ensure that all bleed and drain valves are closed.

Adjust the make-up water pressure regulator so a minimum **5 psig, 82.7 kPa** system pressure is maintained at the highest point in the system piping. A minimum system pressure of **20 psig, 138 kPa** must be maintained at boiler operating conditions. A minimum system pressure of **30 psig, 207 kPa** fill pressure is required, at boiler operating conditions, on glycol mixtures within a closed loop.

Open the system bleed and drain valves, one at a time, to purge the air trapped in the heating system piping.

With the boiler off, run the system pump for at least 30 minutes and bleed the system piping using the bleed valves. If strainers are used in the system piping the make-up water valve should be closed and the strainers checked and cleaned.

The system expansion tank should be checked to ensure that tank air pressure equals cold static fill pressure.

Start the boiler as described in the OPERATING INSTRUCTIONS below. Run the boiler for at least an hour. The system pump(s) and all radiation units must be operated during this time. Ensure that the make-up water valve is open.

Shut the boiler off and open the bleed valves to purge the air trapped in the heating system piping. Close the make-up water valve and check and clean the strainers and make-up water pressure reducing valve.

Open the make-up water valve and adjust the system pressure if necessary.

The system should be checked and bled after three days of operation.

OPERATING INSTRUCTIONS

FOR YOUR SAFETY READ BEFORE OPERATING. ONLY QUALIFIED LICENSED SERVICE TECHNICIANS SHALL START, TROUBLESHOOT, AND SERVICE THIS APPLIANCE WITH APPROVED COMBUSTION ANALYZER.

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHÉ

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

Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement la veilleuse. Ne tentez pas d'allumer la veilleuse manuellement.

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 suppliers instructions.
- If you cannot reach your gas supplier, call the fire department.

AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour détecter une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service de incendies.

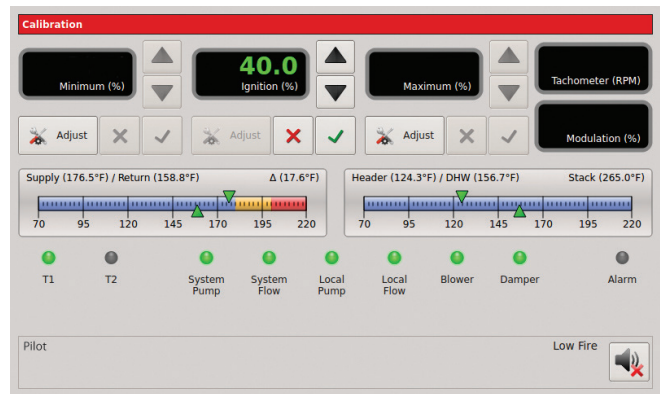
C. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control that has been under water.

N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

Operating Instructions

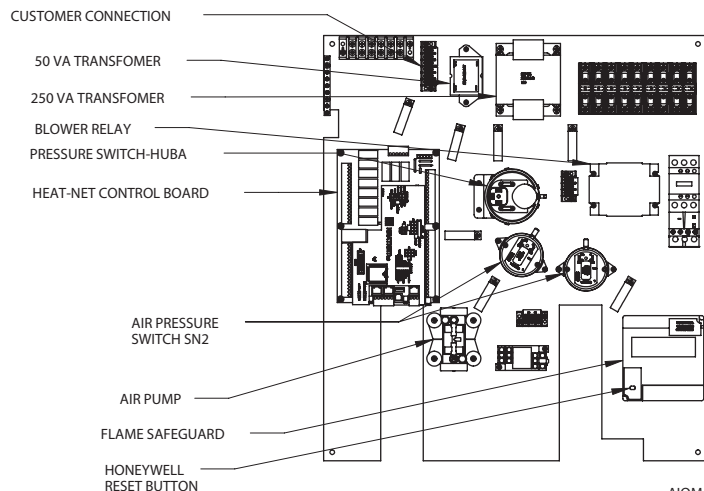
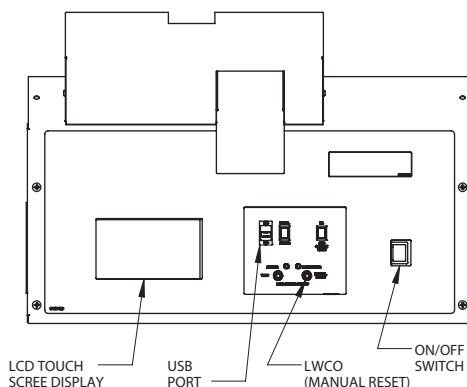
1. STOP! Read the safety information above. If, at any time, the appliance will not operate properly, follow the instructions "TO TURN OFF GAS TO APPLIANCE" and call your service technician or gas supplier.
2. Set the operating control to off and disable any outside (BMS) call for heat.
3. Turn off all electric power to the appliance.
4. Remove the front cover.
5. Close manual main shut-off valves 1 and 2 and the pilot gas shut-off valve, Figure 17.
6. Purge the gas piping up to the manual valve ahead of the main gas control of air. When the bleeding is complete, check all gas joints up to the gas valve for leaks.
7. Wait five (5) minutes to clear out any gas.
8. Install a fitting at the supply test port and connect a manometer having a minimum range of 20 in, 508 mm WC to it, Figure 17.
9. Remove the 1/8 in pipe plug from the pilot tee and connect a manometer having a minimum range of 6in, 154mm WC to it.
10. Open the manual main shut-off valves 1 and 2 and the pilot gas shut-off valve, Figure 17.
11. Place the "Remote/Local" switch to Remote.
12. Turn the power switch on the front of the boiler to "on". It will light up when the power is on. If all interlocks are properly closed, the display will say "Standby", Figure 18.
13. Slide the HeatNet controls low fire switch (on the HeatNet control board) to the low fire position.

14. The boiler will begin the start sequence.
15. When the main display reads "PILOT RUNNING" and the flame current is 5VDC, switch the Honeywell 7800 to the "test" position, Figure 18. This will hold the Honeywell 7800 in its ignition state.
16. Adjust the pilot pressure per the CHECKING, ADJUSTMENT & OPERATION on page 27.
17. To adjust the IGNITION value as shown in the display, place the 'S2' Calibration switch located on the 3.0 Heat Net board to the 'CAL' position. A reload message will be displayed then the calibrate screen. Press the 'Adjust' button under the Ignition (%) setting. The percentage value will turn green and the boiler will ramp to the ignition setting. Set the Blower speed, using the arrow keys, to provide the desired rate for ignition. When the adjustment is satisfactory, press the check key to save the setting. When complete place the 'S2' switch back to the 'NORM' position.



18. Remove the demand from the 7800 control by disabling the low fire switch allowing the boiler to stop.
19. Close manual main shut-off valve 2 and the pilot gas shut-off valve, Figure 17. Remove the manometer fitting from the pilot tee and replace the plug.

Figure 18 - Control Panel



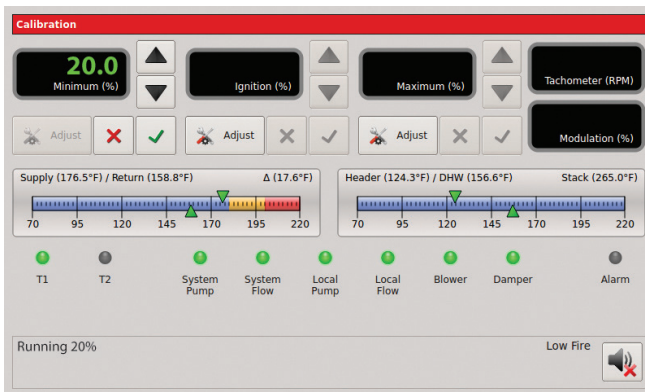
20. Switch the Honeywell 7800 back to "run".
21. Create a minimum input demand as before (enable low fire switch on the HeatNet board). The boiler will begin the start sequence.
22. Monitor the flame current on the 7800. No flame current should be detected and the 7800 should lock out. If flame current is detected at any time up to the 7800 locking out, the 120V wiring on the ignition transformer must be reversed and the test run again to insure that no flame is detected.

WARNING Warning Improper wiring of the ignition transformer can result in an explosion causing extensive property damage, severe personal injury or death!

23. Open both manual main shut-off valves and the pilot gas shut-off valve.
24. Reset the Honeywell 7800. The boiler will start and will run at minimum input rate.
25. Setting the Min VFD and Low Fire Combustion values: The boiler will cycle and achieve low fire status. Allow low fire to settle out for a few minutes and observe the combustion reading.

NOTE: The Calibration (Min % & Max %) represents the mapped signal sent to the blower and doesn't reflect the (modulation %) as indicated on the Master/Member Screens.

- a. Place the 'S2' - Calibration switch located on the 3.0 HeatNet board to the 'CAL' position. A reloading message will be displayed and then the calibrate screen.

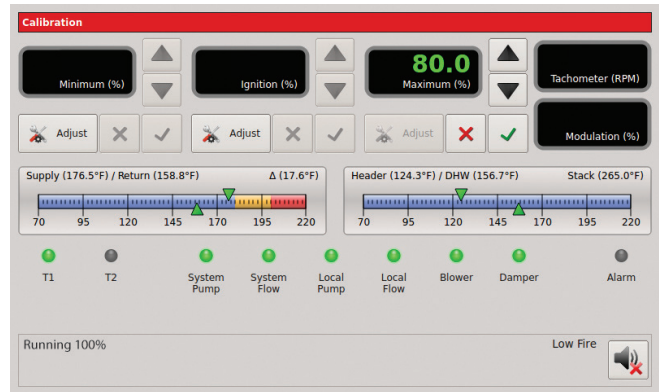


- b. Press the 'Adjust' button under the Minimum (%) setting. The percentage value will turn green. Adjust the minimum value (%), using the arrow keys, to achieve the required combustion - CO2/O2, (Table 11), and pressure – delta p, (Table 12), at low fire based on the desired turn down.

- c. Adjust low fire O2-CO2 by opening the low fire adjustment door located on the forward facing side of the main gas valve, (Figure 17). Inserting an allen wrench and rotating the allen screw clock-wise will increase the CO2 and lower the O2; rotating counter clock-wise will decrease the CO2 and increase the O2.
- d. When the adjustment is satisfactory, press the check key to save the setting.

26. Setting the Max VFD and High Fire Combustion values:

- a. Verify the 'S2'- Calibration switch located on the 3.0 HeatNet board is in the 'CAL' position.



- b. Press the 'Adjust' button under the Maximum (%) setting. The percentage value will turn green and will change to 80 % indicating that it can be changed. Adjust the maximum value (%), using the arrow keys, to achieve the required combustion – CO2/O2 (Table 11), and pressure-delta p, (Table 12).
- c. The high fire trim adjustment is located on the outlet flange, (Figure 17), of the gas valve.
- d. When the adjustment is satisfactory press the check key to save the setting. When complete, place the 'S2' switch back to the 'NORM' position.
- e. Allow the boiler to settle into min input and observe combustion readings to ensure the boiler is operating correctly. Make any required adjustments. When complete disable the low fire hold switch.
- f. Follow the instructions in the HeatNet Control manual to allow adjustments required for high altitude installations.

Instructions De Mise En Marche

1. ARRÊTEZ! Lisez les instructions de sécurité sur la portion supérieure de cette étiquette.
2. Réglez le thermostat à la température la plus basse.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement la veilleuse. Ne tentez pas d'allumer la veilleuse manuellement.
5. Fermer la vanne manuelle d'arrêt d'alimentation de gaz.
6. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz. Si vous sentez une odeur de gaz, ARRÊTEZ! Passez à l'étape B des instructions de sécurité sur la portion supérieure de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
7. Ouvrir la vanne manuelle d'arrêt d'alimentation de gaz.
8. Mettez l'appareil sous tension.
9. Réglez le thermostat à la température désirée.
10. Si l'appareil ne se met pas en marche, suivez les instructions intitulées couper l'admission de gaz de l'appareil et appelez un technicien qualifié ou le fournisseur de gaz.

TO TURN OFF GAS TO APPLIANCE

1. Set the operating control to its lowest setting.
2. Turn off all electric power to the boiler if service is to be performed.
3. Close the manual main and pilot gas shut-off valves.

COMMENT COUPER L'ADMISSION DE GAZ DE L'APAREIL

1. Réglez le thermostat à la température la plus basse.
2. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
3. Fermer la vanne manuelle d'arrêt d'alimentation de gaz.

SEQUENCE OF OPERATION**NO DEMAND****Standby**

1. The boiler is idle with no interlocks in the fault condition.

DEMAND**Pre-Purge**

1. The blower operates at purge RPM. The water flow interlock must 'make' within 15 seconds after the demand signal is initiated.
2. The Honeywell 7800 starts a 10 second purge delay once the air prove switch contacts close.

Pilot Run - %Input

1. The blower operates at minimum ignition setting. See the calibration section in the "KN-Series Control-IOM" to enter the calibration menus.
2. The ignition transformer is energized. The pilot solenoid valve opens for the 10 second pilot ignition trial.

Main Run %Input

1. The main gas valve opens.
2. The ignition transformer is de-energized.
3. The pilot solenoid valve closes.
4. The blower stays at the minimum input setting for 3 seconds then operates at demand % input. See the calibration section in the "KN-Series Control-IOM" to enter the calibration menus.

NO DEMAND**Post-Purge**

1. The main gas valve closes.
2. The blower operates at purge RPM for 10 seconds.
3. The boiler is idle with no interlocks in the fault condition.

Table 11 - Combustion Settings

KN-Series Plus Whirlwind Bekaert Burner w/Gas Orifice Slide Trim**						
Inlet Air Temp.	CO ₂ %				O ₂ %	
	NG		LPG		Low Fire	High Fire
	Low Fire	High Fire	Low Fire	High Fire		
-40°F	7.2	8.8	8.4	10.3	8.3	5.1
-30°F	7.3	8.9	8.5	10.5	8.1	5.0
-20°F	7.4	9.0	8.7	10.6	7.9	4.8
-10°F	7.5	9.1	8.8	10.7	7.8	4.6
0°F	7.6	9.2	8.9	10.8	7.6	4.4
10°F	7.7	9.3	9.0	10.9	7.4	4.2
20°F	7.8	9.4	9.2	11.0	7.2	4.0
30°F	7.9	9.5	9.3	11.1	7.1	3.9
40°F	8.0	9.6	9.4	11.2	6.9	3.8
50°F	8.1	9.7	9.5	11.3	6.7	3.7
60°F	8.2	9.8	9.6	11.4	6.5	3.5
70°F	8.3	9.9	9.7	11.5	6.4	3.3
80°F	8.4	10.0	9.8	11.6	6.2	3.1
90°F	8.5	10.1	9.9	11.7	6.1	3.0
100°F	8.6	10.2	10.1	11.8	5.9	2.9

**Located on outlet flange of gas valve. (Figure 17)

Due to job conditions, deviation from specified may be required – allow ± (0.2)% range adjustment.

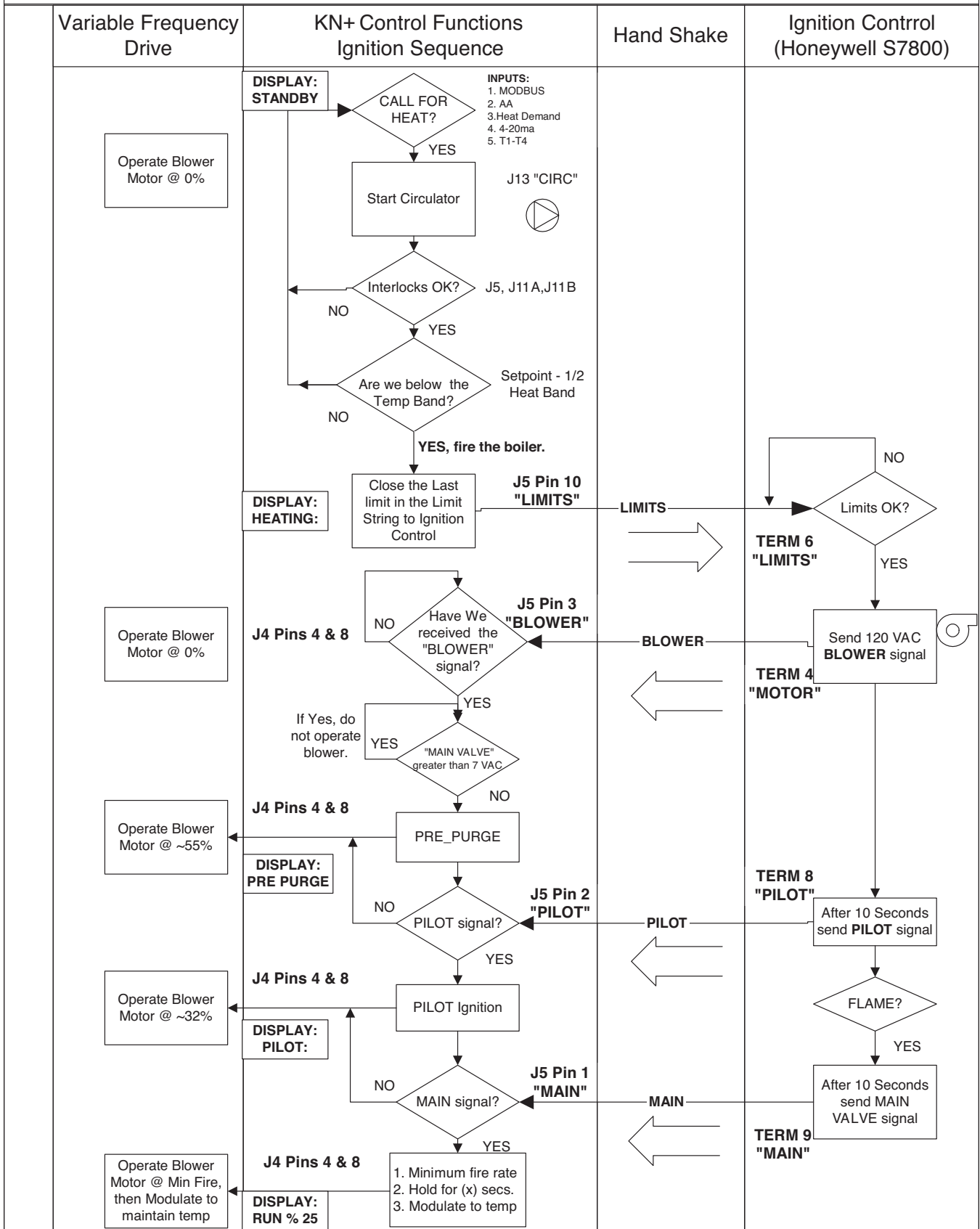
Note: When units are installed with direct sealed combustion air, during periods of time with low outdoor temperature, it is possible for the room air to condense and possibly form frost on the air handling components of the boiler. Refer to (2015 ASHRAE Cold-Climate Buildings Design Guide)

Table 12 - Pressure Signal (P) - (Nat. Gas)

Firing Rate	6+	10+	16+	20+	26+	30+	40+
	(Delta P) in WC	(Delta P) in WC	(Delta P) in WC	(Delta P) in WC	(Delta P) in WC	(Delta P) in WC	(Delta P) in WC
100%	7.00	7.00	11.50	10.00	9.50	7.50	8.50
33%	0.85	0.85	1.40	1.25	1.20	0.90	1.00
25%	0.60	0.60	0.95	0.85	0.80	0.65	0.75
20%	0.40	0.40	0.50	0.45	0.45	0.40	0.45

To determine signal in mm WC, multiply signal pressure by 25.4 - (See Factory Startup sticker for LP).

KN-Series Plus "HeatNet Control" Troubleshooting (Firing the KN+ Boiler)

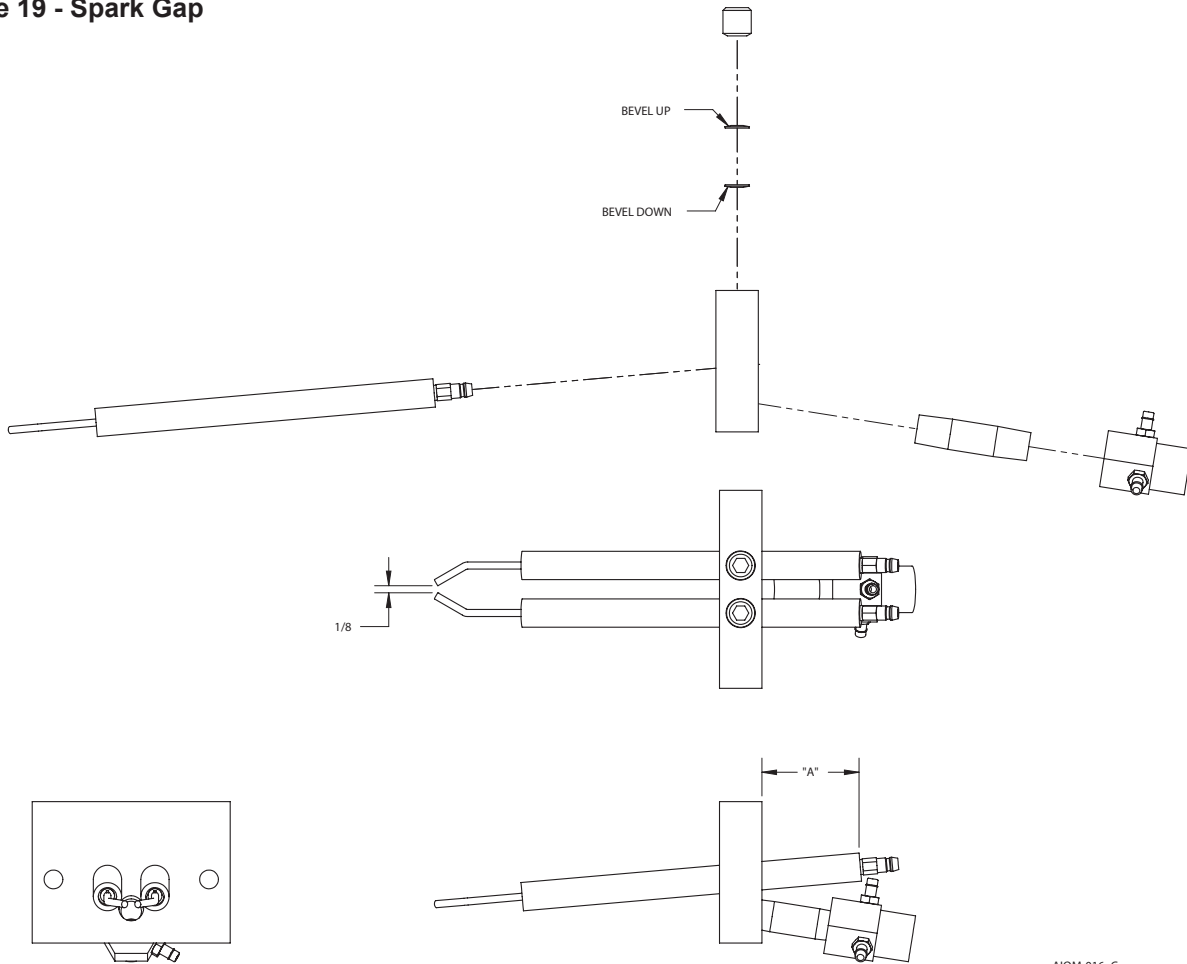


CHECKING, ADJUSTMENT & OPERATION

Spark Gap

The gap has to be measured and adjusted with the igniter removed from the boiler. Observe the trial for ignition to confirm that the spark is strong and continuous. If not, allow the electrodes to cool. Check and adjust the spark gap as shown in Figure 19. Electrode tips should face slightly downward.

Figure 19 - Spark Gap



AIOM-016_C

Pilot Adjustment

To check the pilot pressure close the manual main shut-off valve and the pilot gas shut-off valve, (Figure 17). Remove the 1/8 in pipe plug from the pilot test port (located as shown in (Figure 17) or on newer models as shown in (Figure 20) and connect a manometer having a minimum range of **6 in, 154 mm WC** to it. Open the pilot gas shut-off valve. With the unit powered generate a call for heat. When the prepurge is complete the ignition/pilot trial will begin. At this point put the Honeywell 7895C test switch in the test position. The control will hold in the ignition/pilot sequence allowing you to check the pressure. Verify the pilot pressure has been set within a range of (2.5 in.- 3.5 in WC) at test port location (Figure 17); if applicable - (2.0 in.-3.0 in WC) at test port location (Figure 20).

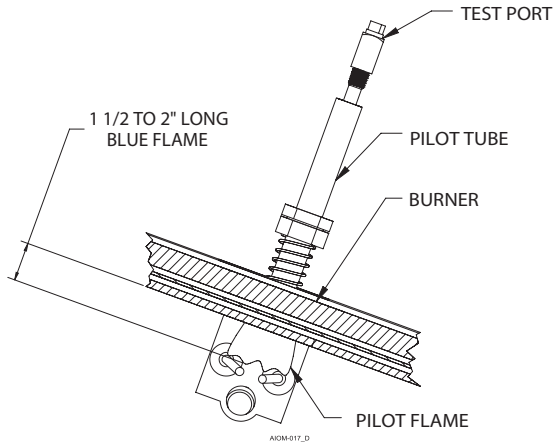
Recommended Electrode Insertion Depth, ± 1/4"	
Model	DIM "A"
40+	1 1/2"
30+	1 1/2"
26+	1 1/2"
20+	1 1/2"
16+	1 3/4"
10+	2 1/4"
6+	2 1/4"

To adjust the pilot the following steps must be taken:

1. Remove the pilot gas pressure regulator cap.
2. Turn the pressure regulator adjustment screw clockwise to increase the pressure and counterclockwise to decrease it.
3. Replace the pressure regulator adjustment screw cap.

CAUTION Never force the regulator adjustment screw beyond the stop limits or damage to the regulator will occur!

Figure 20 - Pilot Flame



Pilot flame UV signal

Before you check the pilot signal you need to make sure the polarity of the 120v supply to the ignition transformer is correct. To do this close the manual main shut-off valve 2 (Figure 17) and the manual pilot shut-off valve. With the unit powered generate a call for heat. The boiler will start to go through it start up sequence. During the ignition/pilot sequence observe the lights on the Honeywell 7895C. The pilot light should come on but not the flame light. If the flame light comes on along with the pilot light, interrupt the call for heat and turn off the main power. Reverse the 120v supply leads to the Honeywell 652B ignition transformer and run this test again. With this done the flame signal should be between 3vdc and 5vdc. Check the voltage on the test connections of the Honeywell 7895C's amplifier with a dc voltmeter.

Ignition Safety

To test the ignition safety shutoff device, close the manual shutoff valve 1 (Figure 17) in the gas supply line. Within 5 seconds of main burner flame extinction, the main gas valve solenoid should close. The control board will lockout and display "LOW GAS PRESSURE". Open the manual shutoff valve in the gas supply line and reset the control board by toggling the power switch.

To confirm the input of the unit follow the instructions in the INPUT RATE section below.

Input Rate, Natural Gas

1. Turn off all other gas appliances that use the same gas meter as the boiler.
2. Call your gas supplier and ask for the heating value of the gas (Btu per cu/ft).
3. Start the boiler and let it run for 15 minutes.
4. With the boiler operation clock the time that it takes to burn 10 cu/ft of gas at full fire.
5. Insert the heating value and the time, in seconds, into the formula below.

6. Input = 10 / seconds (Btu per cu/ft)(3600).

7. If the computed rate exceeds the desired input follow section "operating instructions" to make the appropriate adjustments.

CAUTION Never increase the input to the boiler above that for which it is rated. Doing so can cause premature failure of the boiler!

Low Water Cutoff

Ensure that the low water cutoff device(s) function properly.

Test in accordance with the manufacturer's instructions included with the device(s).

DIAGNOSTICS

The KN+ has a display that indicates the sequence of operation, Figure 18. The display will also list faults should the unit fail to operate. An explanation of each fault is listed below.

STANDBY KN: Indicates that power is being supplied to the unit and there is no call for heat.

STANDBY OPERATING LIMIT: Indicates that the operating limit if used is open.

HONEYWELL ALARM "flashing": Indicates that there is a call for heat and the Honeywell 7895C is locked out.

STANDBY START DEMAND: Indicates that there is a call for heat and the Honeywell 7895C is not functioning or is locked out.

STANDBY WATER LIMIT: Indicates that either the high limit, low water cut off, or both are open without a call for heat.

LOCKOUT WATER LIMIT: Indicates that either the high limit, low water cut off, or both are open with a call for heat.

STANDBY GAS PRESSURE: Indicates that the low gas pressure switch or the high gas pressure switch if used is open without a call for heat.

LOCKOUT GAS PRESSURE: Indicates that the low gas pressure switch or the high gas pressure switch if used is open with a call for heat.

WAITING FOR FLOW: Indicates that minimum flow hasn't been achieved.

FAULT INSUFFICIENT FLOW: Indicates that inadequate flow is present.

LWCO LOCKOUT: Indicates low or no water in the boiler.

MAINTENANCE

WARNING Disconnect electrical power and close the manual gas shut off valve before performing maintenance or severe personal injury may result!

CAUTION Servicing, inspection and adjustment must be done by a trained technician in accordance with all applicable local and national codes. Improper servicing or adjustment can damage the boiler!

The boiler must be inspected at least once a year and before each heating season. Make sure that combustion readings and air box pressures are taken on each boiler and match the desired emissions outlined under the specification in the Installation Manual – adjust as necessary. Accessing the burner compartment isn't necessary during normal maintenance unless combustion values or air box pressures don't meet specification. The condensate pan must be inspected and cleaned as required.

CAUTION Improper burner servicing can result in premature burner failure voiding the warranty!

Burner Removal & Inspection

WARNING Wear a tightly fitted dust mask when servicing the burner and gently handle the burner and its gasket to prevent inhalation of airborne fibers.

NOTICE Do not attempt to remove the burner without having a burner gasket kit on hand.

Heat Exchanger Cleaning

In the unlikely event that the heat exchanger becomes blocked consult the factory for the proper cleaning procedure.

Air Intake & Vent System

Thoroughly inspect the air intake and vent systems for any signs of blockage, corrosion or leakage. Immediately replace any unsound vent system piping. Inspect the air filter and replace when required.

Condensate Pan Cleaning

Remove the (6) bolt - base pan door from the front of the boiler. Using a hose, flush out any residual material in the base pan through the condensate drain opening. Re-install the base door with a replacement gasket (if required). Flush the drain trap and refill with 50% water/glycol mix to prevent evaporation in the trap.

Controls

Use the BOILER OPERATION and CHECKING AND ADJUSTMENT sections of this manual for reference.

1. Check the operating controls for proper operation.
2. The probe on a probe low water cut off must be removed, cleaned and inspected at least once a year. Ensure that the low water cutoffs operate properly. If not, replace them.
3. The flow sensor isolation valves must be open in order for proper flow.

NOTICE In the unlikely event that the SIKA flow sensor requires cleaning, in order to flush the flow sensor, close the ball valve installed upstream of the flow sensor, connect a hose to the drain fitting provided and open the drain valve. Drain approximately a gallon of water to properly flush the flow sensor. The drain is then closed and the upstream valve re-opened.

4. The relief valve should not weep or discharge water at normal system pressure. If it does contact a qualified service technician to have it inspected. **NEVER** try to clean or repair the relief valve! If the valve fails to operate properly, have it replaced!
5. The aquastat high limit controls the maximum water temperature in the boiler. It is adjustable from **130°F, 54°C** to **215°F, 102°C**. If the water temperature reaches the set temperature before the demand for heat has been met, the aquastat high limit should shut the boiler off. The water temperature should never exceed the maximum set point of **215°F, 102°C**. The aquastat high limit cannot be repaired. If it fails to function properly replace it.
6. Visually check the pilot and main burner flames to ensure proper operation, see Figures 20 & 21.

WARNING Visual flame appearance with proper combustion will have a red and blue striped appearance at low fire and flecked areas of red with a majority of blue across the metal mesh burner at high fire. Areas of deep red indicate an infrared condition requiring a combustion adjustment to reduce CO₂ levels.

Figure 21 - Main Burner Flame

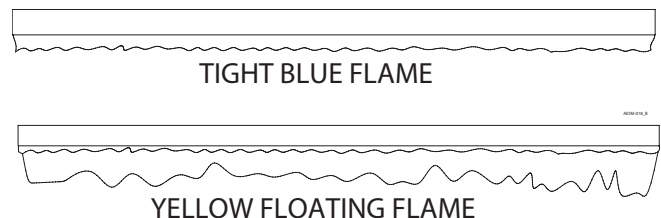


Figure 22 - KN6+, 10+, 16+, 20+, 26+, 30+ and 40+ Pressure Switches

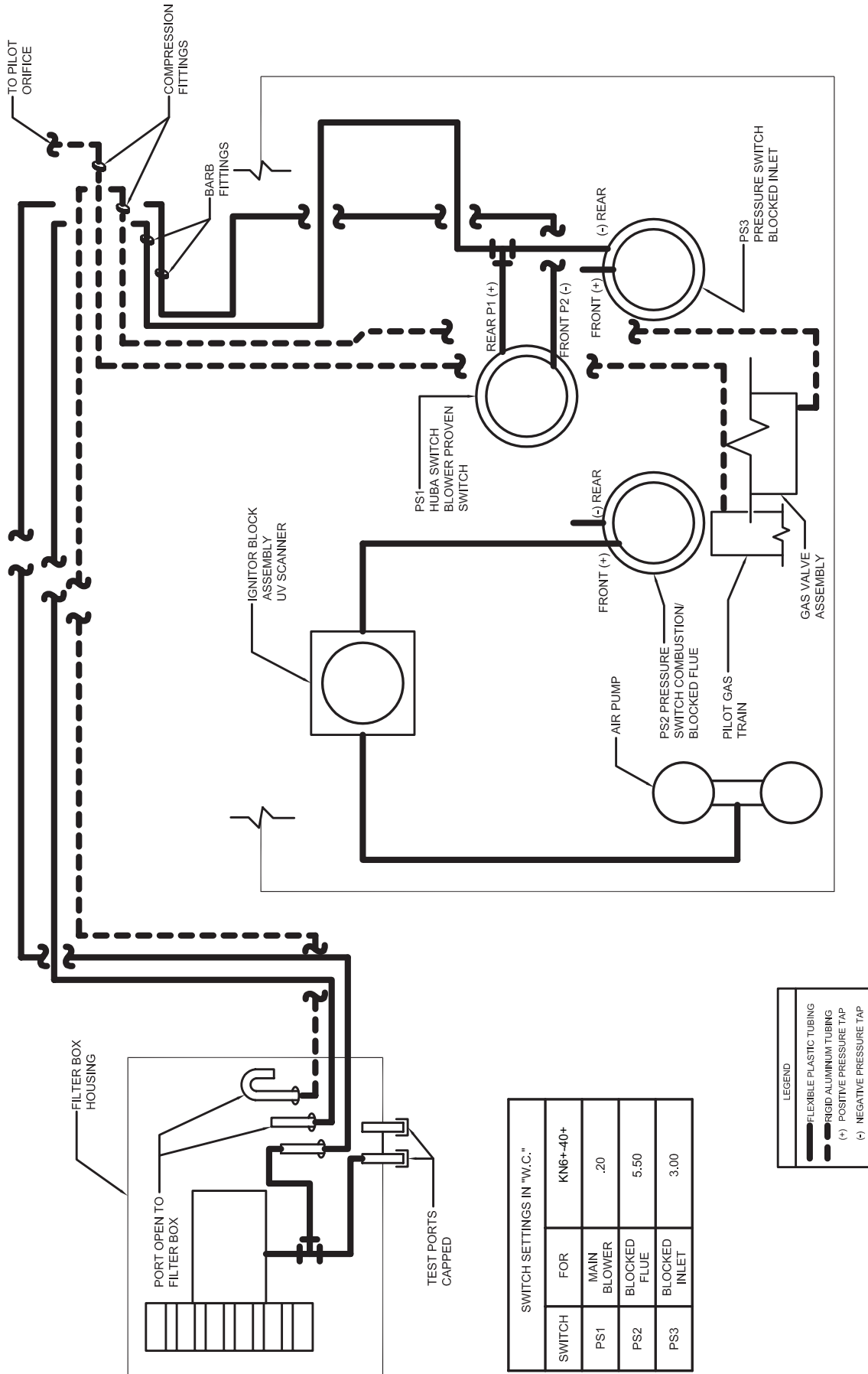
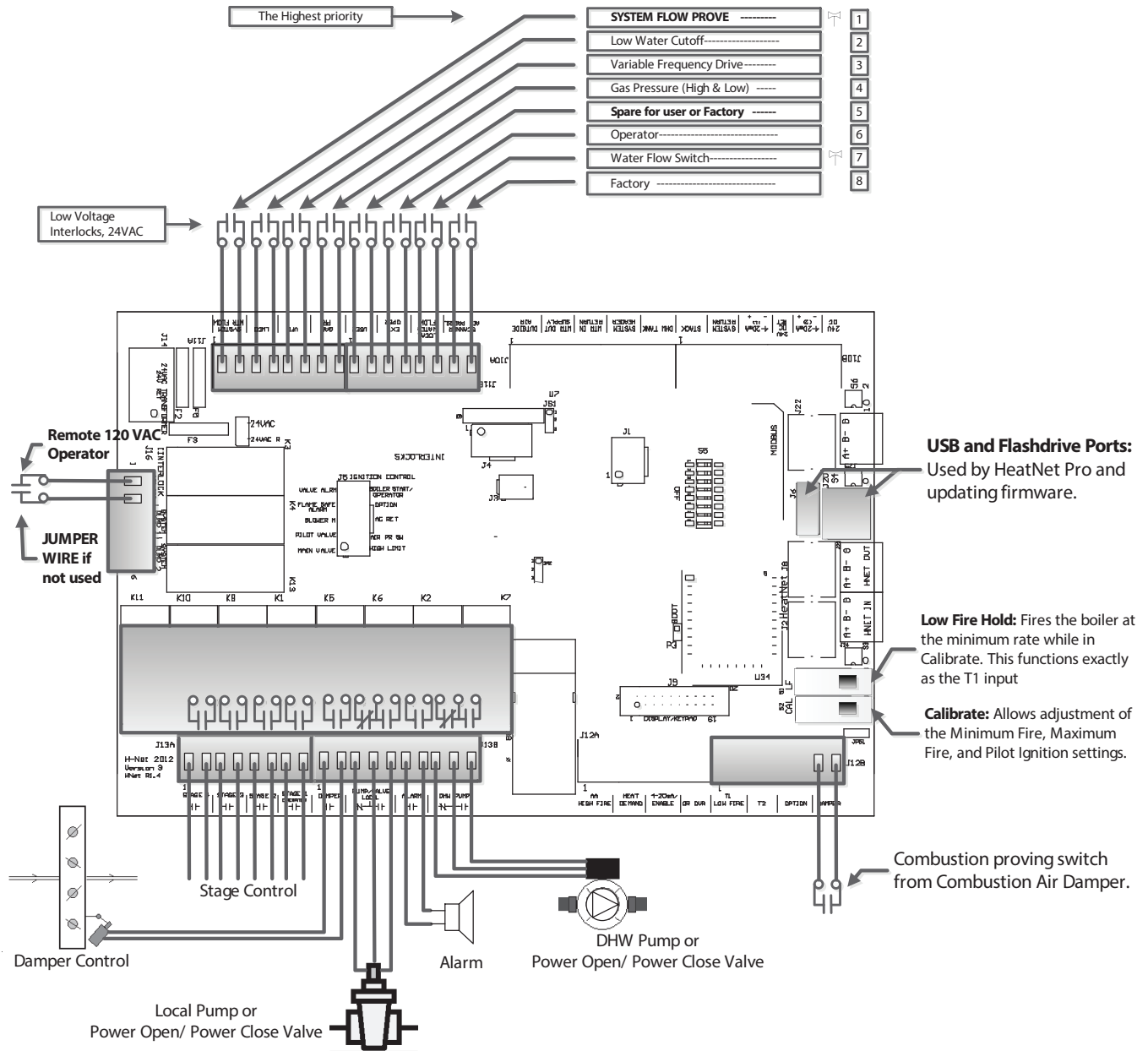


Figure 23 - KN6+, 10+, 16+, 20+, 26+, 30+ and 40+ Relays, Interlocks and Boiler Status



START-UP REPORT

DATE:	JOB NAME:
TECHNICIAN:	LOCATION:
COMPANY:	MODEL:
PHONE NUMBER:	SERIAL #:

PRE-STARTUP CHECK LIST

- | | |
|--|--|
| <input type="checkbox"/> NO VISIBLE DAMAGE TO UNIT | <input type="checkbox"/> INLET AIR FILTER INSTALLED AND CLEAN |
| <input type="checkbox"/> PIPING PROPERLY CONNECTED | <input type="checkbox"/> PROPER SERVICE CLEARANCES PROVIDED |
| <input type="checkbox"/> BOILER CIRCULATOR WIRED | <input type="checkbox"/> PUMP RUNNING, HEAT EXCHANGER FULL |
| <input type="checkbox"/> VENT/STACK CONNECTED | <input type="checkbox"/> GAS LINES PURGED, NO LEAKS, NO MISSING TEST PLUGS |

BOILER START UP SEQUENCE

Note: Locate the S2 Calibration Switch and low fire hold switch in the bottom-right of the electrical panel on the main HeatNet board. Also locate the manometer test ports at the bottom of the filter box.

1. Perform pre-start up checks and set up: (follow section "Operating Instructions"; Steps 1-10).
2. Disable any external call for heat and toggle the remote/local switch to REMOTE (follow section "Operating Instructions"; Steps 11-14).
3. Ignition and pilot adjustment: Toggle the LOW FIRE switch to cycle the boiler then hold at trial for pilot ignition (follow section "Operating Instructions"; Steps 15-17).
4. Set pilot pressure (follow section "Checking, Adjustment & Operation") (flame signal should read 5.0 VDC).
5. Set min VFD and low fire combustion values: (follow section "Operating Instructions"; Steps 18-25).
6. Record combustion and Delta P at low fire.
7. Set max VFD and high fire combustion values; (follow section "Operating Instructions"; Step 26).
8. Record combustion and Delta P at high firing rate.
9. Check all combustion results using a calibrated flue gas analyzer.
10. Release the LOW FIRE switch to place boiler in standby.

NOTICE

In addition to completing the KN-Series Plus start-up report, complete the control set-up information in the rear of the HeatNet manual.

COMBUSTION ANALYSIS	MINIMUM FIRING RATE	100% FIRING RATE
GAS INLET PRESSURE (WC)	INCHES WC	INCHES WC
CO ₂	%	%
O ₂	%	%
CO (PPM)	PPM	PPM
NET STACK TEMPERATURE	°F	°F
AIR BOX DIFFERENTIAL (DELTA P - WC)	INCHES WC	INCHES WC

SAFETY TEST CHECKLIST

- FLOW SWITCHES (By Others)
- AIR SWITCH
- FLAME SAFEGUARD
- LOW WATER CUT-OFF
- HIGH LIMITS

COMMISSIONING THE BOILER

<ul style="list-style-type: none"> <input type="checkbox"/> UNIT CYCLED MINIMUM OF 15 TIMES <input type="checkbox"/> CUSTOMER INSTRUCTED <input type="checkbox"/> ALL COVERS REPLACED <input type="checkbox"/> CUSTOMER GIVEN MANUAL <input type="checkbox"/> TARGET TEMPERATURE SET PER CUSTOMER <p>COMMISSIONED BY: _____ (SIGNATURE)</p> <p>DATE: _____</p>	<p>THE DELTA T BETWEEN THE HEATER INLET AND OUTLET IS CRITICAL TO PROPER FLOW. BEFORE YOU LEAVE THE JOB-SITE, YOU MUST RECORD THE DELTA T. THIS READING SHOULD NOT EXCEED 100°F, 55°C, NOR BE LOWER THAN 20°F, 11.1°C.</p> <p style="text-align: center;">DELTA T = <input style="width: 100px; height: 20px;" type="text"/></p>
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ADDITIONAL NOTES AND COMMENTS

Figure 24 - KN6+, 10+, 16+, 20+, 26+, 30+ and 40+

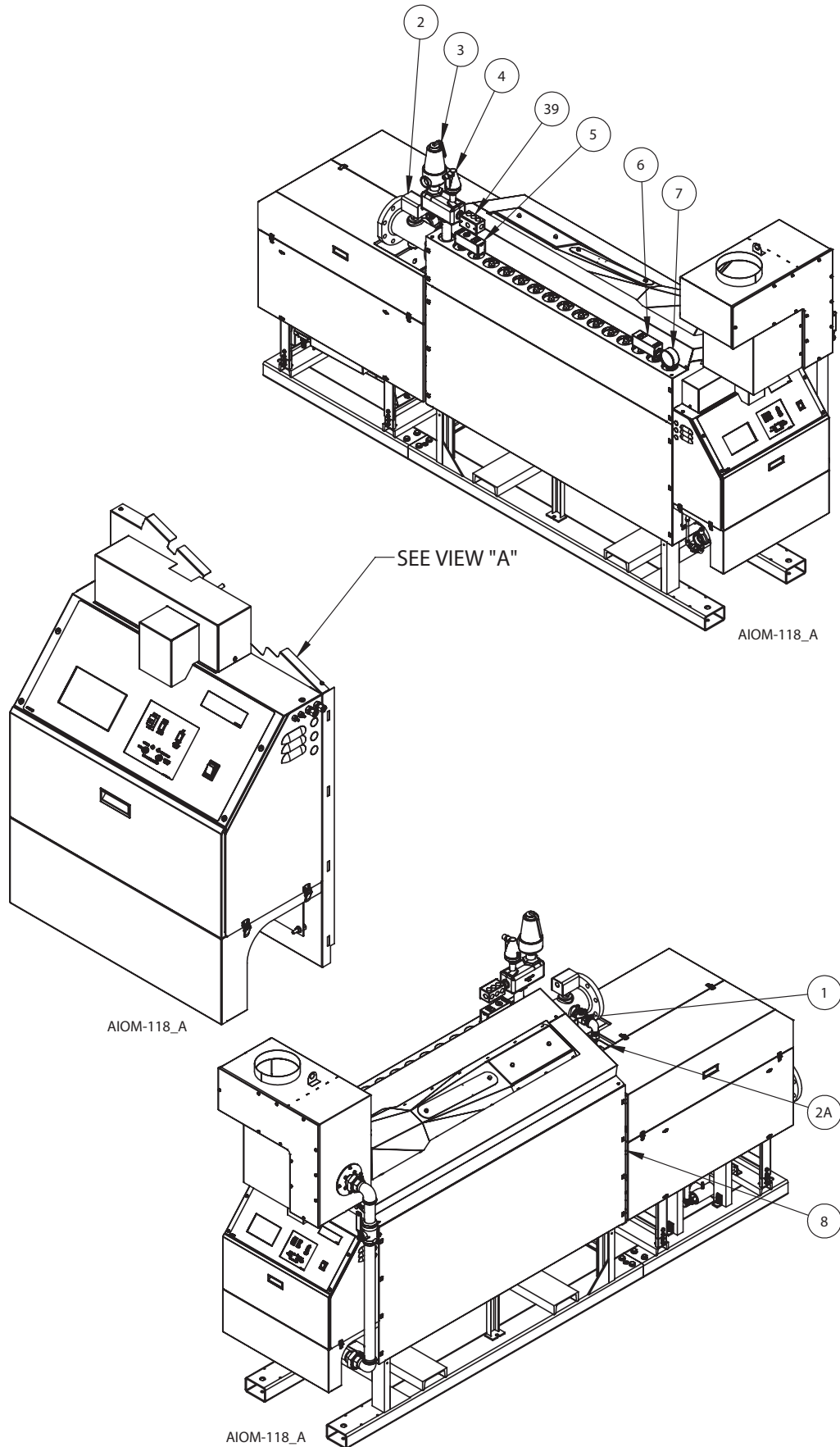


Figure 25 - KN6+, 10+, 16+, 20+, 26+, 30+ and 40+

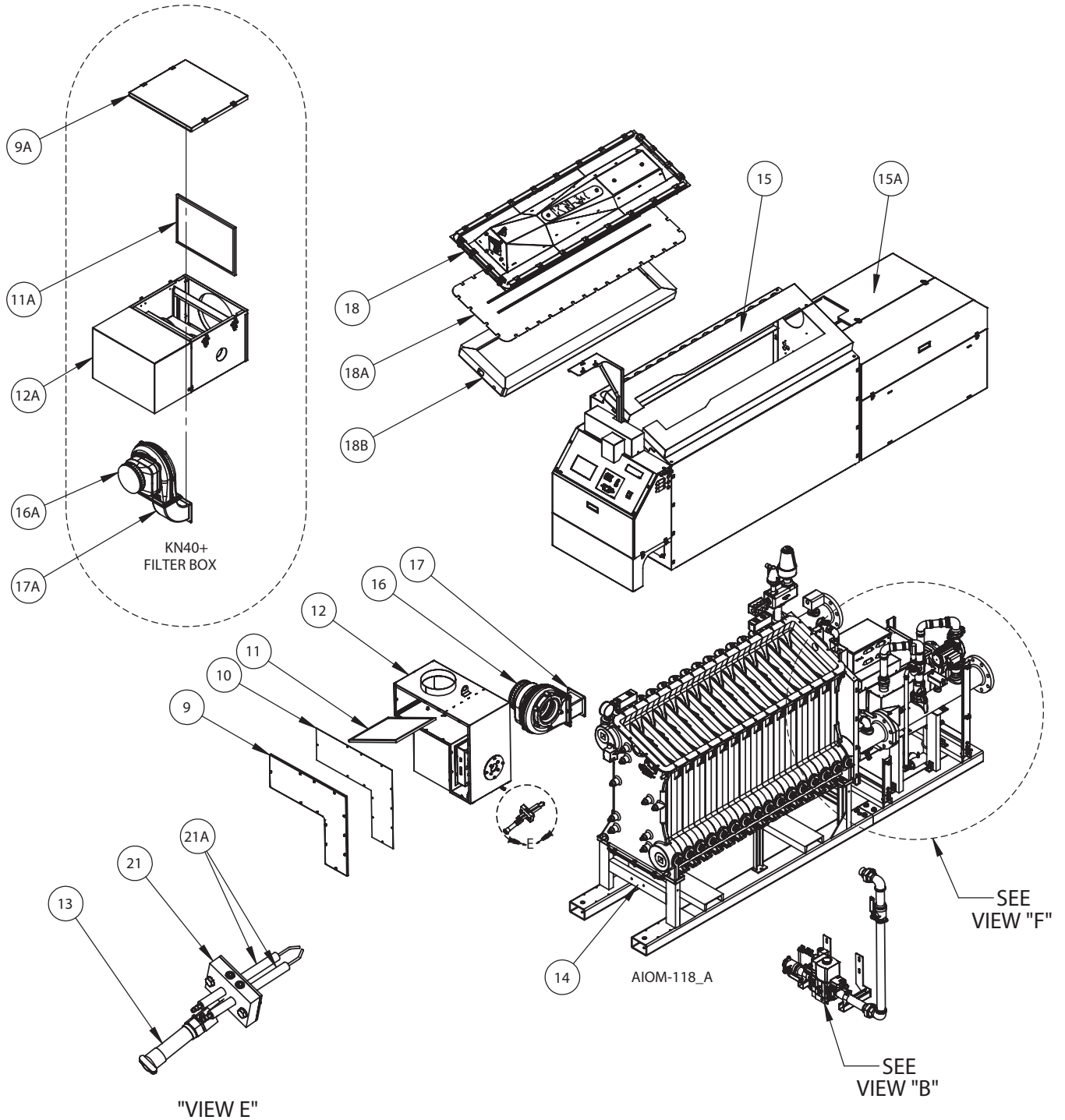
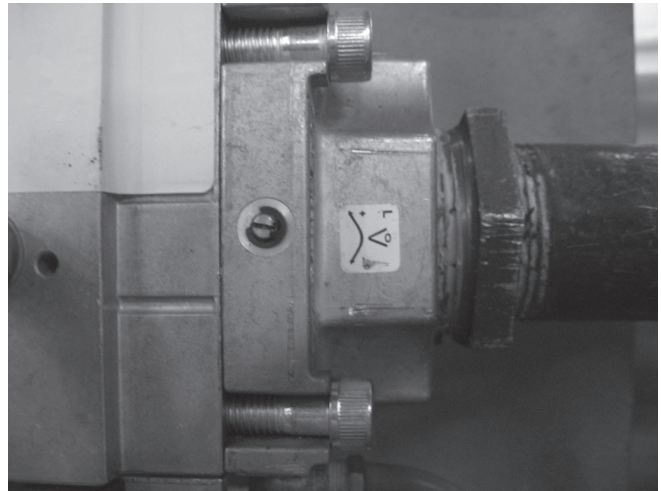
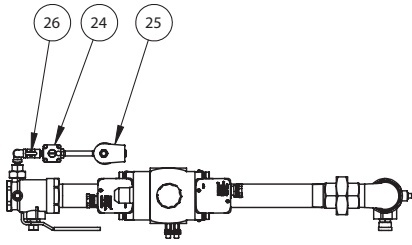
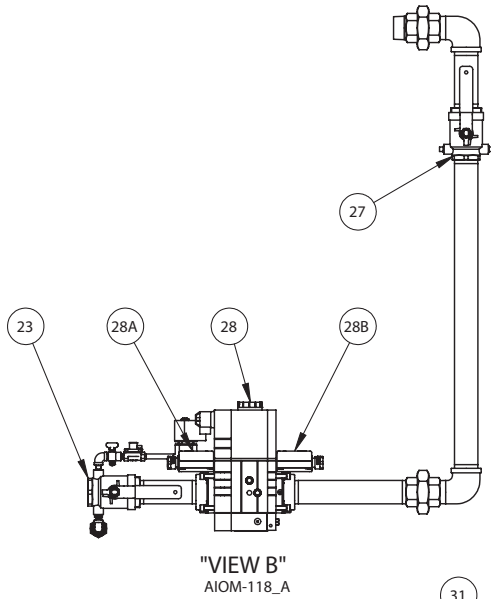


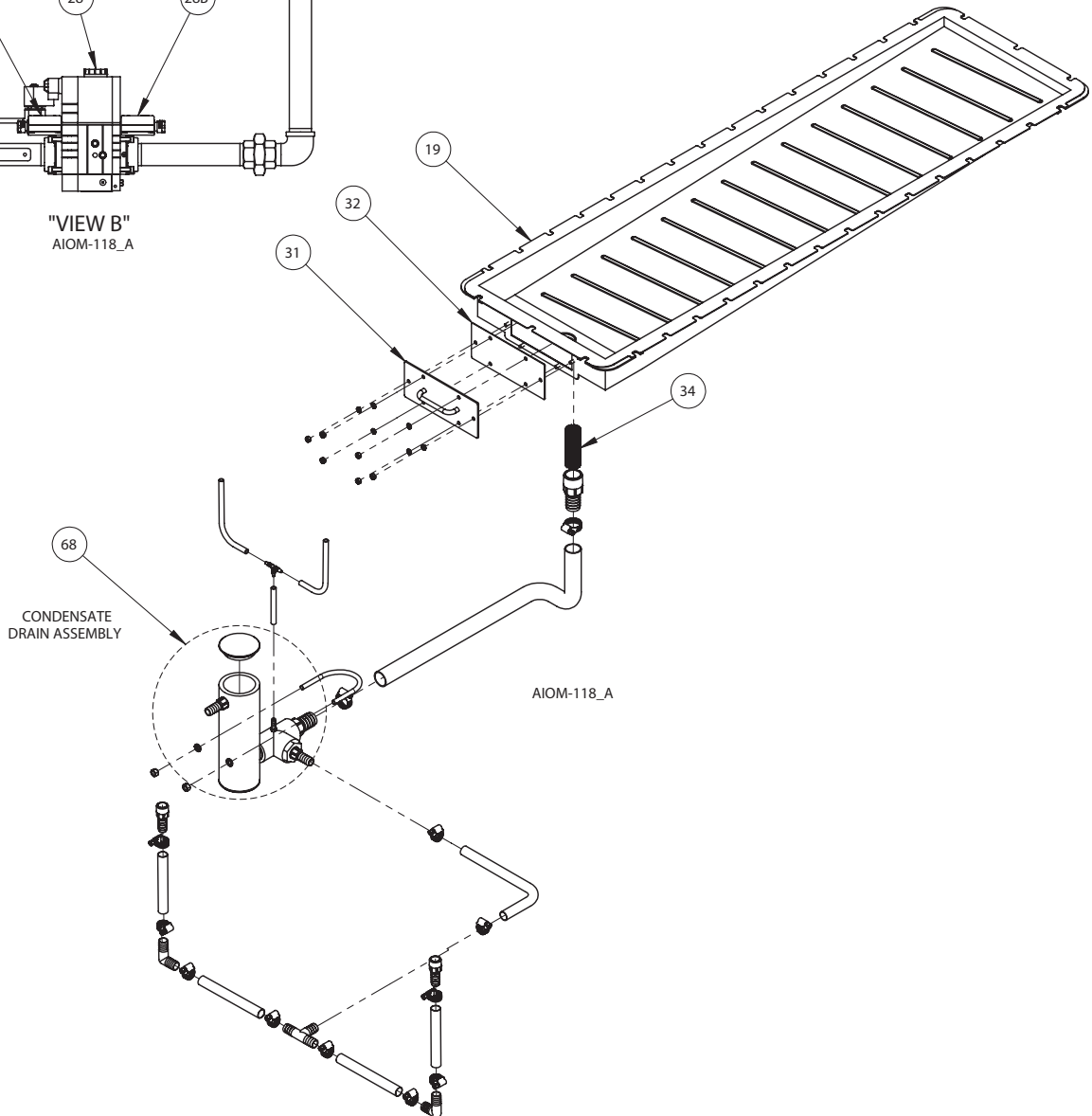
Figure 26 - Gas Train/Drain Pan



KN6+, 10+, 16+, 20+, 26+, 30+, 40+ High Fire CO₂
Adjustment Screw -
Clockwise = Increase
Counterclockwise = Decrease



"VIEW B"
AIOM-118_A



CONDENSATE
DRAIN ASSEMBLY

AIOM-118_A

Figure 27 - Control Panel

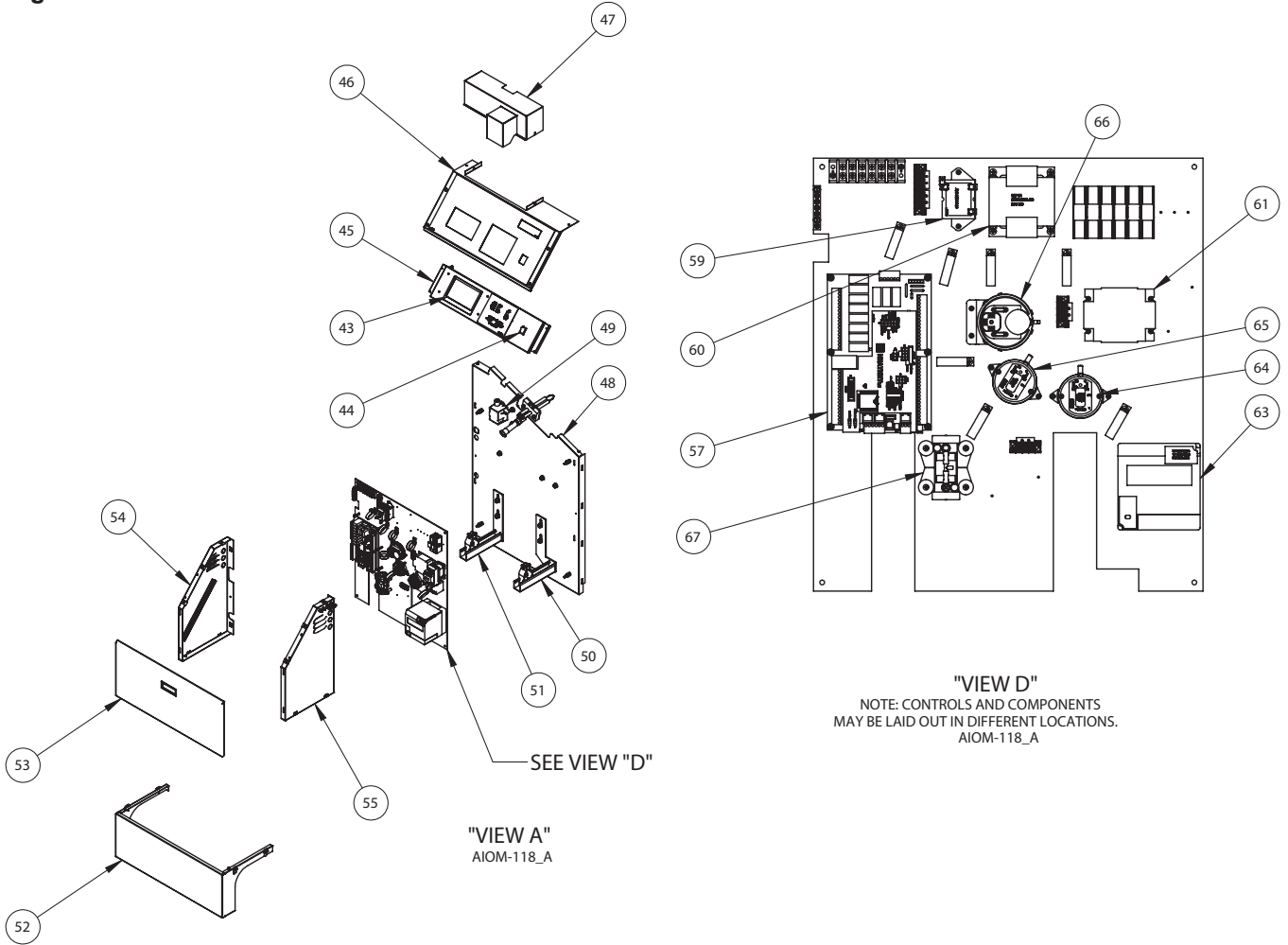
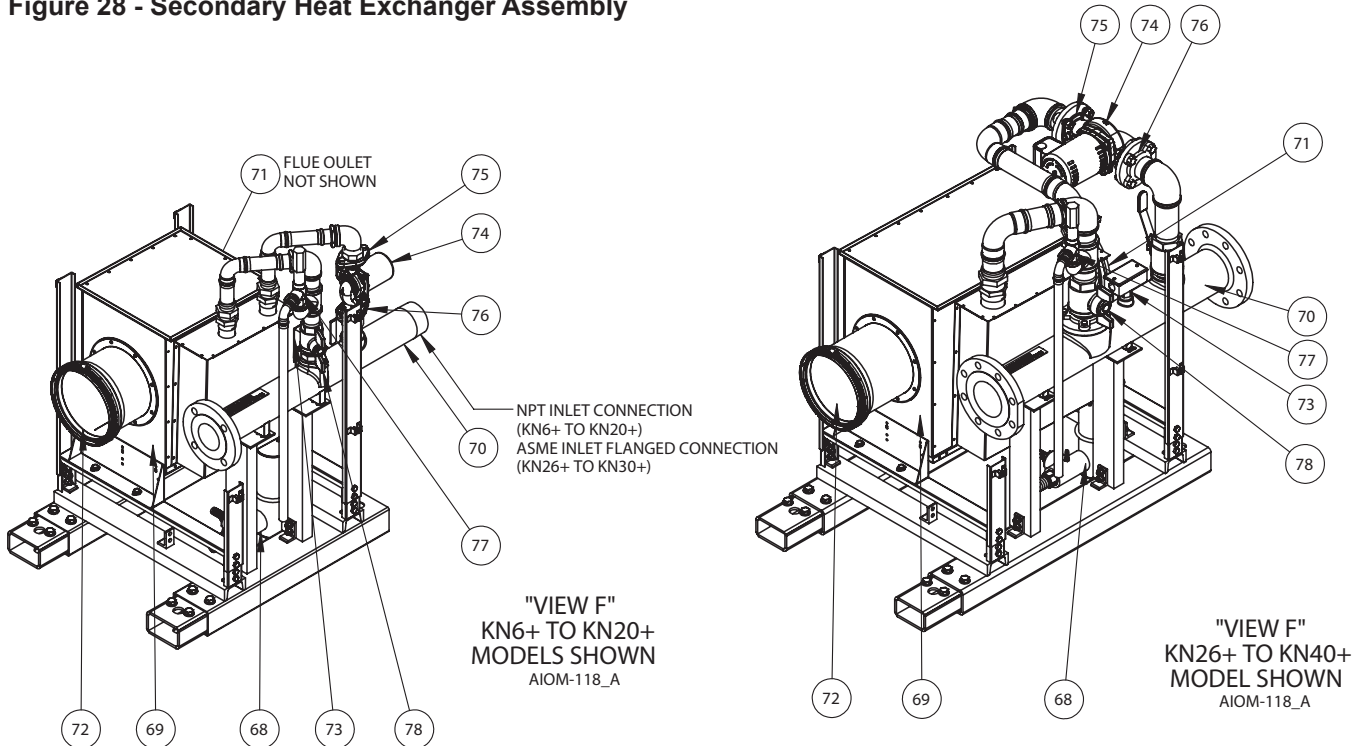


Figure 28 - Secondary Heat Exchanger Assembly



SERVICE AND REPLACEMENT PARTS LIST - KN6+, KN10+, KN16+, KN20+, KN26+, KN30+ and KN40+

Ref	Name of Part	Part No.	Model Size with Item Quantities Below						
			6+	10+	16+	20+	26+	30+	40+
1	Supply Sensor w/Well	02-4284	1	1	1	1	1	1	1
2	Flow Sensor (VVX15)	13-00256	1	1	1	1	1	1	1
3	30 psi Relief Valve	22-1805	1	1					1
		22-1809			1	1			1
		22-1820					1	1	1
	50 psi Relief Valve	22-1807	1	1					1
		22-1810			1	1			1
		22-1821					1	1	1
	75 psi Relief Valve	22-1803	1	1					1
		22-1811			1	1			1
		22-1822					1	1	1
	100 psi Relief Valve	22-1808	1	1					1
22-1812				1	1			1	
22-1823						1	1	1	
4	Air Vent Assembly	75-00532-001	1	1	1	1	1	1	1
	Air Vent	13-00401	1	1	1	1	1	1	1
NS	Raised Air Manifold	01-00001-001	1	1	1	1	1	1	1
NS	Sight Glass	60-4280	1	1	1	1	1	1	1
	Sight Glass Gasket	05-00103-001	1	1	1	1	1	1	1
	Inner Sight Glass Gasket	59-1064	1	1	1	1	1	1	1
5	High Limit Aquastat (Manual Reset)	02-2800	1	1	1	1	1	1	1
	Well 1/2"	02-3413	1	1	1	1	1	1	1
6	High Limit Aquastat (Auto Reset)	02-3204					1	1	1
	Well 1/2"	02-3413					1	1	1
7	T&P Gauge (30 & 50 psi)	20-1021	1	1	1	1	1	1	1
	T&P Gauge (75 & 100 psi)	20-1020	1	1	1	1	1	1	1
8	Return Sensor w/Well	02-4284	1	1	1	1	1	1	1
9	Filter Box Cover Assembly	75-00222-001	1	1	1	1	1	1	
		75-00289-000							1
10	Gasket, Filter Box Cover	06-00013-001	1	1	1	1	1	1	
11	Air Filter	20-00003-001	1	1	1	1	1	1	
		20-00003-000							1
12	Filter Box Assembly	75-00214-006	1						
		75-00214-005		1					
		75-00214-004			1				
		75-00214-003				1			
		75-00214-002					1		
		75-00214-001						1	
NS	Gas Orifice (NG) Must order orings below	75-00321-001							1
		10-00001-006	1						
		10-00001-005		1					
		10-00001-004			1				
		10-00001-003				1			
		10-00001-002					1		2
NS	Gas Orifice (LP) Must order orings below	10-00001-001						1	
		10-00001-012	1						
		10-00001-011		1					
		10-00001-010			1				
		10-00001-009				1			
		10-00001-008					1		
NS	Orings, Gas Orifice	10-00001-007						1	
		10-00001-005							2
NS	Conversion Kit (NG to LP)	SP95-00002-153	1	1	1	1	1	1	2
		SP95-00002-157	1	1	1	1	1	1	2
NS	Conversion Kit (NG to LP)	75-00574-001	1						
		75-00574-002		1					
		75-00574-003			1				
		75-00574-004				1			
		75-00574-005					1		
		75-00574-006						1	
		75-00574-007							1
NS	Conversion Kit (LP to NG)	75-00575-001	1						
		75-00575-002		1					
		75-00575-003			1				
		75-00575-004				1			
		75-00575-005					1		
		75-00575-006						1	
		75-00575-007							1

SERVICE AND REPLACEMENT PARTS LIST - KN6+, KN10+, KN16+, KN20+, KN26+, KN30+ and KN40+

Ref	Name of Part	Part No.	Model Size with Item Quantities Below						
			6+	10+	16+	20+	26+	30+	40+
NS	Gasket, Blower/Filter Box	06-00010-001			1	1	1	1	1
NS	1/4" Aluminum Tubing	SP89-00005-021	per foot						
13	UV Flame Sensor, C7027	02-5206	1	1	1	1	1	1	1
NS	3" Supply & Return Casting	01-00051-001	2	2	2	2			
	4" Supply & Return Casting	01-00054-001					2	2	2
14	Block / Sections	Consult Customer Service - model and serial number required							
15	Jacket Assembly								
NS	Gasket, Blower Adapter/Upper Cover	06-00017-001	1	1	1				
		06-00009-001				1	1	1	1
NS	Flue Adapter	09-00002-003	1	1					
		09-00002-002			1	1			
		09-00002-001					1	1	
		09-00002-005							1
16	Blower	12-00001-001	1	1					
		12-00002-001			1	1			
		12-00003-001					1	1	
		12-00006-001							1
	Replacement Kit 8.9 Ametek Blower	75-00567	1	1					
	Clear RTV Sealant	66-00103-001	3	3	3	3	3	3	3
NS	Gasket, Blower / Filter Box	06-00018-001	1	1					
NS	Gasket, Blower/Blower Adapter	06-00016-001	1	1					
		06-00008-001			1	1	1	1	1
17	Blower Adapter Weldment	74-00210-003	1	1					
		74-00210-002			1				
		74-00210-001				1	1	1	
		74-00210-000							1
18, 18a	Upper Cover / Burner Assembly	75-00255-001	1						
		75-00256-001		1					
		75-00246-001			1				
		75-00254-001				1			
		75-00245-001					1		
		75-00204-001						1	
		75-00204-000							1
18a	Burner Weldment	74-00231-006	1						
		74-00231-005		1					
		74-00231-004			1				
		74-00233-003				1			
		74-00233-002					1		
		74-00233-001						1	
		74-00233-000							1
NS	Gasket Burner/Ceramic Chamber	06-00002-006	1						
		06-00002-005		1					
		06-00002-004			1				
		06-00002-003				1			
		06-00002-002					1		
		06-00002-001						1	
		06-00002-000							1
18b	Combustion Chamber	05-00003-001	1						
		05-00004-001		1					
		75-00244-004			1				
		75-00244-003				1			
		75-00244-002					1		
		75-00244-001						1	
		75-00244-000							1
NS	Burner Rebuild Kits	75-00540-006	1						
		75-00540-005		1					
		75-00540-004			1				
		75-00540-003				1			
		75-00540-002					1		
		75-00540-001						1	
		75-00540-000							1
NS	Burner Gasket Kit	75-00543-006	1						
		75-00543-005		1					
		75-00543-004			1				
		75-00543-003				1			
		75-00543-002					1		
		75-00543-001						1	
		75-00543-000							1

SERVICE AND REPLACEMENT PARTS LIST - KN6+, KN10+, KN16+, KN20+, KN26+, KN30+ and KN40+

Ref	Name of Part	Part No.	Model Size with Item Quantities Below						
			6+	10+	16+	20+	26+	30+	40+
19	Drain Pan Assembly	75-00202-006	1						
		75-00202-005		1					
		75-00202-004			1				
		75-00202-003				1			
		75-00202-002					1		
		75-00202-001						1	
		75-00202-000						1	
NS	RTV Red Sealant 10 Oz Tube	10-6635	1	1	1	1	1	1	1
NS	Pilot Tube	10-00105-002	1	1	1				
		10-00105-001				1	1	1	1
	Pilot Orifice NG	10-00050-001	1	1	1	1	1	1	1
	Pilot Orifice LP	10-00050-002	1	1	1	1	1	1	1
	Pilot Orifice Adapter	10-00101-002	1	1	1				
		10-00101-001				1	1	1	1
21	Ignitor Block Assembly	70-1345R	1	1	1	1	1	1	1
21a	Electrode	04-1343	2	2	2	2	2	2	2
	Gasket, Electrode	05-00102-001	1	1	1	1	1	1	1
	Washer, Electrode (2 per)	57-00079-004	4	4	4	4	4	4	4
NS	Ignition Cable 24"	16-00004-001	1	1	1	1	1	1	1
NS	Ground Cable 15"	16-00008-001	1	1	1	1	1	1	1
22	Condensate Drain Assembly	75-00234-002	1	1	1	1	1	1	1
	Condensate Trap Cap	04-00110	1	1	1	1	1	1	1
23	Manual Shutoff Valve 1"	02-1575	1	1					
	Manual Shutoff Valve 1 1/2"	02-1578			1	1	1	1	
	Manual Shutoff Valve 2"	SP84-01300-006							1
24	Pilot Regulator	23-1014	1	1	1	1	1	1	1
25	Pilot Gas Valve V4046C	11-00401-001	1	1	1	1	1	1	1
26	1/8 Gas Cock	23-1016	1	1	1	1	1	1	1
27	Manual Shutoff Valve 1"	02-1575	1	1					
	Manual Shutoff Valve 1 1/2"	02-1578			1	1	1	1	
	Manual Shutoff Valve 2"	SP84-01300-006							1
28	Gas Valve MBC	11-00001-001	1	1					
	MBC Filter Kit	11-00109	1	1					
	Gas Valve MBC	11-00002-001			1	1	1	1	
	MBC Filter Kit	11-00110			1	1	1	1	
	Gas Valve MBC	11-00003-001							1
28a	Low Gas Pressure Switch	11-00201-001	1	1	1	1	1	1	1
28b	High Gas Pressure Switch	11-00202-001					1	1	1
30	Drain Pan Bolt Assembly	75-00203-001	1	1	1	1	1	1	1
31	Drain Pan Clean Out Cover	74-00202-001	1	1	1	1	1	1	1
32	Drain Pan Clean Out Cover Gasket	06-00001-001	1	1	1	1	1	1	1
34	Drain Pan Filter Screen	03-00263-001	1	1	1	1	1	1	1
39	#751 LWCO less Case	14-00202-001	1	1	1	1	1	1	1
40	Rocker Switch	58-1555	2	2	2	2	2	2	2
43	Display Board (touchpad)	40-00752-001	1	1	1	1	1	1	1
	Touchscreen Display Enclosure	40-00752-003	1	1	1	1	1	1	1
44	Power Switch, Rocker	58-1536	1	1	1	1	1	1	1
49	Ignition Transformer	15-00004-001	1	1	1	1	1	1	1
50	Gas Support Bracket (Right)	74-00213-001	1	1	1	1	1	1	
51	Gas Support Bracket (Left)	74-00213-002	1	1	1	1	1	1	
52	Gas Train Shroud	74-00221-001	1	1	1	1	1	1	1
NS	Jacket Panel Insulation, 2" Foil Back	10-5008	per square foot						
57	HNet Board (3.0)	40-00756-001	1	1	1	1	1	1	1
NS	Ribbon Cable (Touchscreen)	40-00269	1	1	1	1	1	1	1
59	50VA Transformer	26-3211	1	1	1	1	1	1	1
60	250VA Transformer	15-00003-001					1	1	1
61	Blower Relay, Solid State	15-00106	1	1					
		15-00105-001			1	1	1	1	1
63	Flame Safeguard RM7895C	02-4012	1	1	1	1	1	1	1
NS	Display Module S7800	02-4263	1	1	1	1	1	1	1
NS	Purge Timer ST7800	02-4014	1	1	1	1	1	1	1
NS	UV Amplifier, R7849B	16-00255-001	1	1	1	1	1	1	1
64	Pressure Switch NS2-0334-00 3.0" WC	14-00304-001	1	1	1	1	1	1	1
65	Pressure Switch NS2 5.5" WC	14-00306-001	1	1	1	1	1	1	1
66	Pressure Switch - HUBA 0.10" WC	14-00301-001	1	1	1	1	1	1	1
	Bracket, Pressure Switch	14-00302-001	1	1	1	1	1	1	1
67	Air Pump	09-1518	1	1	1	1	1	1	1

SERVICE AND REPLACEMENT PARTS LIST - KN6+, KN10+, KN16+, KN20+, KN26+, KN30+ and KN40+

Ref	Name of Part	Part No.	Model Size with Item Quantities Below						
			6+	10+	16+	20+	26+	30+	40+
NS	Touchscreen Overlay	82-00410-001	1	1	1	1	1	1	1
	Model Overlay	82-00412-013	1						
		82-00412-012		1					
		82-00412-011			1				
		82-00412-010				1			
		82-00412-009					1		
	82-00412-008						1		
	82-00412-007							1	
NS	Rating Label	82-00004-001	1	1	1	1	1	1	1
68	Condensate Drain Assembly	75-00234-002	1	1	1	1	1	1	1
69	Secondary Heat Exchanger	52-00151-003	1	1					
		52-00151-002			1	1			
		52-00151-001					1	1	
		52-00151-000							1
70	Weldment, Economizer Return Manifold	74-00292-003	1	1					
		74-00292-002			1	1			
		74-00292-001					1	1	
		74-00292-000							1
71	Flue Adapter	09-00002-004	1	1					
		09-00002-002			1	1			
		09-00002-001					1	1	
		09-00002-005							1
72	Collar, Economizer	09-00501-002	1	1	1	1			
		09-00501-001					1	1	1
73	Temperature, Sensor	02-4284	1	1	1	1	1	1	1
74	Circulator	09-1516	1	1					
		09-1517			1	1			
		12-00210-001					1	1	
		12-00214-001							1
75	Flange	12-00302-003	1	1	1	1			
		12-00302-004					1	1	
		12-00302-008							1
76	Flange, Shut Off Swivel	12-00301-005	1	1	1	1			
77	Relief Valve	13-00001	1	1	1	1	1	1	
78	Ball Valve	SP84-01308-007	1	1	1	1	1	1	
		SP84-01308-008							1

**KN+ and KN Series Water Boiler
Limited Warranty****One-Year Warranty**

The “Manufacturer” warrants to the original owner at the original installation site that the KN-Series modulating water boiler supplied boiler parts (“Products”) will be free from defects in material and workmanship for one (1) year from the date of installation or eighteen (18) months from the date of shipment from the factory whichever comes first. If upon examination by the manufacturer the product is shown to have a defect in material or workmanship during the warranty period, the manufacturer will repair or replace, at its option that part of the product, which is shown to be defective.

Twenty-Five Year Warranty

The manufacturer warrants to the original owner at the original installation site that the products Cast Iron Heat Exchanger (Cast Iron Block) will be free from defects in material or workmanship and against failure due to condensate corrosion, for a period of twenty-five (25) years (non-prorated) from the date of shipment from the factory. This warranty will cover damage due to thermal shock, such as leaks to the cast iron sections, when installed as a closed loop hot water boiler. If upon examination by the manufacturer the product is shown to have a defect in material or workmanship during the warranty period, the manufacturer will repair or replace, at its option the products Cast Iron Heat Exchanger, which is shown to be defective.

Five Year Warranty

The manufacturer further warrants to the original owner at the original installation site that the products Secondary Heat Exchanger will be free from defects in material, workmanship, condensate corrosion and leaks due to thermal shock, when installed as a closed loop hot water boiler, for a period of five (5) years (non-prorated) from the date of shipment from the factory. If upon examination by the manufacturer the product is shown to have a defect in material or workmanship during the warranty period, the manufacturer will repair or replace, at its option the products Secondary Heat Exchanger, which is shown to be defective.

This Limited Warranty does not Apply:

- (a) This warranty does not cover damage due to water side corrosion, scaling, sooting or to improper installation practices. The inlet/outlet water temperature differential across the boiler heat exchanger must not exceed 100 degrees F. System water quality: dissolved solids must be less than 500 ppm and no greater than 300 ppm hardness. Suspended solids such as magnetite, Iron Oxides must be flushed from the system prior to commissioning the boiler(s). In addition, pH levels must be in the 6.5-11 range. Failure to follow these guidelines will void the warranty.
- (b) If the product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, has not been installed, maintained or operated in accordance with the furnished written instructions, or has been altered or modified in anyway by any unauthorized person.
- (c) To any expenses, including labor or material, incurred during the removal or reinstallation of the product or parts thereof.
- (d) To products which were not installed and or serviced by a qualified contractor and or serviceman.
- (e) To burners, jackets, controls and other auxiliary equipment furnished by the manufacturer, but manufactured by others. Any warranties for such items shall be limited to those warranties offered by the original equipment manufacturer.
- (f) To any workmanship by any installer of the product.

This limited Warranty is Conditional Upon:

- (a) Shipment, to the manufacturer, of that part of the product thought to be defective. Goods may only be returned with prior written approval of the manufacturer. All returns must be freight prepaid.
- (b) Determination in the reasonable opinion of the manufacturer that there exists a defect in material or workmanship. Repair or replacement of any part under this Limited warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, AND ALL SUCH OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS LIMITED WARRANTY. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE IN ANY WAY FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER, OR FOR ANY AMOUNTS IN EXCESS OF THE SELLING PRICE OF THE PRODUCT OR ANY PARTS THEREOF FOUND TO BE DEFECTIVE. THIS LIMITED WARRANTY GIVES THE OWNER AT THE ORIGINAL INSTALLATION SITE SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS, WHICH MAY VARY BY EACH JURISDICTION.

