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KN SERIES GAS BOILER WITH CONTROL INSTALLATION & OPERATING INSTRUCTIONS



MEA #444-05-E

MASS Plumbers #G1-06-04-28

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.

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

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

WHAT TO DO IF YOU SMELL GAS:

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

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

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

INSTALLER, THESE INSTRUCTIONS TO BE AFFIXED ADJACENT TO THE BOILER / WATER HEATER.
CONSUMER, RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE PURPOSES.

HydroTherm®

 A MESTEK COMPANY

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AVERTISSEMENT. 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 pouvez 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.

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BEFORE YOU START

This manual covers the application, installation, operation and maintenance of a KN series 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.

If installed in the Commonwealth of Massachusetts, you **MUST FOLLOW** the additional instructions contained in HydroTherm's instruction sheet MACODE-3. Please refer to the back of this manual for required regulations.

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 HydroTherm distributor or contact the HydroTherm 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 installations only. 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.

NOTE: 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	6	152
Right Side	6	153	6	152
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.

NOTE: 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 5.3, 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
2000	500	3224	668	4308	2000	12,896
3000	750	4836	1002	6462	3000	19,344

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 above.

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 1, 2, 3 & 4. 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 ²	mm ²
600	5	127
1000	6	152
2000	9	229
3000	8	203

NOTE: 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 **80 ft, 19.7 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 3. The penetration point in the roof must be properly flashed and sealed. Approved caps are listed in Table 4.

Direct Intake Air Option - Horizontal

The maximum equivalent length for the horizontal intake air pipe is **80 ft, 19.7 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 1, 2 or 4. Approved terminals are listed in Table 5.

Table 4 - Vertical Intake & Vent System Components

Company	Description	Part Number	Dia., in
Flex-L			5
Flex-L			6
Flex-L			8
Heat Fab	Rain Cap	5500CI	5
Heat Fab	Rain Cap	5600CI	6
Heat Fab	Rain Cap	51000CI	8
Pro Tech	Rain Cap	FSRC5	5
Pro Tech	Rain Cap	FSRC6	6
Pro Tech	Rain Cap	FSRC8	8
Z Flex			5
Z Flex			6
Z Flex			8

Table 5 - Horizontal Intake & Vent System Components

Company	Description	Part Number	Dia., in
Flex-L	Vent Adapter		5
Flex-L	Vent Adapter		6
Flex-L	Vent Adapter		8
	Termination T		
	Termination T		
	Termination T		
	Termination EL		
	Termination EL		
	Termination EL		
Heat Fab	Vent Adapter	9501KN10	5
Heat Fab	Vent Adapter	9601KN10	6
Heat Fab	Vent Adapter	90801KN10	8
	Termination T	9590TEE	5
	Termination T	9690TEE	6
	Termination T	90890TEE	8
	Termination EL	7514TERM	5
	Termination EL	9614TERM	6
	Termination EL	90814TERM	8
Pro Tech	Vent Adapter		5
Pro Tech	Vent Adapter	FSA-HFAG	6
Pro Tech	Vent Adapter		8
	Termination T	300313	5
	Termination T	300314	6
	Termination T		8
	Termination EL		5
	Termination EL		6
	Termination EL		8
Z Flex	Vent Adapter		5
	Vent Adapter		6
	Vent Adapter		8
	Termination T	02SVSTTX05	5
	Termination T		6
	Termination T		8
	Termination EL		5
	Termination EL		6
	Termination EL		8

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: Common positive pressure vent systems are not to be used! Improper installation can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

NOTE: A single acting barometric damper must be installed in the vent connector if a vertical vent system produces a negative draft in excess of 0.2 in, 5.08 mm W.C at the flue outlet.

NOTE: One of the vent system adapters listed in Table 5 must be attached to the flue outlet of the boiler before the vent system is connected.

VENT SYSTEM OPTIONS

The KN may be vented the following ways:

- 1) **Direct Vent** - Positive Pressure, Category IV uses a vent system certified to UL 1738 for installations in the United States, ULS636 for installations in Canada. Combustion air is piped from the outdoors to the blower inlet.
- 2) **Side Wall Vent** - Positive Pressure, Category IV uses a stainless steel vent system certified to UL 1738 for installations in the United States, ULC S636 for installations in Canada. Combustion air is obtained from the space in which the unit is installed.
- 3) **Vertical Vent** - Positive Pressure, Category IV uses a stainless steel vent system certified to UL 1738 for installations in the United States, ULC S636 for installations in Canada. Combustion air is obtained from the space in which the unit is installed.
- 4) **Vertical Vent** - Negative Pressure, Category II uses an approved S.S. U.L. 1738 metal chimney system. Combustion air is obtained from the space in which the unit is installed.

Draft Limit	Category II	Category IV
KN-6	-01 to -2" w.c.	+25" w.c.
KN-10	-01 to -2" w.c.	+25" w.c.
KN-20	-01 to -2" w.c.	+25" w.c.
KN-30	-01 to -2" w.c.	+9" w.c.

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 INTAKE AIR OPTION instructions under the COMBUSTION AIR & VENTILATION SECTION must be followed! The vent system must be sized per Table 6.

Table 6 - Direct Vent Pipe Size, Positive Pressure

Model Size	Pipe Diameter	
	in ²	mm ²
600	5	127
1000	6	152
2000	8	229
3000	8	229

Horizontal Direct Vent Systems - Figures 1 & 2

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. The vent terminals listed in Table 5 must also be used. Below is a list of some of the manufactures that have systems that meet these requirements. Others manufacturers that have UL certified systems may be used.

Heat-Fab, Inc.
38 Hayward Street
Greenfield, MA 01301, (800) 772-0739.

Z-Flex U.S., Inc.
20 Commerce Park
North, Bedford, NH 03110-6911, (800) 654-5600.

Protech Systems Inc.
26 Gansevoort Street
Albany, NY 12202 (518) 463-7284

The maximum equivalent length for the horizontal vent pipe is **80 ft, 19.7 m** for KN-6, 10, 20, **120 ft** for KN-30. Each 90° elbow and the vent terminal are equal to **10 ft, 3.3 m** of straight pipe. 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 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.

The vent terminals listed in Table 4 must also be used. Below is a list of some of the manufactures that have systems that meet these requirements. Others manufacturers that have UL certified systems may be used.

Heat-Fab, Inc.
38 Hayward Street
Greenfield, MA 01301, (800) 772-0739.

Z-Flex U.S., Inc.
20 Commerce Park
North, Bedford, NH 03110-6911, (800) 654-5600.

Protech Systems Inc.
26 Gansevoort Street
Albany, NY 12202 (518) 463-7284

The maximum equivalent length for the vertical vent pipe is **80 ft, 19.7 m** for KN-6, 10, 20, **120 ft** for KN-30. Each 90° elbow and the intake air cap are equal to **10 ft, 3.3 m** of straight pipe. 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 3. In addition the vent system must conform to the dimensions shown in Figure 3. 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 4

The boiler can be vented vertically with the intake air piped horizontally through an outside wall. Follow the instructions in the INTAKE AIR OPTION - HORIZONTAL GUIDELINES on page 4. Also follow the general instructions in the COMBUSTION AIR & VENTILATION and GENERAL VENTING GUIDELINES sections.

KN-6 Multiple Boiler Venting Category II Venting (Negative)

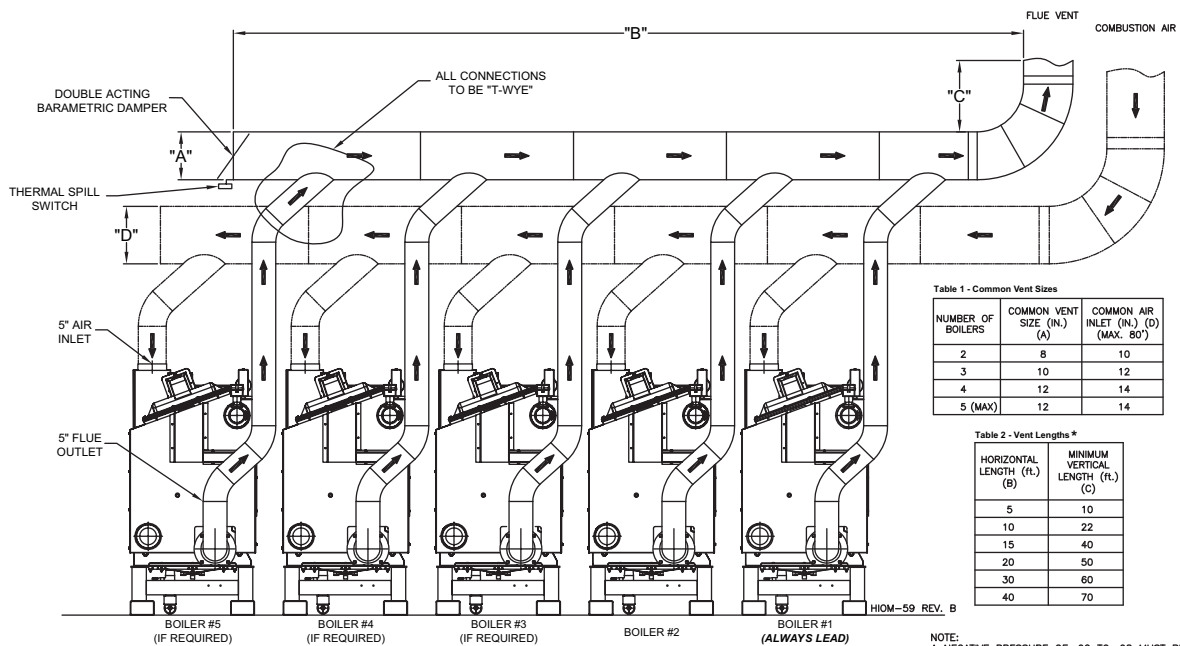


Table 1 - Common Vent Sizes

NUMBER OF BOILERS	COMMON VENT SIZE (IN.) (A)	COMMON AIR INLET (IN.) (D) (MAX. 80)
2	8	10
3	10	12
4	12	14
5 (MAX)	12	14

Table 2 - Vent Lengths*

HORIZONTAL LENGTH (ft.) (B)	MINIMUM VERTICAL LENGTH (ft.) (C)
5	10
10	22
15	40
20	50
30	60
40	70

NOTE:
A NEGATIVE PRESSURE OF .02 TO .08 MUST BE PROVIDED FOR ALL BOILERS CONNECTED TO THE BREACHING WHEN ALL BOILERS ARE IN OPERATION AT FULL INPUT.

*CONSULT FACTORY FOR VERTICAL HEIGHTS BEYOND 100 FT.

KN-10 Multiple Boiler Venting Category II Venting (Negative)

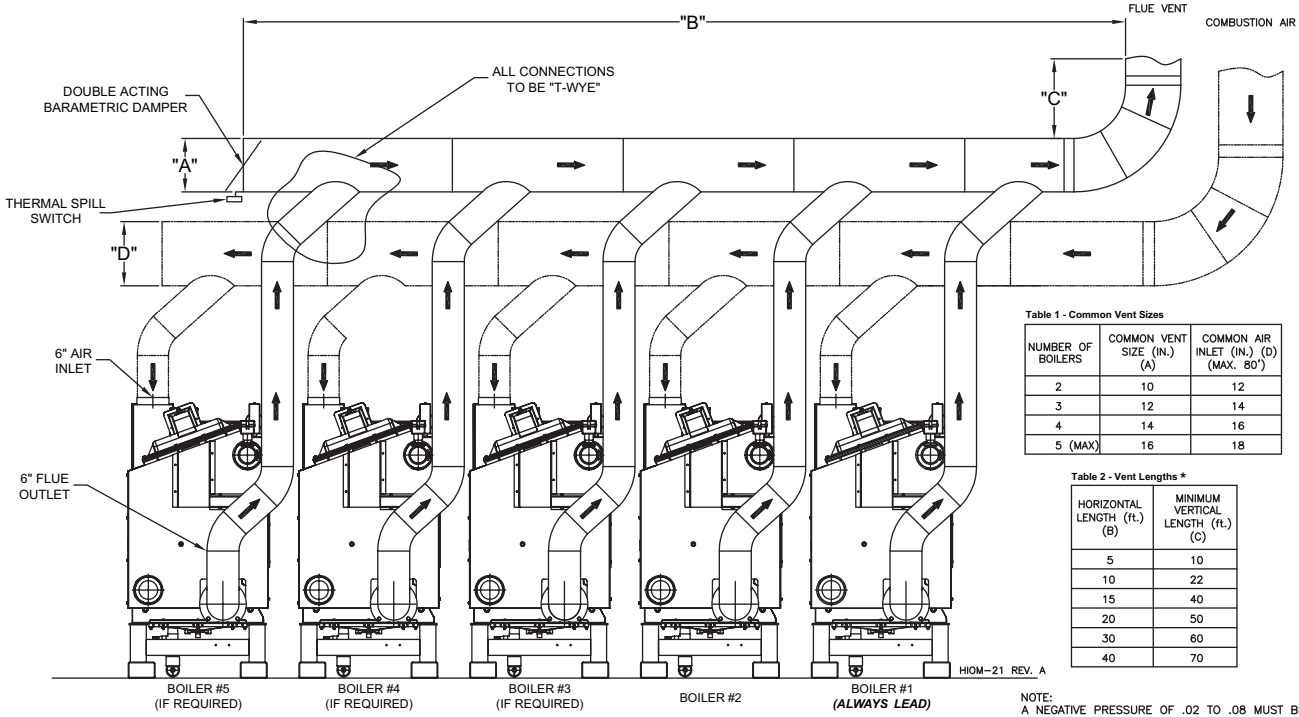


Table 1 - Common Vent Sizes

NUMBER OF BOILERS	COMMON VENT SIZE (IN.) (A)	COMMON AIR INLET (IN.) (D) (MAX. 80')
2	10	12
3	12	14
4	14	16
5 (MAX)	16	18

Table 2 - Vent Lengths *

HORIZONTAL LENGTH (ft.) (B)	MINIMUM VERTICAL LENGTH (ft.) (C)
5	10
10	22
15	40
20	50
30	60
40	70

NOTE:
A NEGATIVE PRESSURE OF .02 TO .08 MUST BE PROVIDED FOR ALL BOILERS CONNECTED TO THE BREECHING WHEN ALL BOILERS ARE IN OPERATION AT FULL INPUT.

*CONSULT FACTORY FOR VERTICAL HEIGHTS BEYOND 100 FT.

KN-20 Multiple Boiler Venting Category II Venting (Negative)

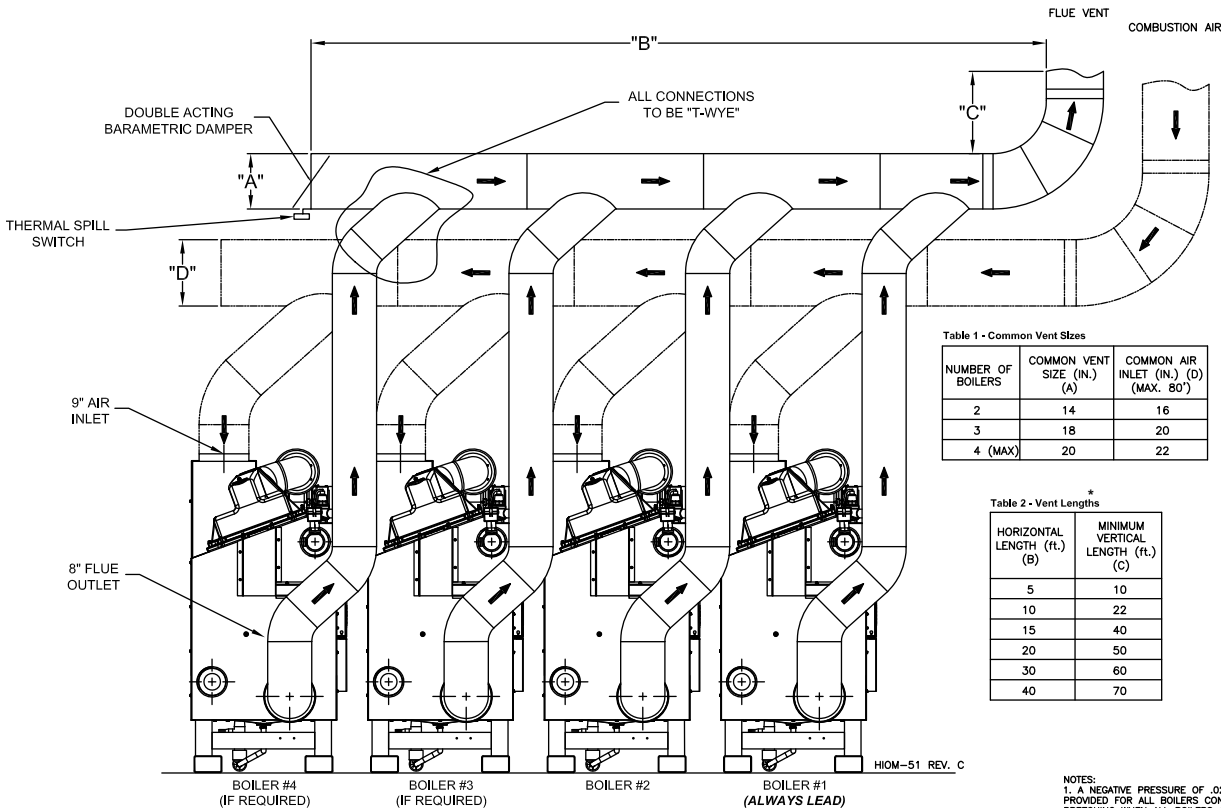


Table 1 - Common Vent Sizes

NUMBER OF BOILERS	COMMON VENT SIZE (IN.) (A)	COMMON AIR INLET (IN.) (D) (MAX. 80')
2	14	16
3	18	20
4 (MAX)	20	22

Table 2 - Vent Lengths *

HORIZONTAL LENGTH (ft.) (B)	MINIMUM VERTICAL LENGTH (ft.) (C)
5	10
10	22
15	40
20	50
30	60
40	70

NOTES:
1. A NEGATIVE PRESSURE OF .02 TO .08 MUST BE PROVIDED FOR ALL BOILERS CONNECTED TO THE BREECHING WHEN ALL BOILERS ARE IN OPERATION AT FULL INPUT.

2. SIDE CLEARANCE FOR EACH UNIT IS 6 INCHES TO COMBUSTIBLES AND 24 INCHES FOR SERVICE.

Figure 1 - Horizontal Air Intake and Venting for a Single Direct Vent System

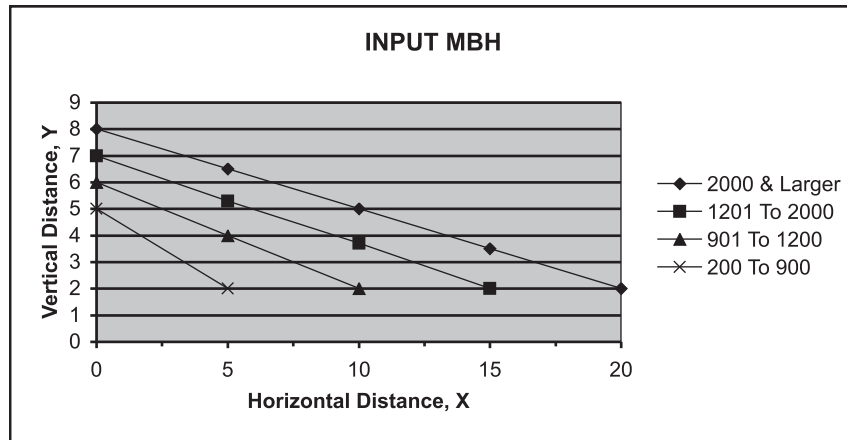
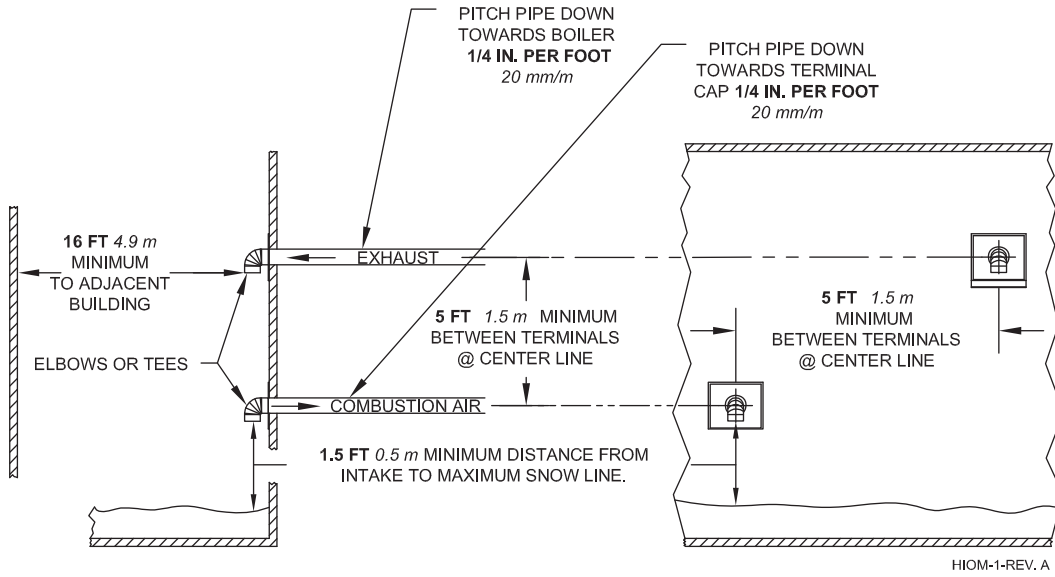


Figure 2 - Horizontal Air Intake and Venting for Multiple Direct Vent Systems

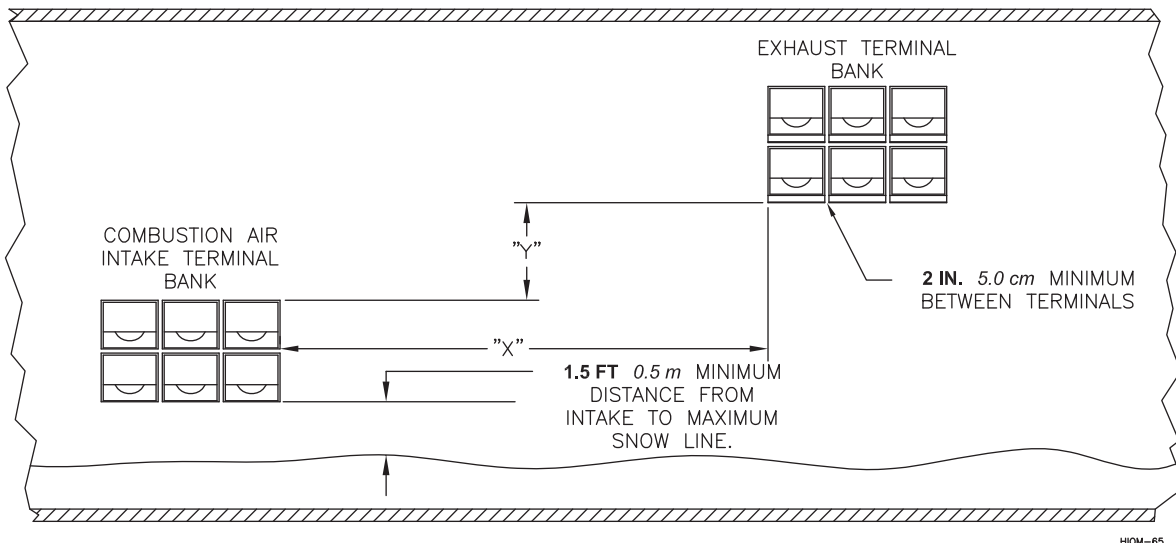


Figure 3 - Vertical Air Intake and Venting for Direct Vent System

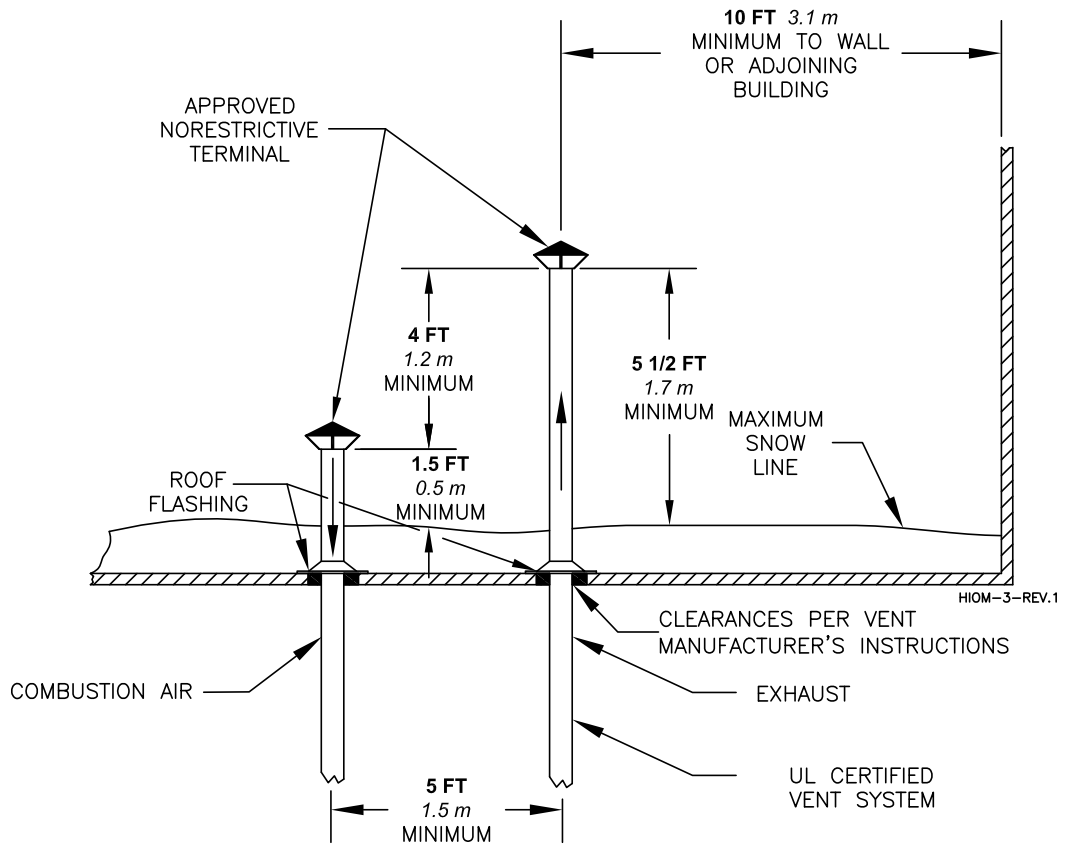
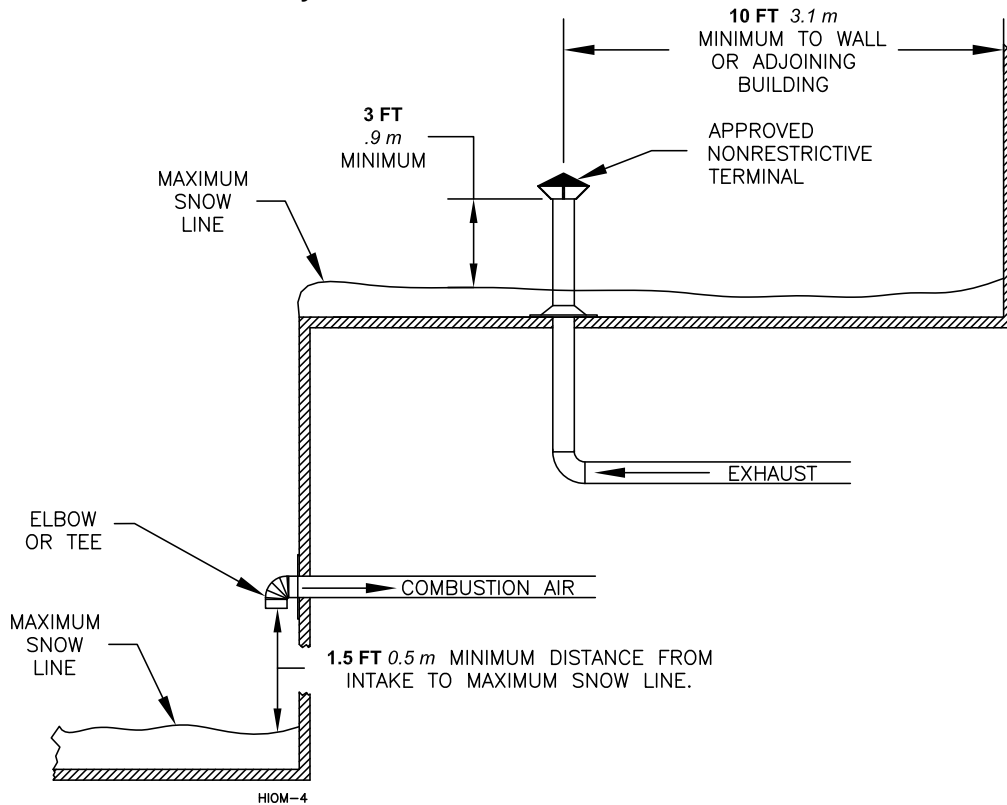


Figure 4 - Combination Direct Vent Systems

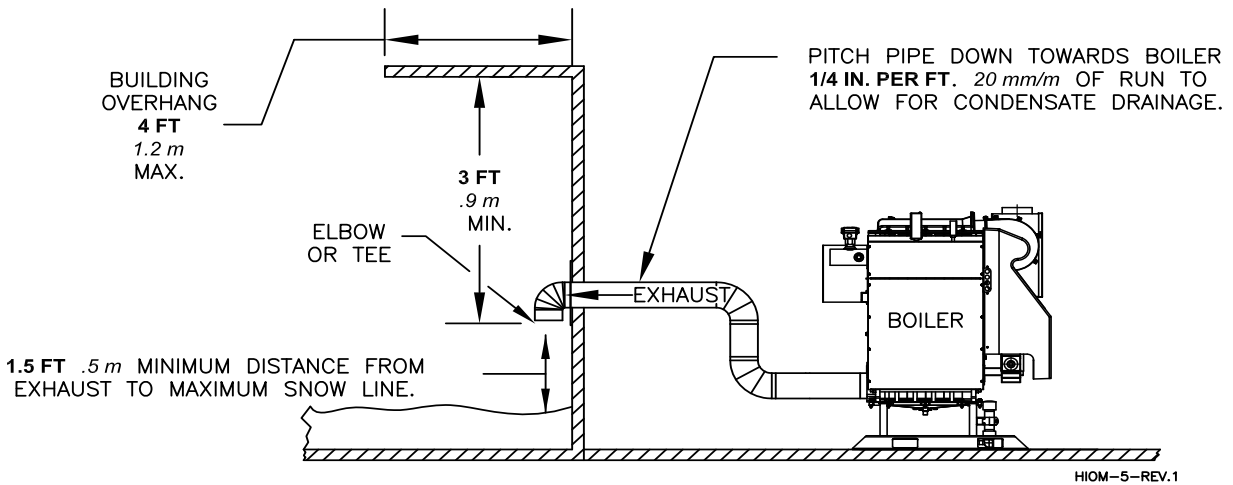


SIDE WALL VENT
POSITIVE PRESSURE, CATEGORY IV

In this configuration the boiler blower is used to push the flue products horizontally to the outdoors, see Figure 5.

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.

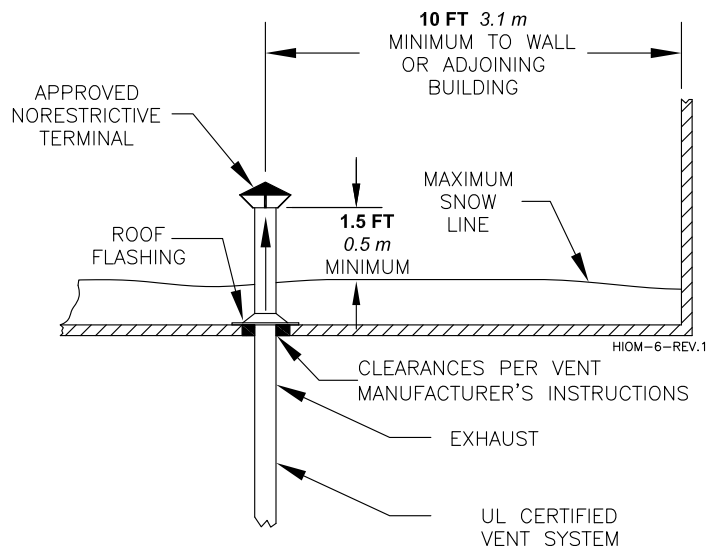
Figure 5 - Side Wall Venting



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 6. 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 6 - Vertical Positive Pressure Venting



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 7. The chimney system must provide a negative pressure of **0.02 to 0.2 in, 0.51 to 5.08 mm** W.C. at the boiler flue collar with the unit running.

NOTE: When using a listed metal chimney system the chimney system manufacturer's instructions must be followed.

Multiple KN's can be vented into a single vertical chimney system. Refer to HydroTherm KN-10 Venting page 7. Refer to page 8 for multiple KN-6 and KN-20 venting applications. Consult with vent manufacturer on KN-30 sizing; based on maximum .2 negative at boiler outlet. See recommendations on page 6.

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 7 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 7 - Equivalent Breeching & Chimney Size, Negative Pressure - Single Boiler

Model Size	Breach & Flue Diameter	
	in ²	mm ²
600	8	204
1000	12	305
2000	16	408
3000	16	408

NOTE: These sizes are based on a 20 ft, 6.1m 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.

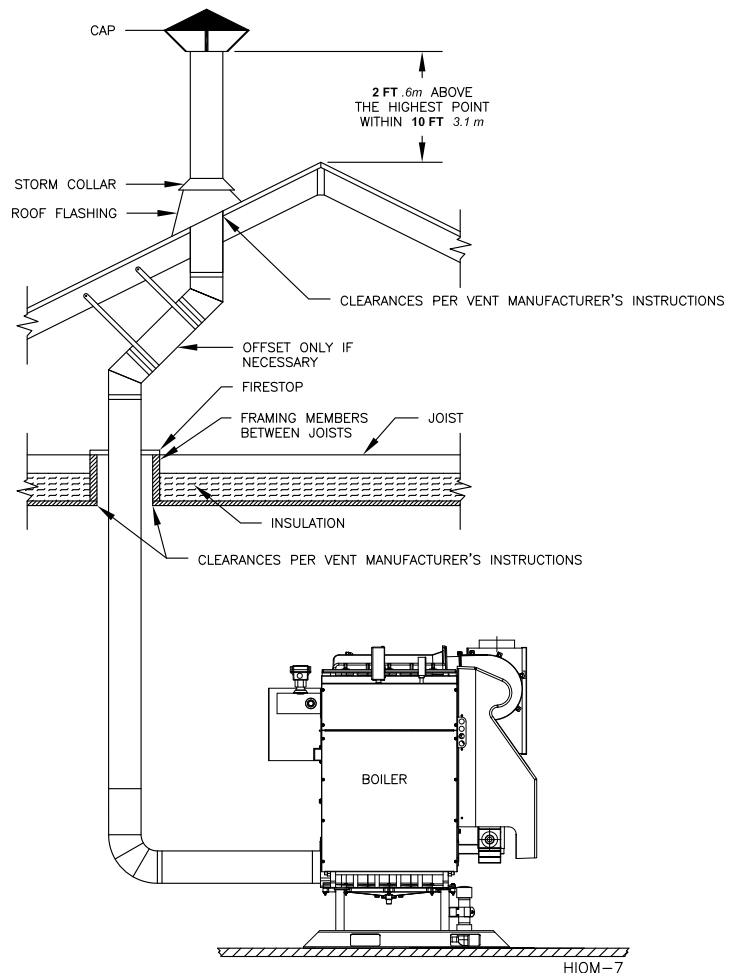
The vent system should be sloped up toward the chimney at a minimum rate of **1/4 in/ft, 2 cm/m**.

WARNING: Never install a vent pipe of a diameter different than that specified in Table 7. Failure to comply with this warning can result in excessive levels of carbon monoxide which can cause severe personal injury or death.

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!

Figure 7 - Vertical Venting with a Metal Chimney System



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.

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!

NOTE: 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 8. Mount on rear section or vertically on supply nipple.

WARNING: 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 Switch

The flow switch (optional on KN-6, 10, and 20; standard on KN-30) is wired to prevent the boiler from firing unless there's adequate water flow through the unit.

NOTE: If using the optional flow switch, failure to maintain the minimum flow rates listed below at the boiler outlet will prevent the flow switch from closing. If a minimum flow rate cannot be maintained at the boiler outlet the flow switch will have to be relocated in the system.

	Water Flow Rates (GPM)		ΔT Across Heat Exchanger	
	Min.	Max.	Min.	Max.
KN-6	10	100	20°F	100°F
KN-10	15	150	20°F	100°F
KN-20	30	300	20°F	100°F
KN-30	45	450	20°F	100°F

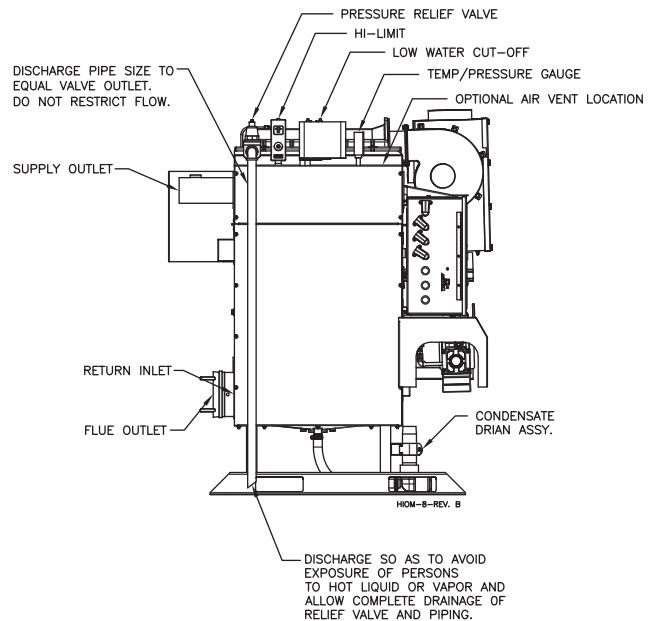
Increase flow rates approximately 30% for glycol mixtures.

We have been informed of a small number of jobs on which the particular glycol/water mix results in foaming within the sections. The air entrapment within this foam significantly decreases heat transfer and could potentially result in damage to the boiler sections. The formation of this foam can be controlled rather simply by introducing an anti-foaming agent to the water/glycol mix.

Upon reviewing different types of glycol, we have found that Dow Frost HD glycol when used in conjunction with Dow Corning Antifoaming Agent part #1410 results in a mix with heat transfer characteristics nearly identical to that of pure water. The higher operating temperature range offered by Dow Frost HD when combined with the greatly reduced foam formation allowed by the antifoaming agent provides an ideal solution to ensure the long life of low mass/high rate of heat transfer KN Series boilers.

On those jobs where glycol is necessary for freeze protection, we highly recommend use of this mixture at a ratio of one gallon of the antifoaming agent per 5,000 gallons of system volume.

Figure 8 - Relief Valve Piping



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 **1 in, 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 **12 psig, 84 kPa** must be maintained at the highest point in the system piping. A minimum system pressure of **25 psig, 172 kPa** fill pressure is required on glycol mixtures within a closed loop.

Cleaning Boiler

Installer must flush and clean out boiler cavity to ensure unit is cleansed of various impurities.

Boiler Piping Connections

The supply and return connections should be sized to suit the system, see Table 8.

Table 8 - Supply & Return Pipe Sizing

Model Size	Supply Size	Return Size
600	2" NPT	2" NPT
1000	3" NPT	3" NPT
2000	3" NPT	3" NPT
3000	4" NPT	4" NPT

Water Treatment

This boiler was designed to operate in a closed loop heating system. Water treatment is required when fill or make-up water contains dissolved solids greater than 200 ppm or if PH level is not within the 6.5-11 range.

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 10.

Primary/Secondary Piping

Although acceptable, the system is not as cost effective as reverse return piping. Figure 11 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 12.

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.

NOTE: 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 9 - Typical Single Boiler Piping (RECOMMENDED)

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

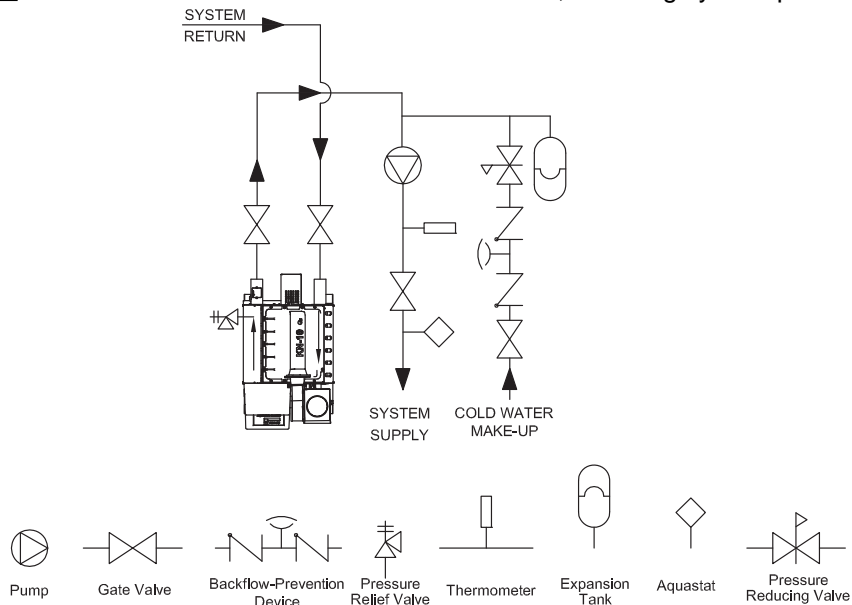
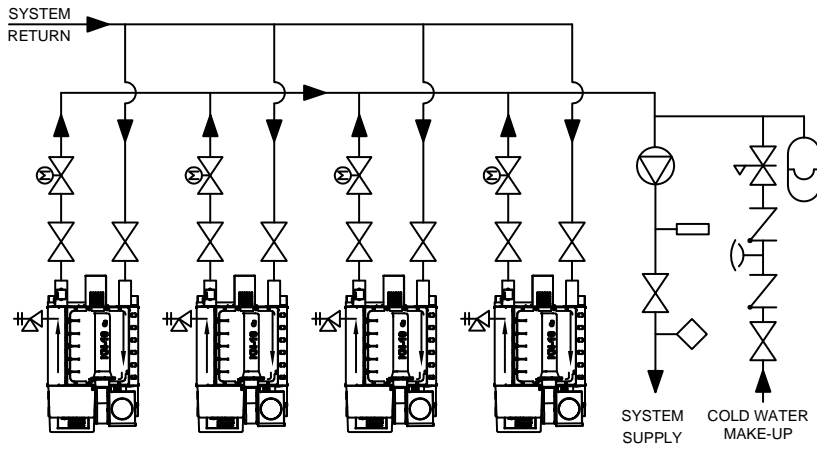


Figure 10 - Typical Multiple Boiler Reverse Return Piping (RECOMMENDED)

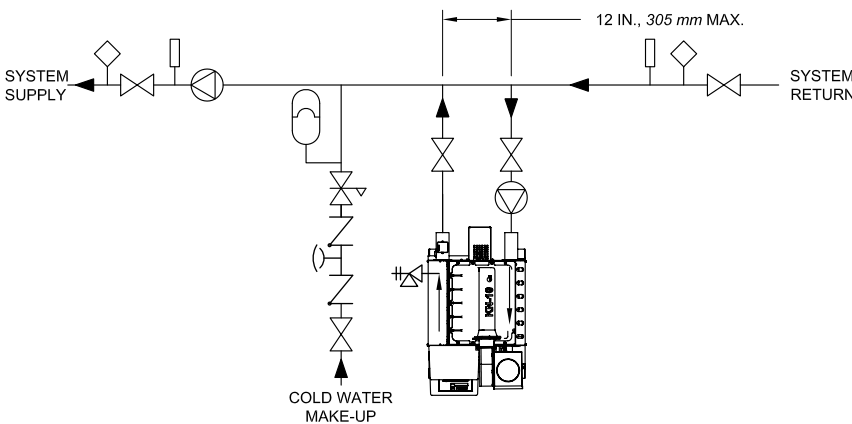
(Careful consideration as to minimum boiler and system water flow rates must be taken. Please consult our local manufactures representative for assistance.)



NOTE: Not all system valves may be shown. Consult local codes for additional system components which may be necessary.

HIOM-11 REV .3

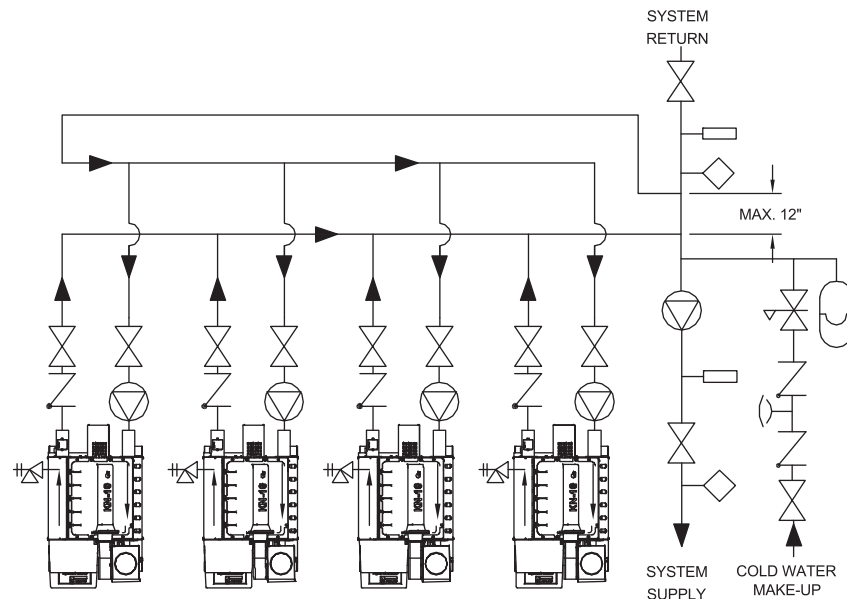
Figure 11 - Typical Single Boiler Primary/Secondary Piping



NOTE: Not all system valves may be shown. Consult local codes for additional system components which may be necessary.

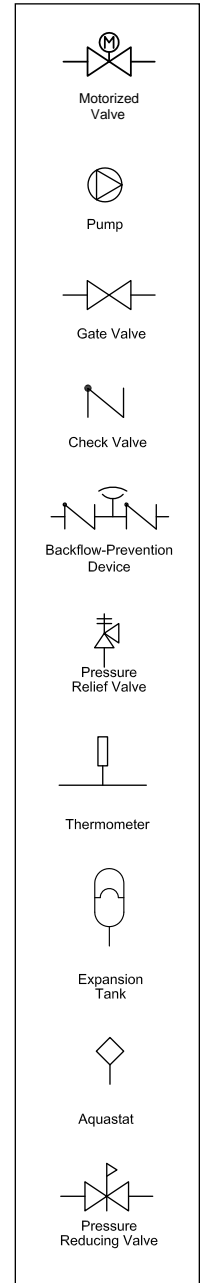
HIOM-9 REV .2

Figure 12 - 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.

HIOM-10 REV .3



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 use 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.

NOTE: 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 13 & 14.

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

Water can be stored a 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 13 - Typical Single Boiler with Indirect Storage Tank Piping

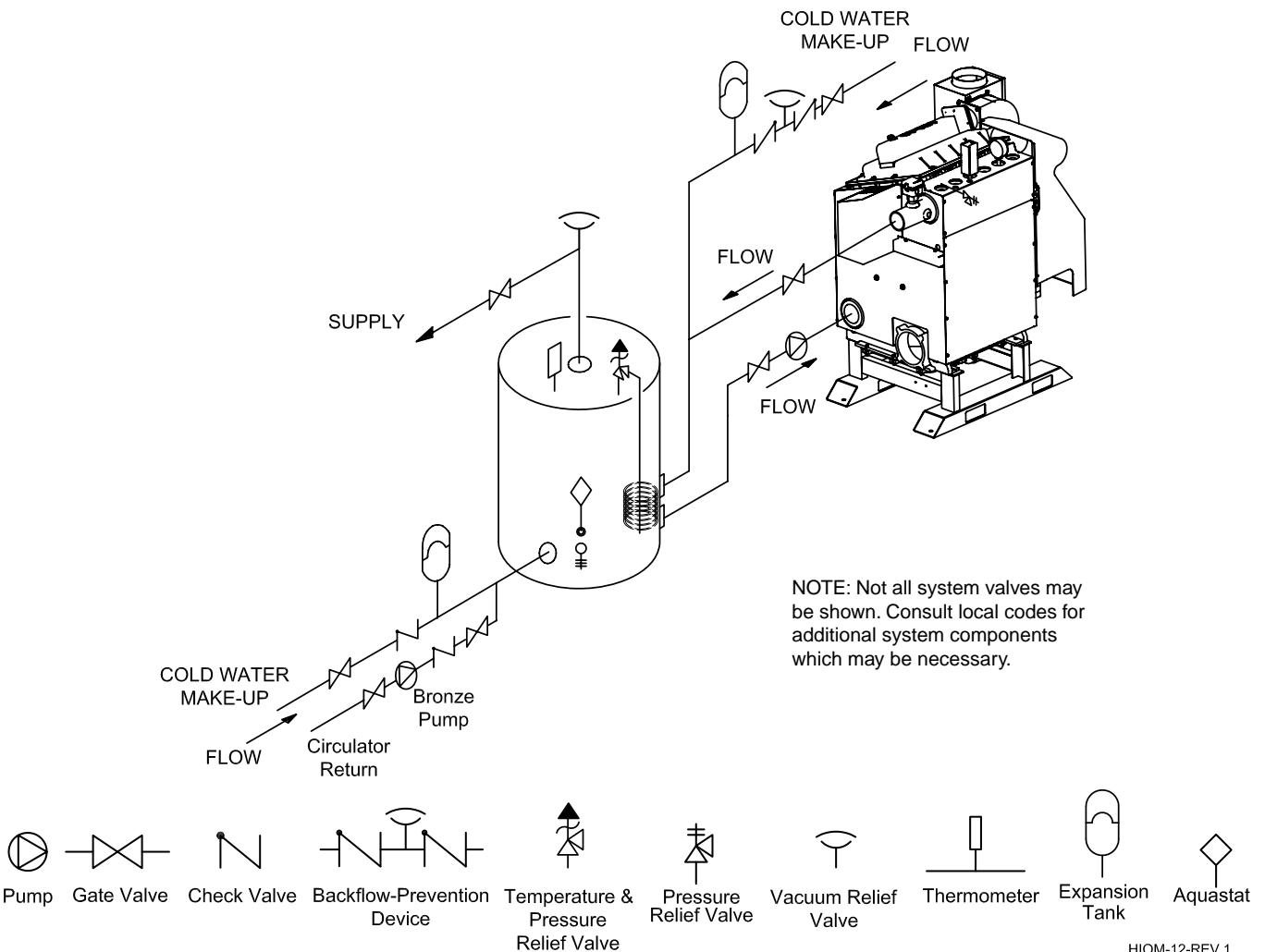
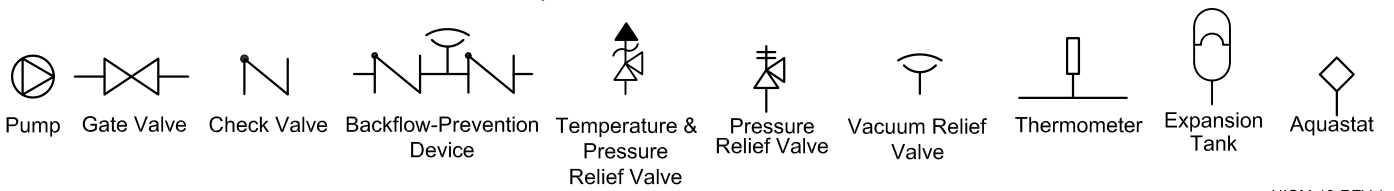
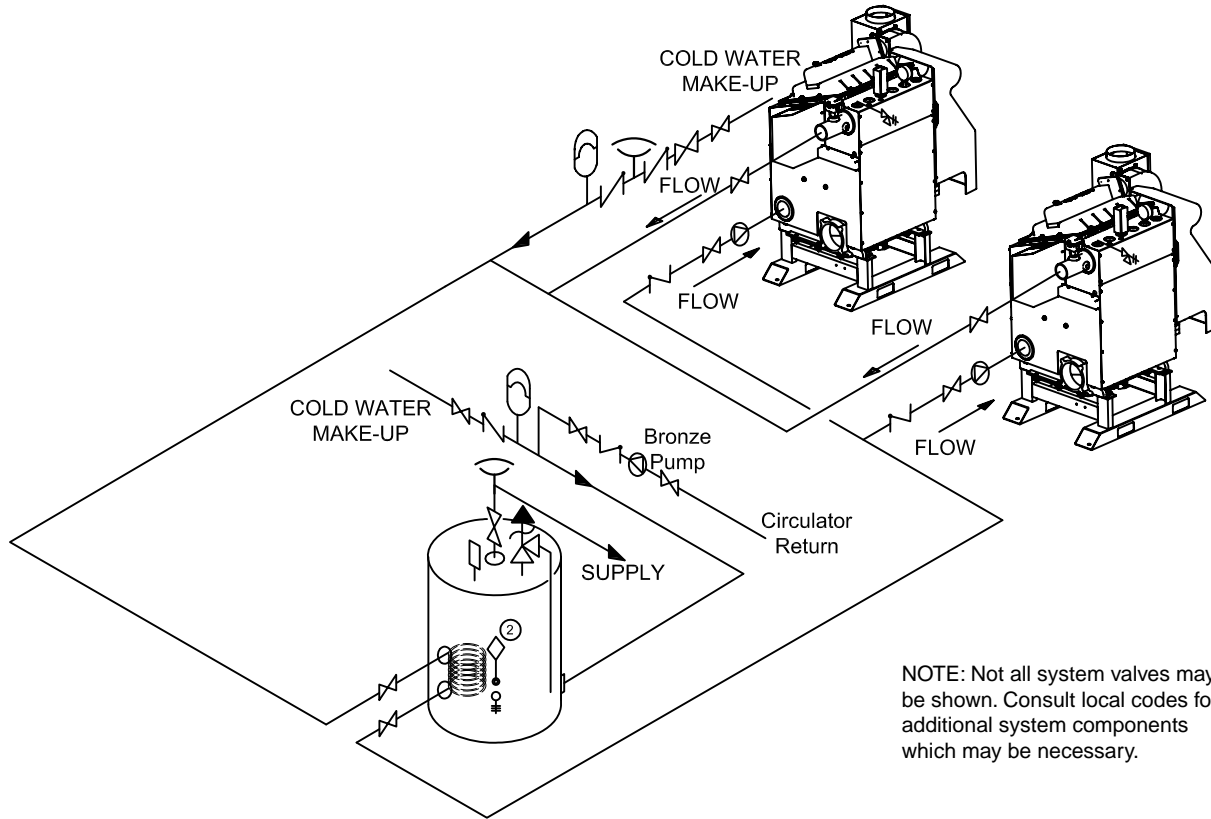


Figure 14 - Typical Multiple Boiler with Indirect Storage Tank Piping



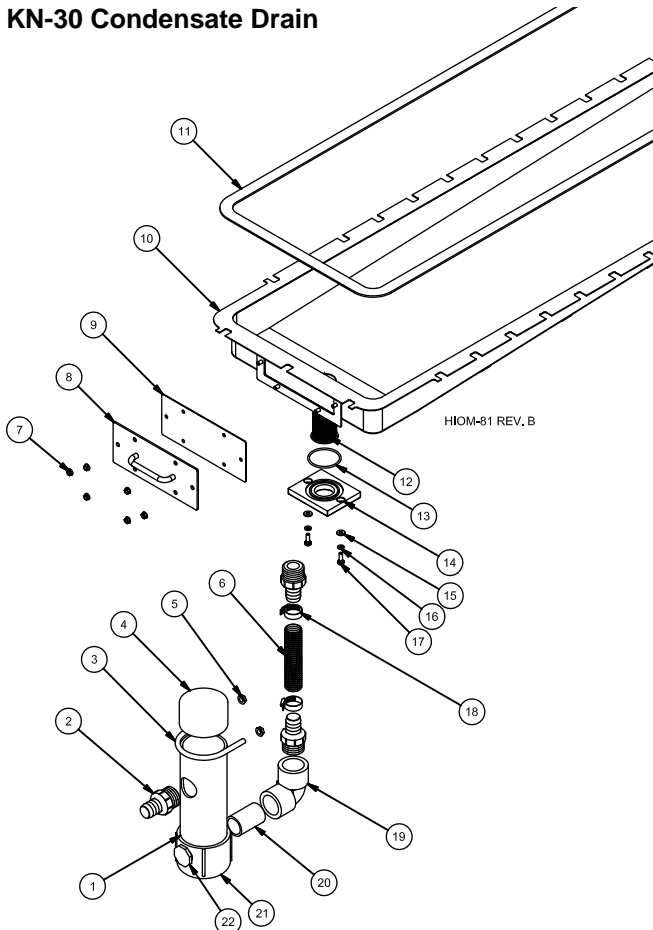
CONDENSATE PIPING

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 installed, it must be positioned prior to boiler room drain. Fill the condensate fill trap with water and antifreeze solution prior to start-up.

BILL OF MATERIALS			
ITEM	PART NO.	DESCRIPTION	QTY.
1	56-3315	3" x 10" CPVC SCH 80	1
2	56-5749	1 1/4" NPT X 1" BARB FITTING	3
3	57-5921	3 1/2" DIA. 1/4-20 U CLAMP BOLT	1
4	56-4728	POLY PRESS CAP	1
5	57-2600/57-4708	1/4-20 HEX NUT/1/4 LOCK WASHER	2
6	56-5708	FLEX HOSE	1
7	57-2600/57-4708	1/4-20 HEX NUT/1/4 LOCK WASHER	6
8	03-1830	CLEAN OUT COVER	1
9	59-1119	CLEAN OUT COVER GASKET	1
10	SEE TABLE 2	DRAIN PAN WELDMENT	1
11	10-6635	DRAIN PAN GASKET, RTV	1
12	03-1826	FILTER SCREEN	1
13	59-2034	O-RING	1
14	01-1656	NIPPLE ADAPTER	1
15	22H-1133078	FLAT WASHER	2
16	22H-1133618	LOCK WASHER	2
17	22H-110120302	HEX BOLT	2
18	57-4903	1 1/2 TO 3/4 HOSE CLAMP	2
19	54-3270	1 1/4" NPT CPVC SCH 80 ELBOW	1
20	54-3307	1 1/4" NPT 2.5" CPVC SCH 80 NIPPLE	1
21	56-4727	3" CPVC SCH 80 END CAP	1
22	56-4706	1" CPVC SCH 80 PLUG	1

TABLE 2				
ITEM	KN-6	KN-10	KN-20	KN-30
10	03-1832	03-1829	03-1831	03-1834

KN-30 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 HydroTherm representative to resolve the problem.

Table 9 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 9 should be used in conjunction with Table 10 to ensure that the gas supply piping has the capacity to meet the demand.

Figure 15 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 feet 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 LP gas.

Table 9 - 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, (in)	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
1 1/4"	1050	730	590	500	440	400	350	305	250
1 1/2"	1600	1100	890	760	670	610	530	460	380
2"	3050	2100	1650	1450	1270	1150	990	870	710

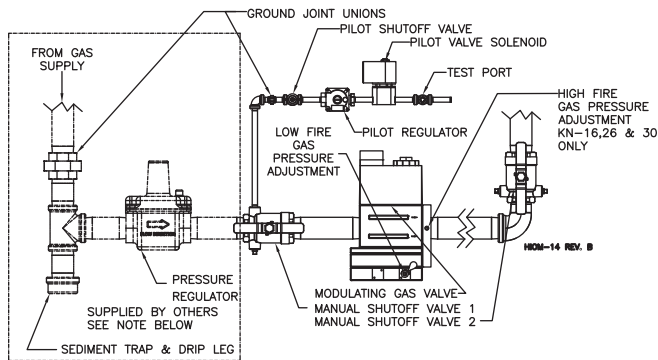
Note: Multiply the gas volume by 0.62 for propane flow capacity in ft³/hr. Multiply the propane flow capacity by 2500 Btu/ft³ to determine the propane Btu/hr capacity for a given pipe size and length.

Table 10 - Equivalent Pipe Length Chart

Nominal Iron Pipe Size, (in)	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 15 - Gas Supply Piping



NOTE: A lockup style regulator supplied by others, must be installed, see Figure 15, if gas pressure exceeds (14" W.C.). The regulator, when installed as shown, must be installed at a distance of at least 10 pipe diameters from the boiler's main gas valve. All boilers are calibrated and factory test fired at (7" +/- 1" W.C.).

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!

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 15. 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. Install a separate 120 volt 15 amp circuit for each KN-6 or KN-10 boiler. Install a separate 230 volt 1Ø with neutral 20 amp circuit for each KN-20 boiler, 230 volt 3Ø 20 amp circuit required on KN-30. 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.

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

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

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 **12 psig, 84 kPa** system pressure is maintained at the highest point in the system piping (minimum **25 psig, 172 kPa** for anti-freeze systems). If a make-up water pump is used adjust it as stated above.

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 déceler 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. Suives les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service de incendies.

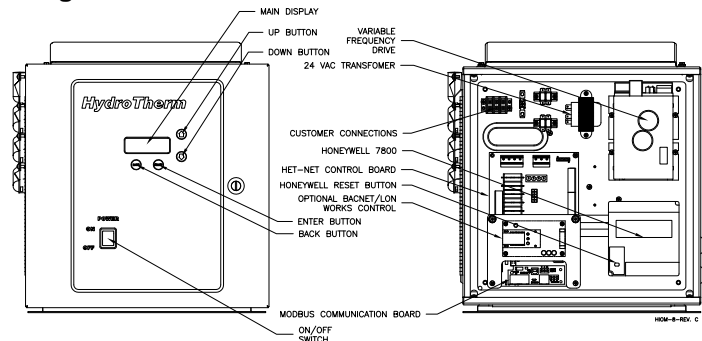
C. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control that has been under water.

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 15.
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. Install a fitting at the bleed point and connect a manometer having a minimum range of **20 in, 508 mm WC** to it, Figure 15.
8. Remove the 1/8" pipe plug from the pilot tee and connect a manometer having a minimum range of **6 in, 154 mm WC** to it.
9. Wait five (5) minutes to clear out any gas.
10. Open the manual main shut-off valves 1 and 2 and the pilot gas shut-off valve, Figure 15.
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 16.
13. Create a min input demand by jumping the TI terminals, Figure 22.
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 16. This will hold the Honeywell 7800 in its ignition state.
16. Adjust the pilot pressure per the CHECKING, ADJUSTMENT & OPERATION section below.
17. Remove the demand from the 7800 control by opening the TI terminals, allowing the boiler to stop.

Figure 16 - Control Panel



18. Remove the manometer fitting from the pilot tee and replace the plug. Close manual main shut-off valve 2 and the pilot gas shut-off valve, Figure 15.
 19. Switch the Honeywell 7800 back to "run".
 20. Create a min (TI) input demand as before. The boiler will begin the start sequence.
 21. 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: Improper wiring of the ignition transformer can result in an explosion causing extensive property damage, severe personal injury or death!**
22. Open both manual main shut-off valves and the pilot gas shut-off valve.
 23. Reset the Honeywell 7800. The boiler will start and will run at minimum input rate.
 24. **Setting the low fire:** Allow the low fire to settle out for a few minutes and observe the combustion reading. They should be as follows:

	CO ₂	O ₂
KN-6, 10, 20 Low Fire	7.4-8.8%	7.6-5.2%
KN-30 Low Fire	6.7-8.1%	8.6-6.8%

The low fire O₂-CO₂ can be adjusted in the field by opening the low fire adjustment door located on the forward facing side of the main gas valve. Inserting an allen wrench and rotating the allen screw clockwise will increase the CO₂ and lower the O₂, rotating counter clockwise will decrease the CO₂ and increase the O₂. In low fire you should see a red and blue striped pattern on the burner. If the mesh is entirely red decrease low fire CO₂.

25. Jumper the "AA" terminals. The boiler input will rise to its maximum input, "Run 100%", see Fig. 22.
26. Allow the boiler to stabilize and adjust the input rate per the CHECKING, ADJUSTMENT & OPERATION section below.
27. When all adjustments are finished, remove jumpers on terminals "TI" and "AA", see Fig. 22.
28. Boiler allows for many modes of operation and control methods. Reference the "Model KN-Series Control-IOM" and the "Model KN-Series Control-Programming Examples" for instruction.

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

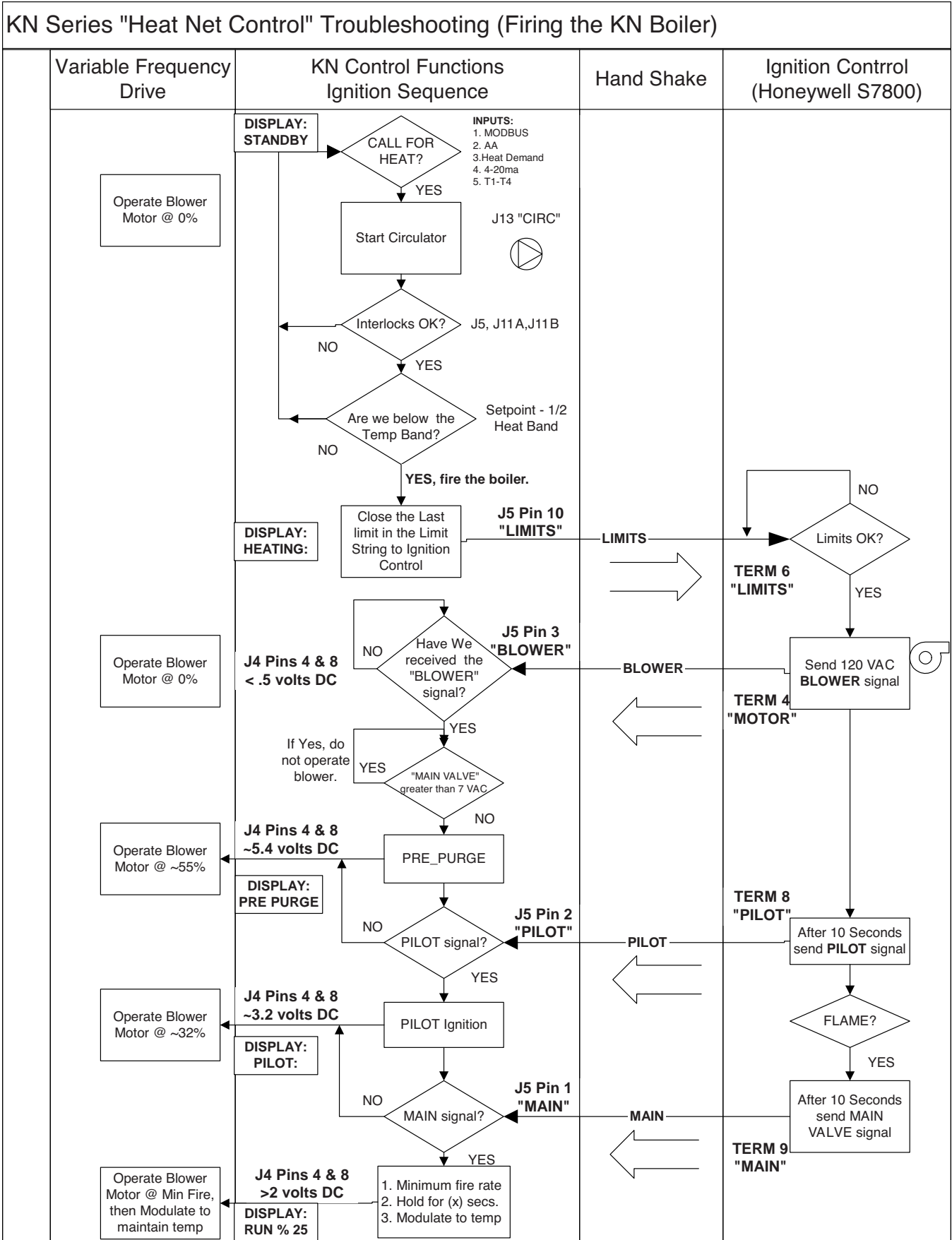
1. The blower operates at minimum ignition setting. See the calibration section in the "KN-Series Control-IOM" to enter the calibration menus.
2. The ignition transformer is energized. The pilot solenoid valve opens for the 10 second pilot ignition trial.

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.



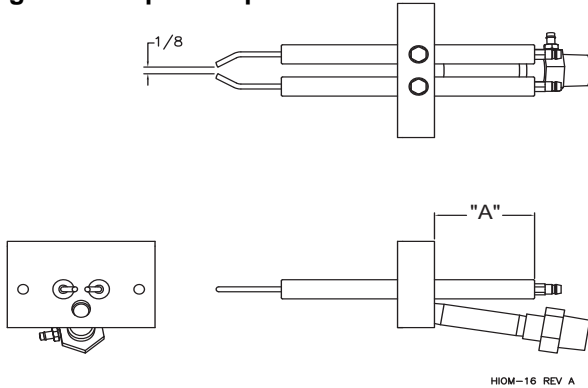
Troubleshooting A Startup				
	Symptom	Identify Source	Check	Action
1.	An Interlock is tripped.	<p>1. Is it a 24 VAC Interlock?</p> <p>2. Is it a 120 VAC Interlock/ Alarm?</p> <p>3. Internal Alarms</p>	<p>1. All 24 VAC Interlocks are located on J11A and J11B. Examples of 24 VAC Interlocks: 1. SPARE3 2. Variable Frequency Drive(VFD) 3. Low Water Cutoff(LWCO), 4. Gas Pressure 5. Spare 4 6. Operator OPLIM 7. Water Flow 8. Air Pressure from UV Sensor.</p> <p>2. All 120 VAC interlocks/Alarms are located on J5. These include: 1. FLAME SAFE ALARM (Ignition CTRL ALARM) 2. Valve Alarm (IRI ALARM) 3. XS_FACTORY (Reserved) 4. HIGH LIMIT</p> <p>1. OPEN SENSOR 2. SHORTED SENSOR 3. COMBUSTION AIR DAMPER</p>	<p>1. Use a multimeter and check for 24 VAC on J11A, J11B to identify which interlock has tripped. Reset the Interlock or check for disconnected wiring or shorts.</p> <p>The Air Pressure from UV Sensor interlock if displayed will allow the boiler to function, but it needs to be functional while the boiler is running for it to clear.</p> <p>1. Use a multimeter on J5 to check for 120 VAC on these interlocks (except the HIGH LIMIT). The High Limit Interlock is displayed when there is no 120 VAC, since the HIGH LIMIT breaks the 120VAC to the Ignition Control.</p> <p>NOTE: Stray Voltages Greater than 8 VAC and less than 18 VAC on these interlocks can cause intermittent operation. If this is the case, check for back fed voltages. from field wiring.</p> <p>Check sensor voltages at J10A and J10B. The Temperature sensor inputs should be between 0 VDC and 5 VDC measured across the sensor. Example: At 77°F, the voltage would read 2.5 VDC.</p> <p>The combustion air damper prove switch must be wired across SPARE 1 and must be a "DRY" contact. Do not apply a voltage to this input, the input supplies it's own voltage/current.</p>
2.	Proceed to Operation Manual or Programming examples manual for more details and problem resolution.			

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 17. Electrode tips should face slightly downward.

Figure 17 - Spark Gap



Electrode Insertion Depth	
Model	DIM "A"
KN-30	1 1/2"
KN-20	1 1/2"
KN-10	1 7/8"
KN-6	1 7/8"

Pilot Adjustment

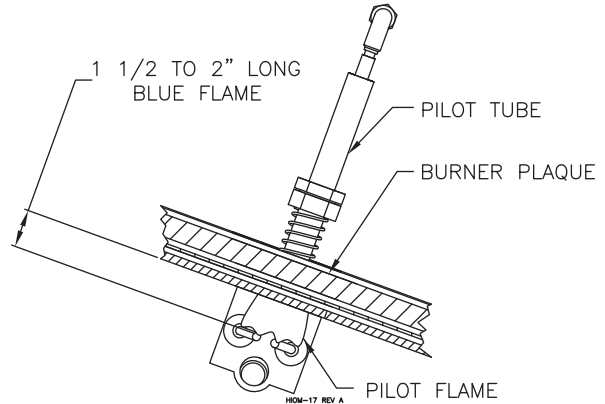
Verify the pilot pressure has been set within a range of 2.5"- 3.5" wc. To check the pilot pressure close the manual main shut-off valve and the pilot gas shut-off valve, (Figure 15). Remove the 1/8" pipe plug from the pilot tee and connect a manometer having a minimum range of 6 in, 154 mm WC to it. 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.

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 18 - 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 15) and the manual pilot shut-off valve. With the unit powered generate a call for heat. The boiler will start to go through its 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.

Main Burner Combustion

A high fire trim adjustment is located inside the airbox (KN-6, 10, 20), see Figures 20A and 20B. The KN-30 high fire trim is located on outlet flange of gas valve, see Figure 20C. This shutter allows for a CO₂ adjustment for high fire only. Once high fire combustion is set, re-test and adjust low fire. Turn gas valve trim screw until low fire CO₂ is approximately 1% below high fire reading.

Air Box Differential 5:1 Turndown

KN-6, 10	Low Fire - .2" wc	High Fire - 3.2" wc
KN-20	Low Fire - .2" wc	High Fire - 2.6" wc
KN-30	Low Fire - .48" wc	High Fire - 9.2" wc

Air Box Differential 4:1 Turndown

KN-6, 10	Low Fire - .28" wc	High Fire - 3.2" wc
KN-20	Low Fire - .28" wc	High Fire - 2.6" wc
KN-30	Low Fire - .70" wc	High Fire - 9.2" wc

Air Box Differential 3:1 Turndown

KN-6, 10	Low Fire - .44" wc	High Fire - 3.2" wc
KN-20	Low Fire - .44" wc	High Fire - 2.6" wc
KN-30	Low Fire - 1.1" wc	High Fire - 9.2" wc

Ignition Safety

To test the ignition safety shutoff device, close the manual shutoff valve 1 (Figure 15) 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. $\text{Input} = 10 / \text{seconds (Btu per cu/ft)}(3600)$.
7. If the computed rate exceeds the desired input rate or 1,000,000 Btu/hr reduce the input. To do this use the maximum Btu adjustment pot located on the face of the display, Figure 16.

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 16. 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.

STANDBY FLOW SWITCH: Indicates that the water flow switch is open without a call for heat.

OPTIONAL LOCKOUT FLOW SWITCH: Indicates that the water flow switch is open with a call for heat.

UV SCANNER SWITCH "flashing": Indicates that the UV scanner air pump proving switch is open with the boiler running.

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 the burner and ignition components are free from dust, soot, dirt, corrosion or other deposits that would impair the boiler's performance. Visually inspect the burner through the site glass. Refer to page 26 for component identification.

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.

NOTE: 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.

KN-6, 10, 20 Condensate Pan

Remove the (4) bolt exhaust flange from the rear of the boiler. Using a hose, flush out any residual material in the base pan through the condensate drain opening. Reseal the exhaust flange with a high temp silicone. Flush the drain trap and refill with 50% water/glycol mix to prevent evaporation in the trap.

KN-30 Condensate Pan

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. Flush the drain trap and refill with 50% water/glycol mix to prevent evaporation in the trap.

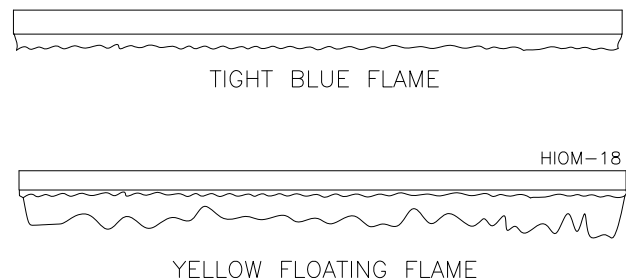
Controls

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

1. Check the operating controls for proper operation.
2. A float type low water cutoff device must be flushed out per the manufacturers' instructions. 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. In not, replace them.
3. The flow switch contacts must be open when water flow is not present.
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 18 & 19.

WARNING: When performing a visual inspection of burner operation you should note a striped pattern of red and blue when operating at low fire. This pattern will change to mostly blue with red speckling during high fire operation. High concentrations of red on high fire would require burner adjustment to reduce CO₂ value.

Figure 19 - Main Burner Flame



TROUBLESHOOTING

OPERATIONAL PROBLEM

CORRECTIVE ACTION

The "Power On" light doesn't illuminate.	<p>Ensure that proper voltage is being supplied to the unit</p> <p>Inspect the circuit breaker for the boiler circuit</p> <p>Check the light</p> <p>Ensure that the power switch operates properly and is wired correctly</p>
Lockout water limit is displayed with a call for heat.	<p>Check both the high limit and low water cut off.</p> <p>Ensure that the boiler has been completely purged of air.</p> <p>Ensure that all system valves are in the correct position.</p>
Lockout gas pressure is displayed with a call for heat.	<p>Ensure that the manual main gas valve is open.</p> <p>Ensure that there is sufficient gas pressure supplying the boiler.</p> <p>Check pressure setting on the low gas pressure switch.</p>
Lockout flow switch is displayed with a call for heat.	<p>Ensure that there is sufficient water flow through the boiler</p>
UV scanner switch is displayed flashing along with the normal running display.	<p>Ensure the scanner-cooling pump is operating.</p> <p>Make sure there are no obstructions in the tubing supplying the air to the scanner.</p>

Inlet Air Temp.	Figure 20A - Hydrotherm KN-6, 10, 20 Series G&D Mat – Mesh Burners (prior to 2010)						Figure 20B - Hydrotherm KN-6, 10, 20 Series Bekaert Burner (2010) w/Air Orifice Slide Trim*						Figure 20C - Hydrotherm KN-30 Series Bekaert Burner (2010) w/Gas Orifice Slide Trim**					
	CO ₂ %				O ₂ %		CO ₂ %				O ₂ %		CO ₂ %				O ₂ %	
	NG		LPG				NG		LPG				NG		LPG			
	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire
-40°F	7.4	7.8	8.7	9.2	7.6	7.0	7.4	8.6	8.7	10.1	7.6	5.6	6.7	8.0	NA	NA	8.6	6.9
-30°F	7.5	7.9	8.8	9.3	7.5	6.8	7.5	8.7	8.8	10.2	7.5	5.4	6.8	8.1	NA	NA	8.5	6.7
-20°F	7.6	8.0	8.9	9.4	7.4	6.6	7.6	8.8	8.9	10.3	7.4	5.2	6.9	8.2	NA	NA	8.5	6.5
-10°F	7.7	8.1	9.0	9.5	7.2	6.5	7.7	8.9	9.0	10.4	7.2	5.0	7.0	8.3	NA	NA	8.4	6.4
0°F	7.8	8.2	9.2	9.6	7.0	6.4	7.8	9.0	9.2	10.5	7.0	4.8	7.1	8.4	NA	NA	8.4	6.2
10°F	7.9	8.3	9.3	9.7	6.8	6.2	7.9	9.1	9.3	10.6	6.8	4.6	7.2	8.5	NA	NA	8.3	6.1
20°F	8.0	8.4	9.4	9.8	6.6	6.0	8.0	9.2	9.4	10.7	6.6	4.4	7.3	8.6	NA	NA	8.1	5.9
30°F	8.1	8.5	9.5	9.9	6.5	5.8	8.1	9.3	9.5	10.8	6.5	4.2	7.4	8.7	NA	NA	7.9	5.7
40°F	8.2	8.6	9.6	10.1	6.4	5.6	8.2	9.4	9.6	10.9	6.4	4.1	7.5	8.8	NA	NA	7.8	5.5
50°F	8.3	8.7	9.7	10.2	6.2	5.4	8.3	9.5	9.7	11.0	6.2	4.0	7.6	8.9	NA	NA	7.6	5.3
60°F	8.4	8.8	9.8	10.3	6.0	5.2	8.4	9.6	9.8	11.1	6.0	3.8	7.7	9.0	NA	NA	7.4	5.2
70°F	8.5	8.9	9.9	10.5	5.8	5.0	8.5	9.7	9.9	11.2	5.8	3.6	7.8	9.1	NA	NA	7.2	5.0
80°F	8.6	9.0	10.1	10.6	5.6	4.8	8.6	9.8	10.1	11.3	5.6	3.4	7.9	9.2	NA	NA	7.1	4.8
90°F	8.7	9.1	10.2	10.7	5.4	4.6	8.7	9.9	10.2	11.4	5.4	3.2	8.0	9.3	NA	NA	6.9	4.7
100°F	8.8	9.2	10.3	10.8	5.2	4.4	8.8	10.0	10.3	11.5	5.2	3.0	8.1	9.4	NA	NA	6.8	4.5

*See page 30 for slide damper location on KN-6, 10, 20.

**Located on outlet flange of gas valve. (page 35)

Figure 20C - Exploded View - Front

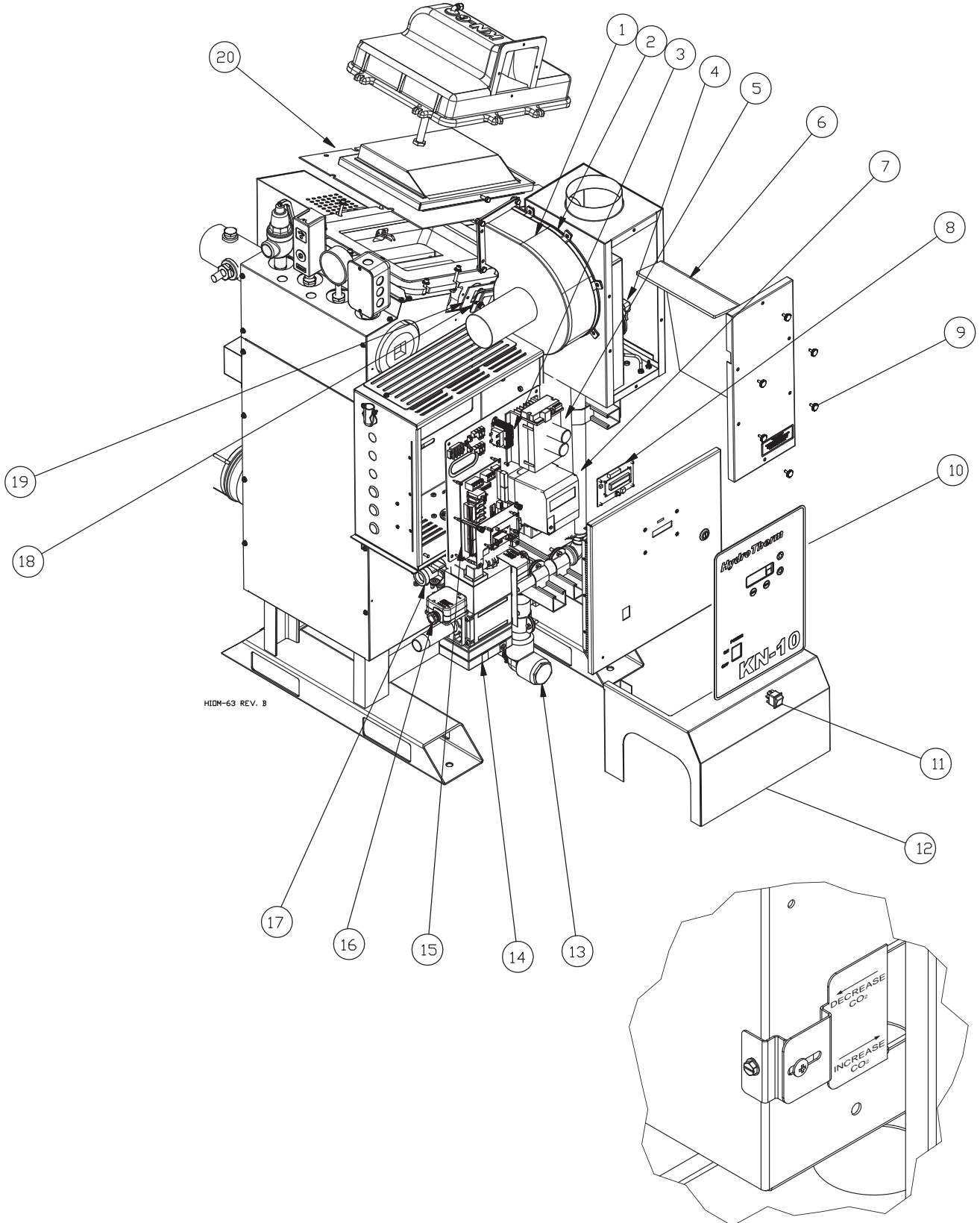
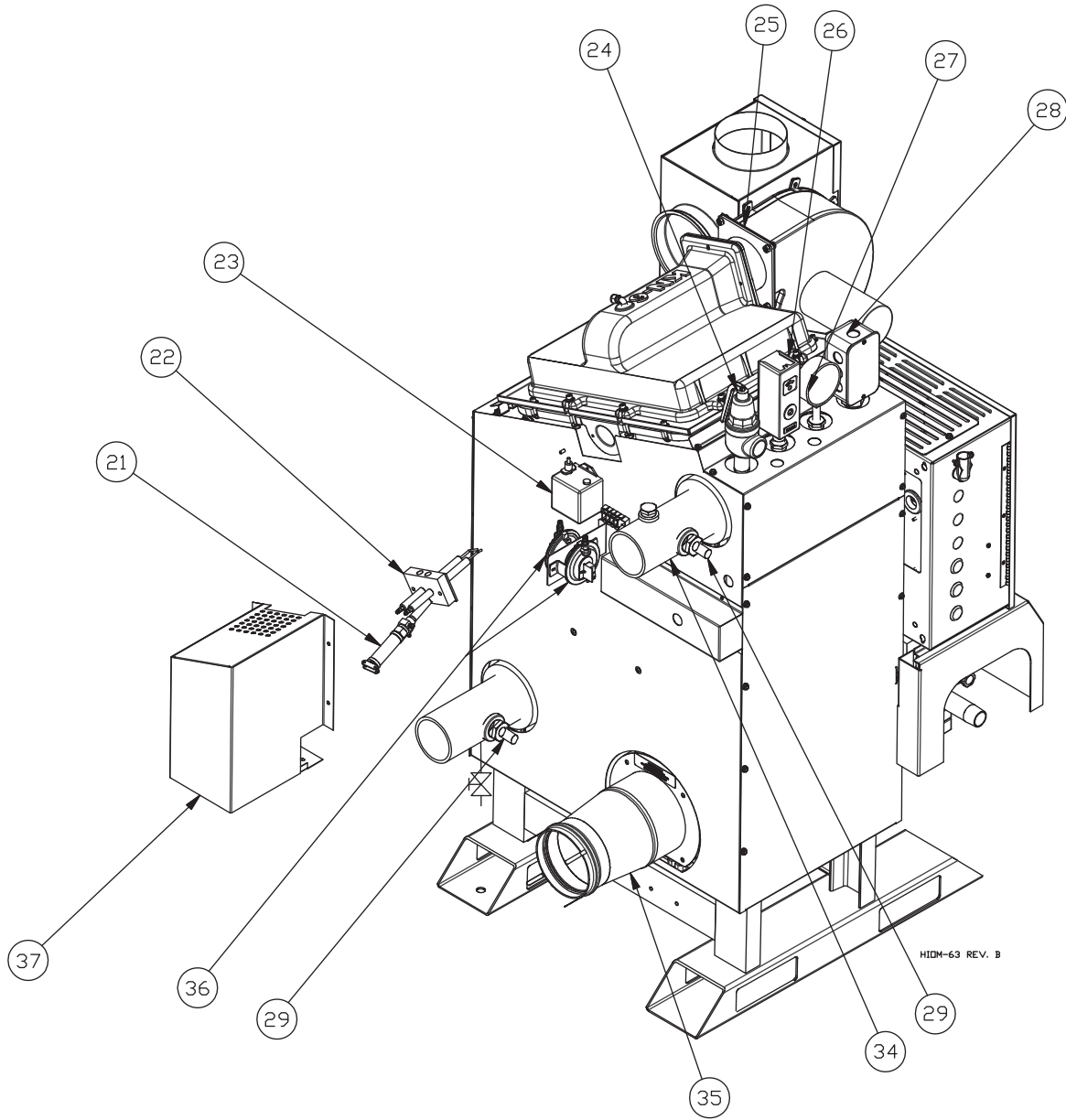
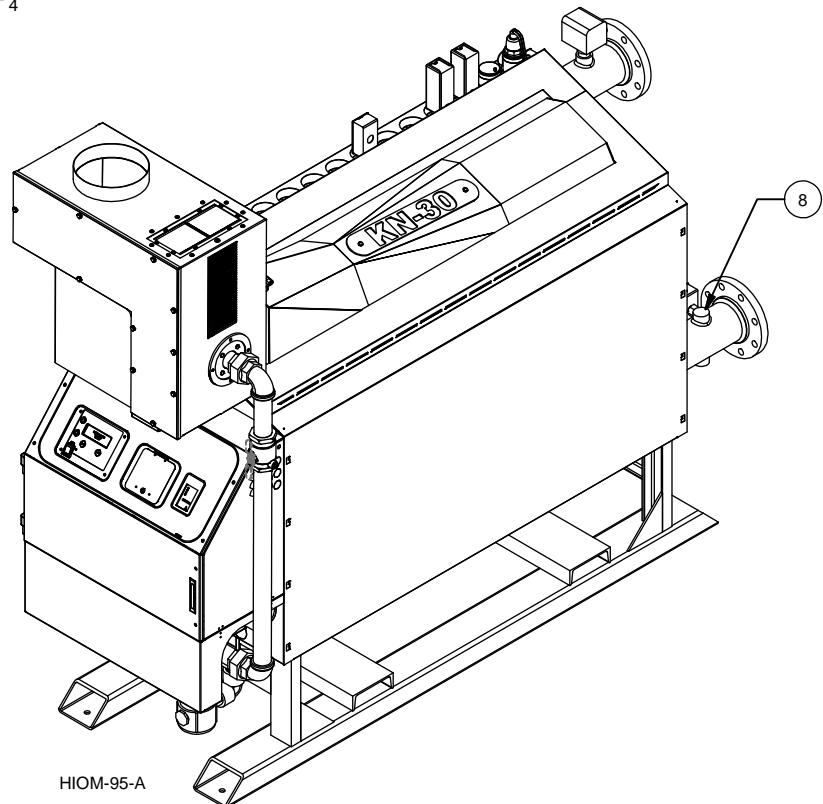
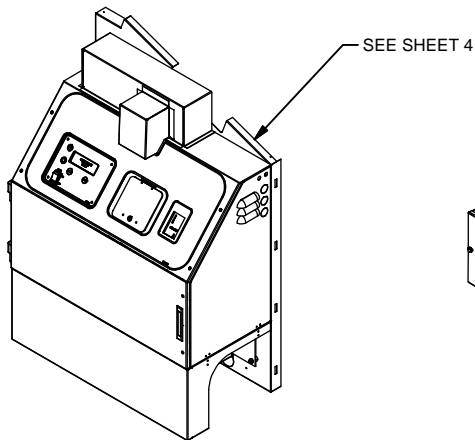
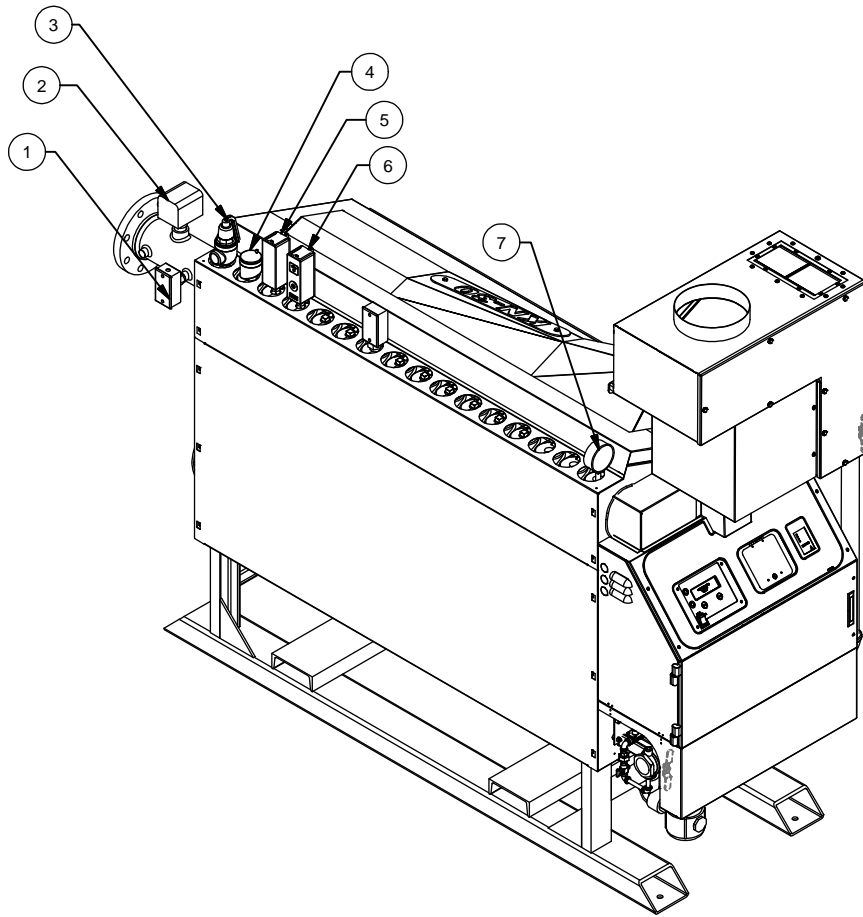


Figure 21 - Exploded View - Back

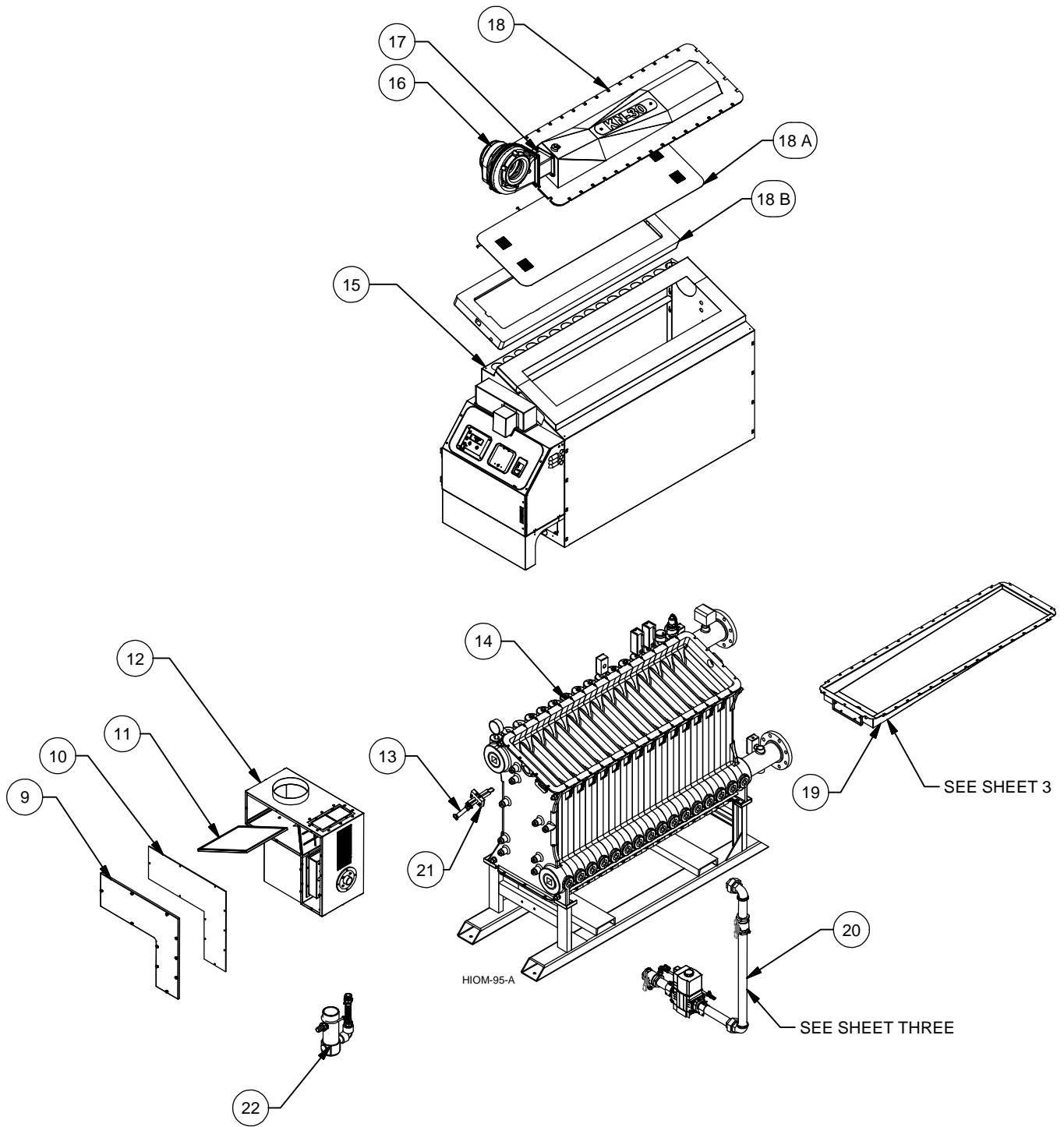


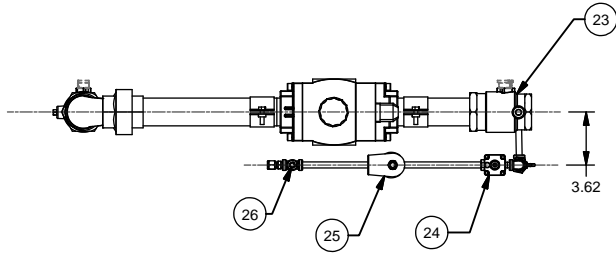
KN INSTALLATION AND OPERATION INSTRUCTIONS
SERVICE AND REPLACEMENT PARTS LIST

Item	Description	Model Size with Item Quantities Below			
		Part #	KN-6	KN-10	KN-20
1	BLOWER ASSEMBLY KIT	BM-1507	1	1	
		BM-1508			1
2	FILTER BOX GASKET	59-1067	1	1	
		59-1072			1
3	50 VA TRANSFORMER	26-3211	1	1	1
4	PRESSURE SWITCH - HUBA	02-4881			
5	FREQUENCY DRIVE	58-1750	1	1	
		58-1752			1
6	AIR FILTER	59-1069	1	1	
		59-1071			1
7	7800 SERIES BURNER CONTROL	02-4012	1	1	1
8	DISPLAY BOARD	02-4278	1	1	1
9	THUMB SCREW	57-3657	6	6	6
10	KEYPAD OVERLAY	60-5633	1		
		60-5632		1	
		60-5614			1
11	ON/OFF SWITCH	58-1536	1	1	1
12	GAS TRAIN SHROUD	03-1725	1	1	1
13	CONDENSATE DRAIN	70-1338	1	1	1
14	GAS VALVE	02-1570	1	1	1
15	CONTROL PC BOARD 2.0	02-4293	1	1	1
16	LOW PRESSURE GAS SWITCH	02-4887	1	1	1
17	SCANNER COOLING PUMP	09-1518	1	1	1
18	VIEW PORT GLASS	60-4280	1	1	1
19	VIEW PORT & IG. BLOCK GASKET	59-1063	1	1	1
20	MESH BURNER ASSEMBLY KIT	BM-1509	1		
		BM-1510		1	
		BM-1511			1
21	UV SCANNER FLAME DETECT	02-5206	1	1	1
22	IGNITOR ASSEMBLY	70-1345	1	1	1
23	SPARK GENERATOR (HONEYWELL)	26-3207	1	1	1
24	RELIEF VALVE 30#	22-1805	1	1	
		22-1809			1
	RELIEF VALVE 50#	22-1807	1	1	
		22-1810			1
	RELIEF VALVE 75#	22-1803	1	1	
		22-1811			1
RELIEF VALVE 100#	22-1808	1	1		
		22-1812			1
25	BLOWER FLANGE REAR GASKET	59-1059	1	1	
	BLOWER FLANGE FRONT GASKET	59-1058	1	1	
	GOOSE NECK GASKET – NOT SHOWN	59-1076			2
26	MANUAL RESET HIGH LIMIT AQUASTAT	02-2800	1	1	1
27	PRESSURE TEMPERATURE GAUGE (30 & 50 PSI)	20-1021	1	1	1
	PRESSURE TEMPERATURE GAUGE (75 & 100 PSI)	20-1020	1	1	1
28	LOW WATER-CUT OFF	21-2061	1	1	1
	MAXTROL PILOT REG. RV12LT – NOT SHOWN	23-1014	1	1	1
	PILOT GAS VALVE V4046C – NOT SHOWN	02-1749	1	1	1
29	SUPPLY & RETURN SENSOR	02-4283	1	1	1
30	SUB BASE, BURNER CONTROL Q7800 – NOT SHOWN	02-4013	1	1	1
31	PURGE TIMER ST7800 – NOT SHOWN	02-4014	1	1	1
32	RECEPTACAL UV AMPLIFIER – NOT SHOWN	02-4015	1	1	1
33	DISPLAY MODULE S7800 – NOT SHOWN	02-4263	1	1	1
34	SUPPLY NIPPLE	70-1347	1	1	1
35	FLUE ADAPTER	5" 56-3347	1		
		6" 56-3349		1	
		8" 156-0006-01			1
		(old) 9" 56-3348			1
36	PRESSURE SWITCH – IN FRONT NOT SHOWN	02-5208	3	3	3
37	IGNITION COVER	70-1336	1	1	1
38	MAXTROL REGULATOR RV53 – NOT SHOWN	02-1830	1		
39	MAXTROL REGULATOR RV61 – NOT SHOWN	02-1831		1	
40	MAXTROL REGULATOR RV81 – NOT SHOWN	02-1832			1
41	SPARK CABLE HOT – NOT SHOWN	40-5403	1	1	1
42	SPARK CABLE GRD – NOT SHOWN	40-5404	1	1	1
NS	SPARK RESISTOR	58-1831	1	1	1

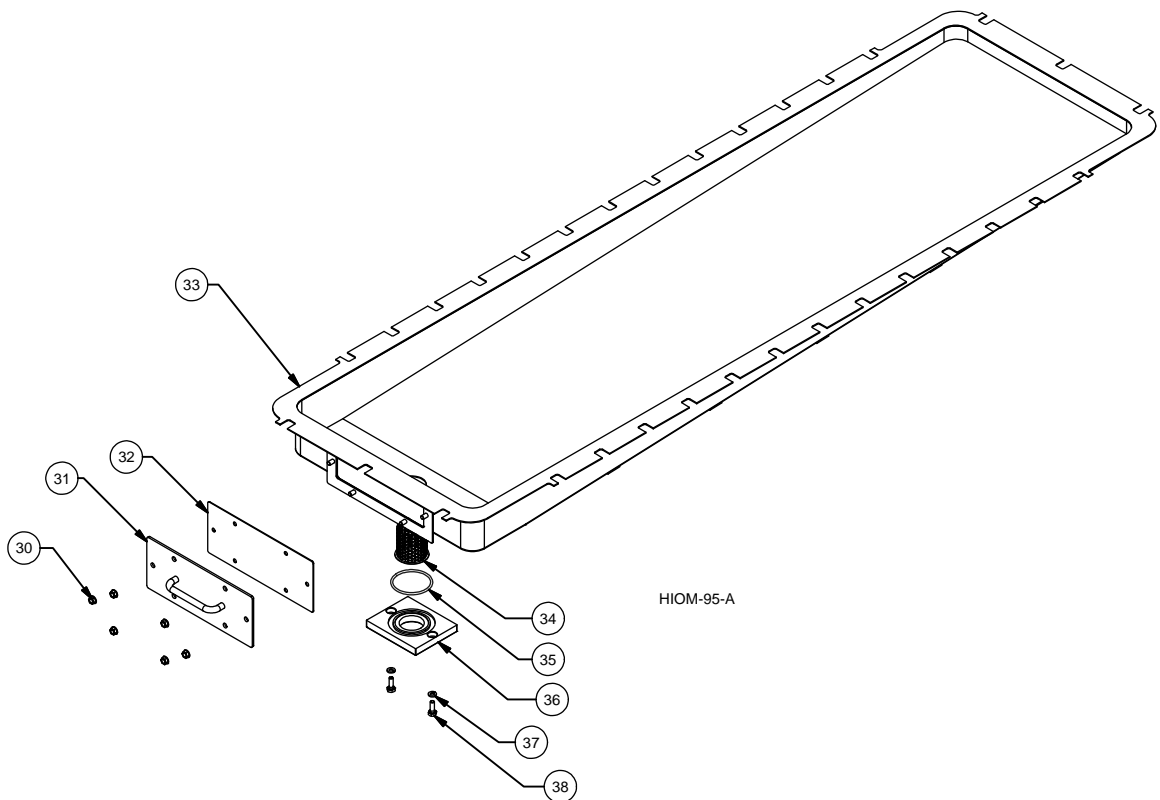
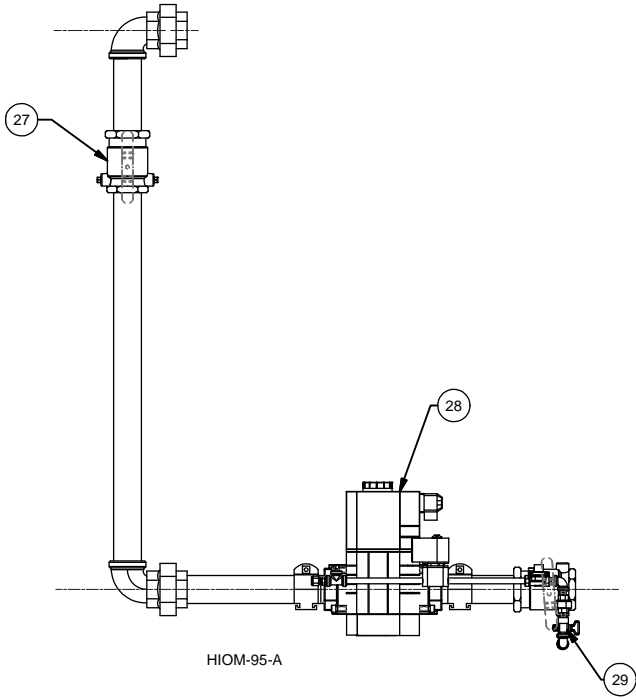


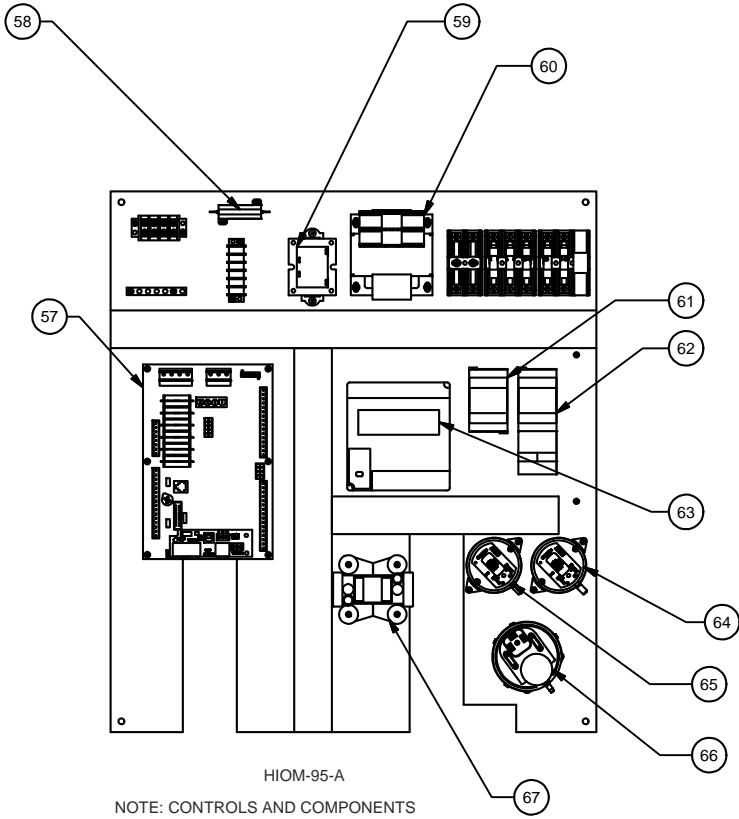
HIOM-95-A





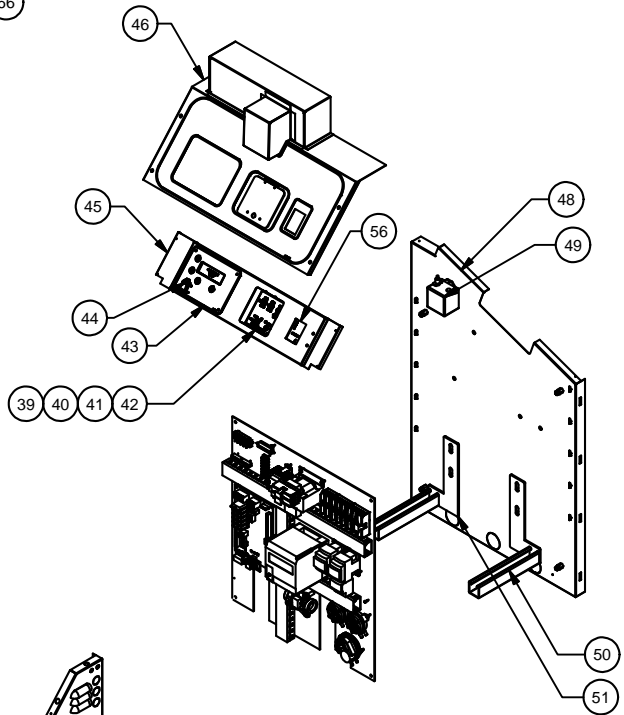
KN-30 High Fire CO₂ Adjustment Screw -
 Clockwise = Decrease
 Counterclockwise = Increase



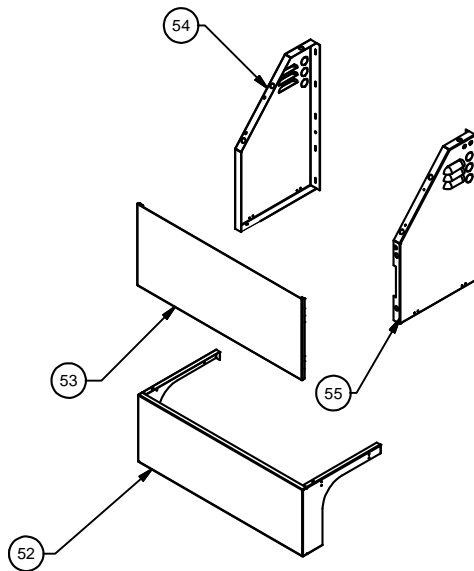


HIOM-95-A

NOTE: CONTROLS AND COMPONENTS
MAY BE LAID OUT IN DIFFERENT
LOCATIONS.



HIOM-95-A



KN INSTALLATION AND OPERATION INSTRUCTIONS
SERVICE AND REPLACEMENT PARTS LIST

Item	Description	Part #	KN-30
1	SUPPLY SENSOR	02-4283	1
2	FS254 FLOW SWITCH	14-0205	1
3	RELIEF VALVE 35#	22-1820	1
	RELIEF VALVE 50#	22-1821	1
	RELIEF VALVE 75#	22-1822	1
	RELIEF VALVE 100#	22-1823	1
4	AIR VENT	60-4257	1
5	AUTOMATIC RESET HIGH LIMIT AQUASTAT L4006A	02-3204	1
6	MANUAL RESET HIGH LIMIT AQUASTAT L4006E	02-2800	1
7	PRESSURE TEMPERATURE GAUGE (30 & 50 PSI)	20-1021	1
7	PRESSURE TEMPERATURE GAUGE (75 & 100 PSI)	20-1020	1
8	RETURN SENSOR	02-4283	1
9	FRONT COVER	03-1867	1
10	FRONT GASKET	59-1146	1
11	FILTER ASSEMBLY	59-1074	1
12	FILTER BOX ASSEMBLY	70-1487	1
13	UV FLAME SCANNER	02-5206	1
14	BLOCK W/ BASE	70-1224	1
15	JACKET ASSEMBLY SS	70-1937	1
16	BLOWER	70-1481	1
17	SPOOL ADAPTER	70-1491	1
18	UPPER COVER ASSY	70-1227	1
18A	MAIN BURNER ASSY	70-1228	1
18B	CERAMIC CHAMBER	45-1275	1
19	DRAIN PAN ASSEMBLY	70-6701	1
20	1 1/2" GAS TRAIN	70-1489	1
21	IGNITOR BLOCK ASSY	70-1345	1
22	CONDENSATE DRAIN KN	70-1338	1
23	1 1/2" GAS BALL VALVE	02-1578	1
24	MAXITROL REG RV12LT	23-1014	1
25	V4046C PILOT GAS VALVE	02-1749	1
26	1/8 GAS COCK	23-1016	1
27	1 1/2" GAS BALL VALVE	02-1578	1
28	DUNGS VALVE	02-1592	1
29	1/8 GAS COCK	23-1016	1
30	1/4-20 NEX NUT	57-2600	1
31	CLEAN OUT COVER	03-1830	1
32	CLEAN OUT COVER GASKET	59-1119	1
33	DRAIN PAN	03-1834	1

Item	Description	Part #	KN-30
34	FILTER SCREEN	03-1826	1
35	O-RING	59-2034	1
36	THREADED BLOCK	01-1656	1
37	HELICAL SPRING LOCK WASHER	22H-1133618	1
38	HEX BOLT - UNC	22H-110120302	1
39	LWCO	21-2061	1
40	LWCO LOCAL/REMOTE SWITCH	58-1535	1
41	LWCO ALARM RESET	58-1534	1
42	LIGHT SWITCH	58-1535	1
43	DISPLAY MOUNT PLATE ASSEMBLY	70-1475	1
44	POWER SWITCH	58-1536	1
45	HIDDEN PANEL WELDMENT	70-1480	1
46	FRONT CONTROL PANEL WELDMENT	70-1486	1
48	FRONT JACKET PANEL	03-1854	1
49	HONEYWELL SPARK GENERATOR	26-3207	1
50	GAS BRACKET SUPPORT (RIGHT)	03-1842	1
51	GAS BRACKET SUPPORT (LEFT)	03-1843	1
52	GAS TRAIN SHROUD	03-1863	1
53	FRONT CONTROL PANEL (DOOR)	03-1839	1
54	LEFT FRONT PANEL	03-1856	1
55	RIGHT FRONT PANEL	03-1855	1
56	BLOWER CONTROLLER	58-1826	1
57	PC CONTROL	02-4299	1
58	SPARK RESISTOR	58-1831	1
59	TRANSFORMER, 50 VA	26-3211	1
60	TRANSFORMER, 250 VA	26-3025	1
61	BLOWER OVERLOAD RELAY	58-1828	1
62 (Optional)	CONTACTOR (1 1/2, 2, 3 HP)	58-1917	1
	CONTACTOR (5 HP)	58-1918	1
	OVERLOAD RELAY (4 - 6AMP) 1 1/2 HP	58-1821	1
	OVERLOAD RELAY (5.5 - 8AMP) 2 HP	58-1822	1
	OVERLOAD RELAY (9 - 13AMP) 3 HP	58-1823	1
	OVERLOAD RELAY (12 - 18AMP) 5 HP	58-1824	1
	PUMP FUSE (1 1/2 HP)	58-1934	3
	PUMP FUSE (2 HP)	58-1931	3
PUMP FUSE (3 HP)	58-1935	3	
PUMP FUSE (5 HP)	58-1936	3	
63	FLAME SAFEGUARD RM7895C	02-4012	1
64	SWITCH 4"	02-5208	1
65	SWITCH 3"	02-5211	1
66	HUBA SWITCH	02-4881	1
67	AIR PUMP	09-1518	1

Figure 22

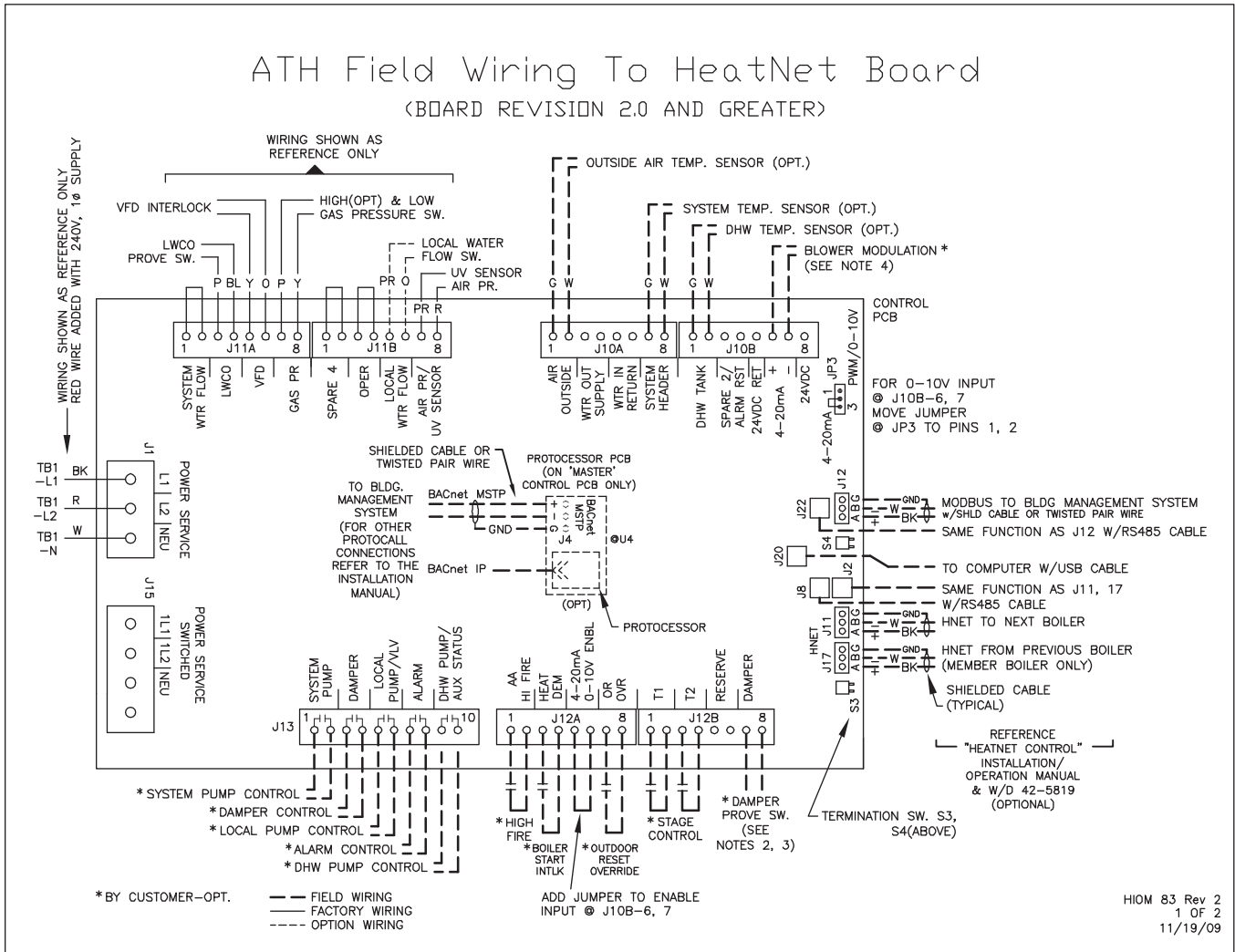
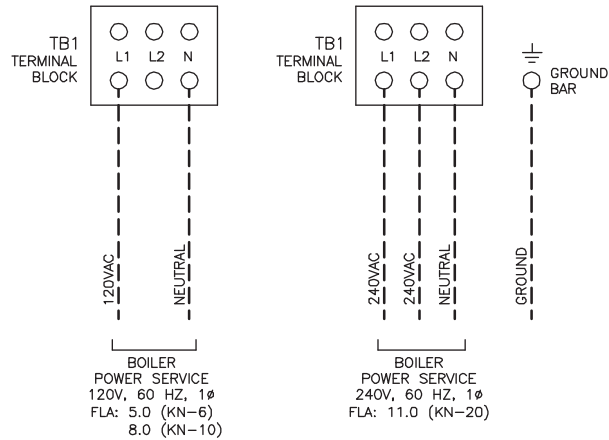


Figure 23

ATH HeatNet Field Wiring To Terminal Block

(BOARD REVISION 2.0 AND GREATER)



NOTES:

1. ---
2. FOR MULTIPLE BOILERS UTILIZING A SYSTEM AIR DAMPER WHEN IN A MASTER/MEMBER CONFIGURATION CONSULT THE FACTORY OR REFERENCE WIRING DIAGRAM 42-5819 SHEET 2 FOR WIRING CONNECTIONS.
3. FOR SINGLE BOILERS OR MULTIPLE BOILERS WITH INDIVIDUAL DAMPERS CONNECT THE END PROVING SWITCH TO CONNECTOR J12B-7 & 8. J13-4 & TB-NEUTRAL PROVIDE 120VAC POWER TO THE DAMPER MOTOR.
4. THERE ARE (2) METHODS IN WHICH A 4-20mA SIGNAL CAN BE USED TO CONTROL HEATNET EQUIPPED BOILERS:
 - METHOD 1: A 4-20mA SIGNAL CAN BE USED TO DIRECTLY MODULATE EACH BOILER FROM A REMOTE PANEL OR BUILDING MANAGEMENT SYSTEM. ON MULTIPLE BOILER INSTALLATIONS, THERE IS NO COMMUNICATION BETWEEN BOILERS, NO HEATNET SYSTEM SENSOR; THEREFORE NO MASTER/MEMBER RELATIONSHIP EXISTS. (USE MENU: SETUP: SETPOINTS: SETPOINT SOURCE: AUTO.)
 - METHOD 2: A 4-20mA SIGNAL CAN BE USED TO CHANGE THE SETPOINT TEMPERATURE THE HEATNET IS MAINTAINING. THIS CAN BE USED ON SINGLE OR ON MULTIPLE BOILERS WITH A MASTER/MEMBER RELATIONSHIP. (USE MENU: SETUP: SETPOINTS: SETPOINT SOURCE: 4-20, THEN SET THE PARAMETERS FOR THE TEMPERATURE AND BOILER START POINT.)

START-UP REPORT

HydroTherm®

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 STARTUP SEQUENCE

Note: Locate the AA terminals and minimum hold switch in the bottom-right of the electrical panel on the main HeatNet board. Also locate the manometer test manifold in the bottom of the electrical panel.

1. Disable any external call for heat and toggle the remote/local switch to REMOTE.
2. Toggle the LOW FIRE switch to cycle the boiler then hold at trial for pilot ignition.
3. Set pressure to 2.5–3.5" w.c. (flame signal should read 5.0 VDC).
4. Release boiler to main flame trial for ignition.
5. Check for stable flame.
6. Record combustion and elbow pressure at minimum firing rate.
7. Jumper the AA terminals to force 100% input.
8. Record combustion and elbow pressure.
9. Remove the AA jumper to place the boiler at minimum rate.
10. Make any final adjustments on low fire.
11. Check all combustion results using a calibrated flue gas analyzer.
12. Release the LOW FIRE switch to place boiler in standby.

NOTICE

In addition to completing the KN Series 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 (W.C.)	INCHES W.C.	INCHES W.C.
CO ₂	%	%
O ₂	%	%
CO (PPM)	PPM	PPM
NET STACK TEMPERATURE	°F	°F
AIR BOX DIFFERENTIAL (W.C.)	INCHES W.C.	INCHES W.C.

SAFETY TEST CHECKLIST

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

COMMISSIONING THE BOILER/WATER HEATER

<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>
---	--

ADDITIONAL NOTES AND COMMENTS

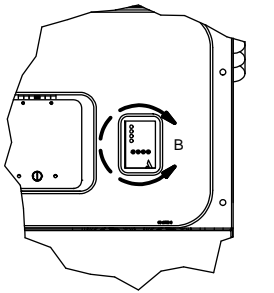
LENZE AC TECH DEFAULT SETTINGS FOR HYDROTHERM KN SERIES BOILERS

PARAMETER		KN-6		KN-10		KN-20		KN-30
#	NAME	NG	LPG	NG	LPG	NG	LPG	
01	Line Voltage	01	01	01	01	01	01	No VFD used see next page for blower in-line card adjustment
02*	Carrier Frequency	03	03	03	03	03	03	
03	Start Method	06	06	06	06	06	06	
04	Stop Method	01	01	01	01	01	01	
05	Standard Speed Source	03	03	03	03	03	03	
06	Relay Output	03	03	03	03	03	03	
10	TB-13A Function Select	01	01	01	01	01	01	
11	TB-13B Function Select	01	01	01	01	01	01	
12	TB-13E Input/Output/Other Functions	01	01	01	01	01	01	
14	Control	01	01	01	01	01	01	
16	Units Editing	02	02	02	02	02	02	
17	Rotation	01	01	01	01	01	01	
19*	Acceleration Time	20.0	20.0	20.0	20.0	20.0	20.0	
20*	Deceleration Time	20.0	20.0	20.0	20.0	20.0	20.0	
21	DC Brake Time	0	0	0	0	0	0	
22	DC Brake Voltage	0	0	0	0	0	0	
23	Minimum Frequency	0	0	0	0	0	0	
24	Maximum Frequency	150	150	150	150	180	180	
25	Current Limit	125	125	125	125	125	125	
26	Motor Overload	80.0	80.0	80.0	80.0	80.0	80.0	
27	Base Frequency	180	180	180	180	180	180	
28	Fixed Boost	1.0	1.0	1.0	1.0	1.0	1.0	
29	Accel Boost	0	0	0	0	0	0	
30	Slip Compensation	0	0	0	0	0	0	
31	Preset Speeds	0	0	0	0	0	0	
32		0	0	0	0	0	0	
33		0	0	0	0	0	0	
34		0	0	0	0	0	0	
35		0	0	0	0	0	0	
36		0	0	0	0	0	0	
37		0	0	0	0	0	0	
38	Skip Bandwidth	0	0	0	0	0	0	
39	Speed Scaling	0	0	0	0	0	0	
41	Fault Delay	0.5	0.5	0.5	0.5	0.5	0.5	
42	Accel/Decel #2	20.0	20.0	20.0	20.0	20.0	20.0	
43	SPD At Minimum Offset	1.9	1.9	1.9	1.9	1.9	1.9	
44	Password	523	523	523	523	523	523	
45*	Speed at Min Signal	25.0	25.0	30.0	30.0	32.5	33.8	
46*	Speed at Max Signal	176	185	198	193	240	216	
47	Clear History	01	01	01	01	01	01	
48	Program Selection	01	01	01	01	01	01	
50	Fault History	View Only						
51	Software Code							
52	DC Bus Voltage							
53	Motor Voltage							
54	Load							
55	0-10 VDC Input							
56	4-20 mA Input							
57	TB Strip Status							
58	Keypad Status							

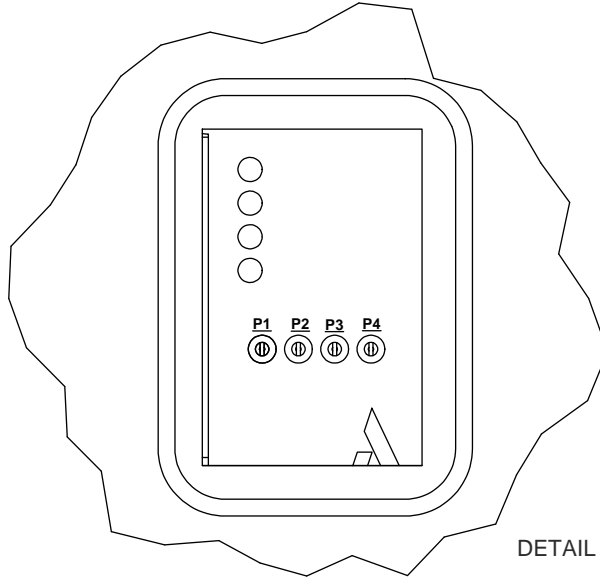
* These values can be adjusted in the field for precision tuning.

**KN-30 INLINE CARD
(BLOWER ADJUSTMENT)**

ADJUST IN HALF TURN INCREMENTS
UNTIL DESIRED RESULTS ARE REACHED



HIOM-097-REV. 0



DETAIL B

HIOM-097-REV. 0

- | | | | |
|---|--|--|--|
| <p>P1</p> <p>INCREASE Ⓢ DECREASE</p> <p>MIN
(LOW)</p> <p>INCREASE BTU INPUT - TURN
COUNTER CLOCKWISE</p> <p>DECREASE BTU INPUT - TURN
CLOCKWISE</p> | <p>P2</p> <p>INCREASE Ⓢ DECREASE</p> <p>MAX
(HI)</p> <p>INCREASE BTU INPUT - TURN
COUNTER CLOCKWISE</p> <p>DECREASE BTU INPUT - TURN
CLOCKWISE</p> | <p>P3</p> <p>DECREASE Ⓢ INCREASE</p> <p>ACCELERATE
(RAMP UP)</p> <p>INCREASE RAMP SPEED - TURN
CLOCKWISE</p> <p>DECREASE RAMP SPEED - TURN
COUNTER CLOCKWISE</p> | <p>P4</p> <p>INCREASE Ⓢ DECREASE</p> <p>DECELERATE
(RAMP DOWN)</p> <p>INCREASE RAMP SPEED - TURN COUNTER
CLOCKWISE</p> <p>DECREASE RAMP SPEED - TURN
CLOCKWISE</p> |
|---|--|--|--|

NOTICE!

Commonwealth of Massachusetts Installation Requirements

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

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.
 - a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
 - b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".
4. **INSPECTION.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

WARNING: Improper venting can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

NOTICE!

Commonwealth of Massachusetts Installation Requirements

In the Commonwealth of Massachusetts, the installation must be performed by a licensed plumber or gas fitter.

(b) Exemptions

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

1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.

When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and
2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.

When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

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

WARNING: Improper venting can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

Hydrotherm 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 ("Product") 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 which ever 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.

Five-Year Warranty

The manufacturer further warrants to the original owner at the original installation site that the products Heat Exchanger (Cast Iron Block) will be free from defects in material and workmanship for five (5) years 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 Heat Exchanger of the product, which is shown to be defective.

Ten Year Warranty

The manufacturer further warrants to the original owner at the original installation site the products Heat Exchanger (Cast Iron Block) will be free from defects in material or workmanship for Ten (10) years from the date of shipment from the factory. If upon examination by the manufacturer the Heat Exchanger is shown to have a defect in material or workmanship during the warranty period, the manufacturer will replace the Heat Exchanger upon payment of a percentage of the manufacturer's trade price in effect at the time of the claim prorated to the year in which the claim is made, as show below.

Replacement Cost Schedule

Year of Claim	6	7	8	9	10
% Of trade price at the time of claim charged to the consumer	55	60	65	70	75

Twenty-One Year Thermal Shock Warranty

The manufacturer further warrants to the original owner at the original installation site that the products (Cast Iron Sections) will be warranted for twenty-one (21) years against thermal shock when the boiler is installed as a closed loop hot water boiler. This warranty will cover damage due to thermal shock, such as leaks to the cast iron sections from cracks from thermal shock. This warranty does not cover damage due to corrosion, scaling, sooting or to improper installation or operation the inlet and outlet water temperature differential across the boiler cannot exceed 100 degrees F.

Water quality is important. As per ASME recommendations, dissolved solids must be less than 200 ppm. Also, PH levels must be in the 6.5-11 range. Failure to follow these guidelines will void the warranty.

This Limited Warranty does not Apply:

- (a) 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.
- (b) To any expenses, including labor or material, incurred during the removal or reinstallation of the product or parts thereof.
- (c) To products which were not installed and or serviced by a qualified contractor and or serviceman.
- (d) 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.
- (e) 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.

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