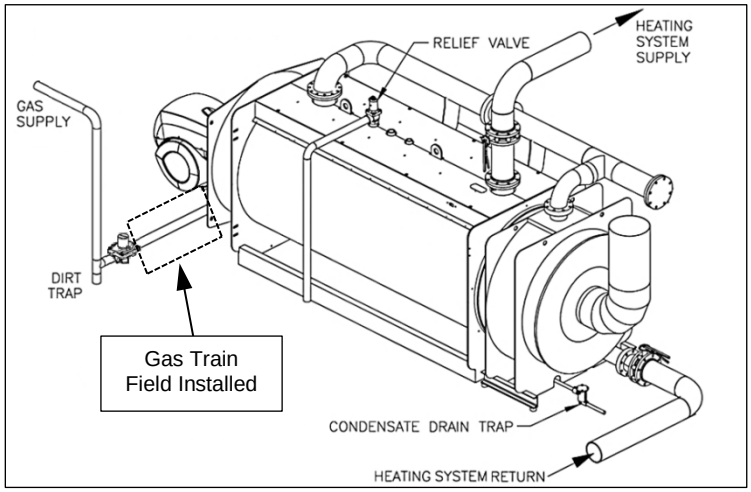
AERCO A WATTS Brand

TECHNICAL APPLICATION GUIDE

GAS & #2 FUEL OIL SUPPLY DESIGN GUIDE

MFC Series Boilers

Multi-Fuel, Condensing Boilers



This document provides Fuel Components, Pressure, Piping, and Venting for MFC Series boilers.

Applies to MFC Series Models:

- MFC 3000
- MFC 4000
- MFC 5000
- MFC 6000
- MFC 8000
- MFC 10000

Latest Update: 2/28/2018

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SECTION 1: GENERAL

AERCO Multi-Fuel Condensing (MFC) Gas and Gas/Oil fired boilers are capable of modulating firing rate when used on gaseous fuels and staged firing when on #2 Fuel Oil. Proper supply of both fuels is required to ensure proper operation of the equipment including firing rate and clean efficient combustion. Designers and Installers must adhere to the AERCO specifications and those of local authorities having jurisdiction. A thorough understanding of these guidelines is required for the successful design and installation of MFC Series Boilers.

SECTION 2: GAS TRAIN

2.1 Gas Train Components

AERCO MFC series of boilers can come equipped with gas and multi-fuel burners supplied by Riello. The burners are UL approved and are available with FM or double-block and bleed (DBB) gas trains. The gas train components were carefully selected in order to operate efficiently by closely controlling the fuel/air ratio throughout the firing range. These components include:

- **Safety Shut off Valves** – The gas train consists of 2 safety shut-off valves piped in series. The first shut-off valve is an electro-hydraulic valve that functions to completely open the valve when power is applied and to completely shut-off the gas flow when electrical power is not present. The second actuator is also an electro-hydraulic actuator which is also used to regulate the pressure to the burner through the adjustment of a regulating spring. This regulating SSOV actuator regulates the amount of gas going through the device when powered and provides a complete seal to prevent gas from flowing when unpowered. Depending upon code requirements, these actuators may contain a proof of closure circuit. The position of both of the actuators can be seen when looking through the visible window on the SSOV actuators.

- **Pressure Switches** – Gas trains come equipped with two gas pressure switches. The first is a low gas pressure switch which is located on the incoming side of the SSOV's and shuts the burner down if the pressure in the gas line is lower than required. The second is a high gas pressure switch and can be found on the outlet side of the SSOV's and is used to shut the burner down if the gas pressure coming out of the SSOV's is too high.

- **Pilot Valve Train** – The pilot gas train consists of a pilot regulator and 2 solenoid valves piped in series. These valves are designed to be completely opened when powered and to prevent any flow when the valves are in an unpowered state. The regulator on the pilot valve train is used to adjust the amount of gas to the pilot gas ignition assembly found within the burner.

- **Gas Modulating Valve** – The gas modulating valve is found after the SSOv's, but before the gas goes into the burner head assembly. The modulating valve is directly connected to a motorized actuator controlled by the flame safeguard. This assembly can turn up to 90 degrees to control the amount of gas going into the burner and is used to adjust the actual firing rate of the burner.

2.2 Gas Pressure Requirements

AERCO MFC boiler with Riello burner requires a stable gas and propane input. A low gas pressure switch prevents the unit from operation when sufficient gas pressure is not present. The allowable inlet gas pressure when firing at the maximum capacity for each boiler is found below:

TABLE 1: Allowable Gas Inlet Pressure Gas Burners (RS)

Model	NATURAL GAS		PROPANE	
	Minimum	Maximum	Minimum	Maximum
MFC 3000 RS68	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 4000 RS120	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 5000 RS160	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 6000 RS160	1 P.S.I.	2 P.S.I.	2 P.S.I.	5 P.S.I.
MFC 8000 RS300	1 P.S.I.	2 P.S.I.	2 P.S.I.	5 P.S.I.
MFC 10000 RS300 (1 to 2 P.S.I.)	1 P.S.I.	2 P.S.I.	Not Available	Not Available
MFC 10000 RS300 (2 to 5 P.S.I.)	2 P.S.I.	5 P.S.I.	2 P.S.I.	5 P.S.I.

TABLE 2: Allowable Gas Inlet Pressure Multi-Fuel Burners (RLS)

Model	NATURAL GAS		PROPANE	
	Minimum	Maximum	Minimum	Maximum
MFC 3000 RLS120	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 4000 RLS160	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 5000 RLS160	14" W.C.	1 P.S.I.	1 P.S.I.	2 P.S.I.
MFC 6000 RLS 160	1 P.S.I.	2 P.S.I.	2 P.S.I.	5 P.S.I.
MFC 8000 RLS 300	1 P.S.I.	2 P.S.I.	2 P.S.I.	5 P.S.I.
MFC 10000 RLS 300 (1 to 2 P.S.I.)	1 P.S.I.	2 P.S.I.	Not Available	Not Available
MFC 10000 RLS 300 (2 to 5 P.S.I.)	2 P.S.I.	5 P.S.I.	2 P.S.I.	5 P.S.I.

NOTE:
Some burners can be supplied for areas requiring lower gas pressures. Please consult the factory for applications with low gas pressure requirements.

Gas pressure should be measured when the unit is operating (firing) at the maximum the boiler will be firing. Measure the gas pressure with a manometer at the Gas Head manometer port/screw by loosening the sampling screw within the head screw. In a multiple boiler installation, gas pressure should initially be set for single boiler operation, and then the remaining boilers should be staged on at full fire, to insure gas pressures never fall below the supply gas pressure when the single unit was firing.

An external regulator must be installed at each MFC boiler, as shown in Diagram 1, below. For installations that have greater than 14.0" W.C. supply pressure, an external lock-up type regulator must be installed. The lock-up type regulator(s) must be sized as follows:

TABLE 3: Lock-Up Regulator Sizing

BOILER SIZE (MBH)	REQUIRED CFH	BOILER SIZE (MBH)	REQUIRED CFH
3000	3000 - 3400	6000	6000 - 6500
4000	4000 - 4500	8000	8000 - 8750
5000	5000 - 5500	10000	2300 – 10000 - 11000

External gas regulators are self-contained with tapped diaphragm vent ports allowing the diaphragm to change its position as required. These vents typically require piping to the outside. For details, see section 2.8 Venting of Gas Supply Regulators, below. The SSOV/Regulator supplied with the burner does not require any vent piping.

CAUTION!

AERCO boilers must be isolated from the system when leak testing.

Drip legs are required at the gas supply of each boiler to prevent any dirt, weld slag, or debris from entering the burner gas train inlet pipe. When multiple boilers are installed, some utilities and local codes require a full size drip leg on the main gas supply line in addition to the drip leg at each unit. The bottom of the gas drip leg(s) should be removable without disassembling any gas piping. The weight of the gas pipe must not be supported from the bottom of the drip leg. The drip leg(s) **MAY NOT** be used to support any part of the gas piping.

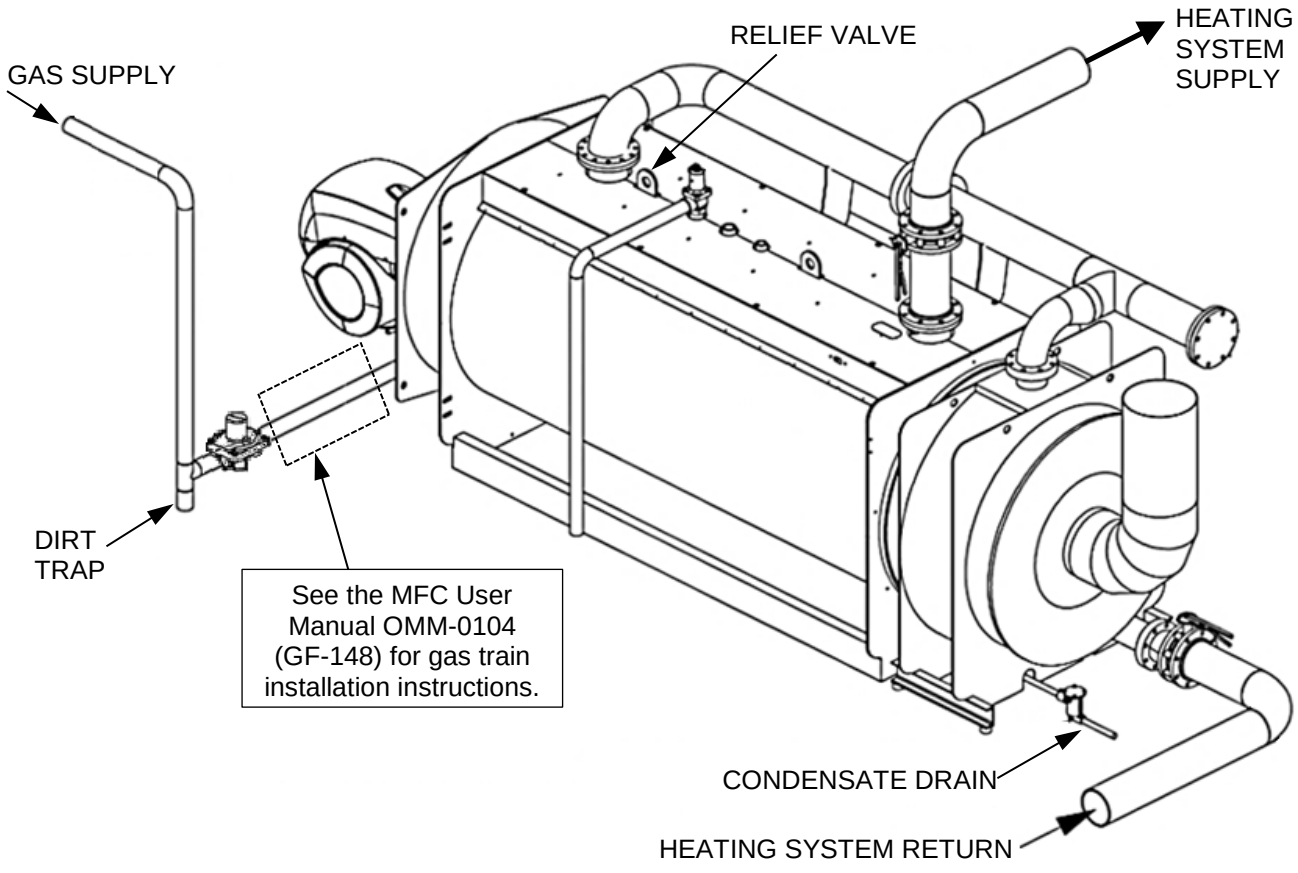


Diagram 1: Single Boiler Gas Pipe Connections (MFC 10000 Shown)

NOTE:

See Table 1 and 2 for minimum gas pressure requirements.

2.3 Custom Gas Trains

Some utilities, insurance carriers, and industrial customers have special requirement gas components on high input devices that are beyond what is normally supplied with AERCO boilers. Secondary shutoffs, high or low pressure operators, and external regulators are typical of the requirements of gas utilities. It is mandatory that a designer or installer comply with these requirements. AERCO assumes no liability when these requirements are not satisfied for any location or installation. Contact your local gas utility for their specific requirements before installing AERCO equipment.

The minimum gas inlet pressure requirements for natural gas (N.G.) and propane (LPG) are as follows:

TABLE 4: Minimum Gas Inlet Pressure Requirements For Natural Gas (N.G.) And Propane (LPG)

	MFC 3000		MFC 4000		MFC 5000		MFC 6000		MFC 8000		MFC 10000	
Gas Train	**N.G.**	**LPG**	**N.G.**	**LPG**	**N.G.**	**LPG**	**N.G.**	**LPG**	**N.G.**	**LPG**	**N.G.**	**LPG**
Double Block	14" W.C.	1 PSI	14" W.C.	1 PSI	14" W.C.	1 PSI	1 PSI	2 PSI	1 PSI	2 PSI	1 PSI	2 PSI

2.4 Gas Piping

All gas piping and components must comply with NFPA local codes, and utility requirements at a minimum. Only gas approved fittings, valves, or pipe should be utilized.

Standard industry practice for gas piping is Schedule 40 iron pipe and fittings. All high and low gas pressure piping systems must comply with local utility and building codes.

Assembled piping should be clean of all debris, pipe chips, or foreign material to prevent any from entering the gas train. Piping should be tested as prescribed in NFPA 54. Equipment should be isolated before testing any piping system over the allowable pressure. ***DO NOT EXCEED 5 P.S.I.*** on the inlet side of the burner gas train.

2.5 Gas Supply Main Sizing

Gas pipe sizing from the utility to the burner, for either a single or multiple boiler installation, shall be sized for a **maximum pressure drop of 0.3" W.C., from the source to the final boiler**. The maximum gas flow rate required is the sum of the maximum inputs of each unit divided by the heat of combustion of the fuel supplied at the location, (approximately 1,030 BTU per cubic foot for natural gas or 2,520 BTU per cubic foot for propane gas). The fuel supplier or utility should be consulted to confirm that sufficient volume and normal pressure is provided to the building at the discharge side of the gas meter or supply pipe. For existing installations with gas equipment, gas pressure should be measured with a manometer to be certain sufficient pressure is available. Before sizing gas piping, a survey of all connected gas devices should be made. Gas piping supplying more than one gas device must be able to handle the total connected input within the allowable gas pressure drop. The allowable minimum and maximum gas pressure for each device should be considered. Whenever the minimum and maximum gas pressures vary between devices, gas pressure regulators at each unit should be installed to allow regulation at any individual unit. Gas pressure to each device must never exceed the maximum allowable rating of the device.

The total length of gas piping as well as fitting pressure drop must be considered when sizing the gas piping. Total equivalent length should be calculated from the meter or source location to the last boiler connected on the header. The values in the Gas Piping Tables 5, 6 and 7 (in section

7, below), which contain data extracted from NFPA 54, should be used as *a minimum guideline*. Gas pipe size should be selected on the total *equivalent* length from the appropriate pressure table. The gas volume for cfh flow will be the input divided by the calorific value of the fuel to be supplied.

2.6 Gas Header Sizing

Main supply gas pipe sizing should be developed for the total plant. Boiler gas manifold piping should be sized based on the volume requirements and lengths between boilers and the fuel main. Header sizes can be either full size or stepped in size as units are connected. A typical gas piping header diagram for a 3-Module MFC Boiler Plant is illustrated in Diagram 2.

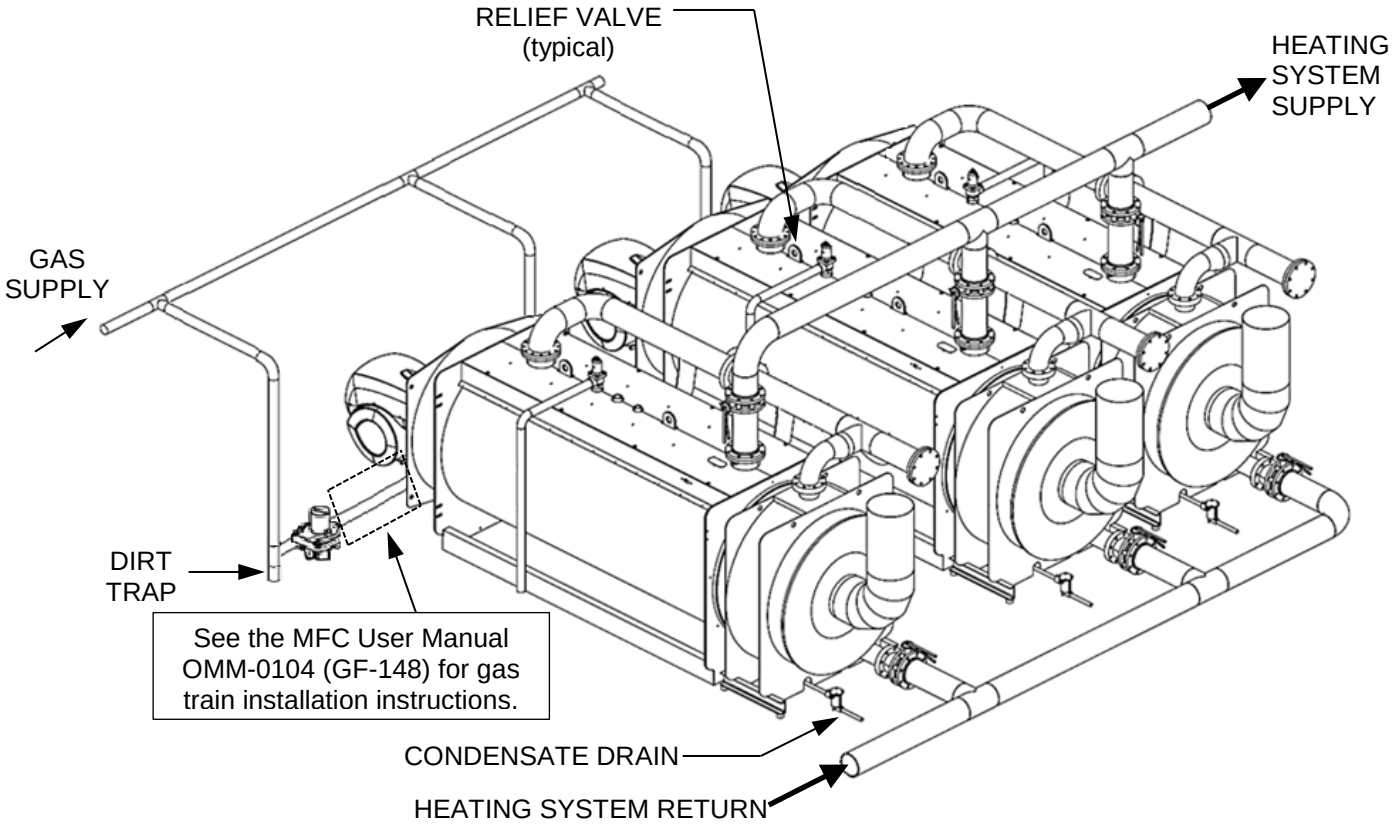


Diagram 2: Typical Multiple Boiler Manifold Construction

NOTE:
See Table 1 and 2 for minimum gas pressure requirements.

Based on Table 5 on the following page for natural gas, 0.6 specific gravity, 1,000 cfh/unit, actual header sizes will vary with length of pipe run and fittings employed. For propane gas (1.6 specific gravity, 2,520 BTU/FT3) header sizing, consult NFPA 54.

If the use of a regulator is necessary, an appropriate sized lock-up style regulator is to be supplied to bring the pressure to the appropriate operating pressure. Gas header should be located above or behind boiler. Gas piping should not be installed directly over top or front of any part of boiler. Sufficient clearances for maintenance are required.

2.7 Gas Piping Tables

The data in the following pipe and vent sizing tables have been extracted from the National Fire Protection Association Article 54 (NFPA 54).

TABLE 5: Maximum Capacity of Pipe in Cubic Feet

of Gas per Hour for Gas Pressures of 0.5 psi or Less and a Pressure Drop of 0.3 inch Water Column

Nominal Iron Pipe Size (Inches)	Internal Diameter (Inches)	TOTAL EQUIVALENT LENGTH OF PIPE (FEET)												
		10	20	30	40	50	60	70	80	90	125	150	175	200
2.00	2.067	3,050	2,100	1,650	1,450	1,270	1,150	1,050	990	930	780	710	650	610
2.50	2.469	4,800	3,300	2,700	2,300	2,000	1,850	1,700	1,600	1,500	1,250	1,130	1,050	980
3.00	3.068	8,500	5,900	4,700	4,100	3,600	3,250	3,000	2,800	2,600	2,200	2,000	1,850	1,700
4.00	4.026	17,500	12,000	9,700	8,300	7,400	6,800	6,200	5,800	5,400	4,500	4,100	3,800	3,500

TABLE 6: Pipe Sizing Table for 1 Pound Pressure Capacity of Pipes

of Different Diameters and Lengths in Cubic Feet per Hour for an Initial Pressure of 1.0 psi with a 10% Pressure Drop and a Gas of 0.6 Specific Gravity

Pipe Size of Schedule 40 Standard Pipe (Inches)	Internal Diameter (Inches)	TOTAL EQUIVALENT LENGTH OF PIPE (FEET)							
		50	100	150	200	250	300	400	500
2.00	2.067	4245	2918	2343	2005	1777	1610	1378	1222
2.50	2.469	6766	4651	3735	3196	2833	2567	2197	1947
3.00	3.068	11962	8221	6602	5650	5008	4538	3884	3442
3.50	3.548	17514	12037	9666	8273	7332	6644	5686	5039
4.00	4.026	24398	16769	13466	11525	10214	9255	7921	7020
5.00	5.047	44140	30337	24362	20851	18479	16744	14330	12701
6.00	6.065	71473	49123	39447	33762	29923	27112	23204	20566
8.00	7.981	146849	100929	81049	69368	61479	55705	47676	42254

TABLE 7: Pipe Sizing Table for 2 Pounds Pressure Capacity of Pipes

of Different Diameters and Lengths in Cubic Feet per Hour for an Initial Pressure of 2.0 psi with a 10% Pressure Drop and a Gas of 0.6 Specific Gravity

Pipe Size of Schedule 40 Standard Pipe (Inches)	Internal Diameter (Inches)	TOTAL EQUIVALENT LENGTH OF PIPE (FEET)							
		50	100	150	200	250	300	400	500
2.00	2.067	6589	4528	3636	3112	2758	2499	2139	1896
2.50	2.469	10501	7217	5796	4961	4396	3983	3409	3022
3.00	3.068	18564	12759	10246	8769	7772	7042	6027	5342
3.50	3.548	27181	18681	15002	12840	11379	10311	8825	7821
4.00	4.026	37865	26025	20899	17887	15853	14364	12293	10895
5.00	5.047	68504	47082	37809	32359	28680	25986	22240	19711
6.00	6.065	110924	76237	61221	52397	46439	42077	36012	31917

TABLE 8: Pipe Sizing Table for 5 Pounds Pressure Capacity of Pipes									
of Different Diameters and Lengths in Cubic Feet per Hour for an Initial Pressure of 5.0 psi with a 10% Pressure Drop and a Gas of 0.6 Specific Gravity									
Pipe Size of Schedule 40 Standard Pipe (Inches)	**Internal Diameter (Inches)**	**TOTAL EQUIVALENT LENGTH OF PIPE (FEET)**							
		50	**100**	**150**	**200**	**250**	**300**	**400**	**500**
2.00	2.067	11786	8101	6505	5567	4934	4471	3827	3391
2.50	2.469	18785	12911	10368	8874	7865	7126	6099	5405
3.00	3.068	33209	22824	18329	15687	13903	12597	10782	9556
3.50	3.548	48623	33418	26836	22968	20365	18444	15786	13991
4.00	4.026	67736	46555	37385	31997	28358	25694	21991	19490
5.00	5.047	122544	84224	67635	57887	51304	46485	39785	35261
6.00	6.065	198427	136378	109516	93732	83073	75270	64421	57095

2.8 Venting of Gas Supply Regulators

AERCO's general guidelines for venting of gas regulators are listed below. AERCO recommends that these guidelines be followed to ensure the most reliable and proper operation of AERCO gas fired equipment. It is also recommended that you consult local codes and the gas regulator manufacturer for additional details. Always follow the most stringent guidelines available, including those listed below.

- When venting a gas supply regulator, the vent pipe must be no smaller than the regulator vent size.
- In a multiple unit installation, each regulator must have a separate vent line.
- Vent lines must not be manifolded together or with any other equipment at the site that also requires atmospheric vents.
- When sizing the vent, pipe diameters must be increased by one pipe diameter every 20 equivalent feet of pipe.

Each 90° elbow is equivalent to approximately:

⇒ 2.5 feet for nominal pipe sizes of up to 3/4"

⇒ 4.5 feet for nominal pipe sizes of up to 1-1/2"

⇒ 10.5 feet for nominal pipe sizes of up to 4"

Each 45° elbow is equivalent to approximately:

⇒ 1 foot for nominal pipe sizes of up to 3/4"

⇒ 2 feet for nominal pipe sizes of up to 1-1/2"

⇒ 5 feet for nominal pipe sizes of up to 4"

2.9 Multiple Unit Installations

The following points apply to sites that have multiple MFC units installed:

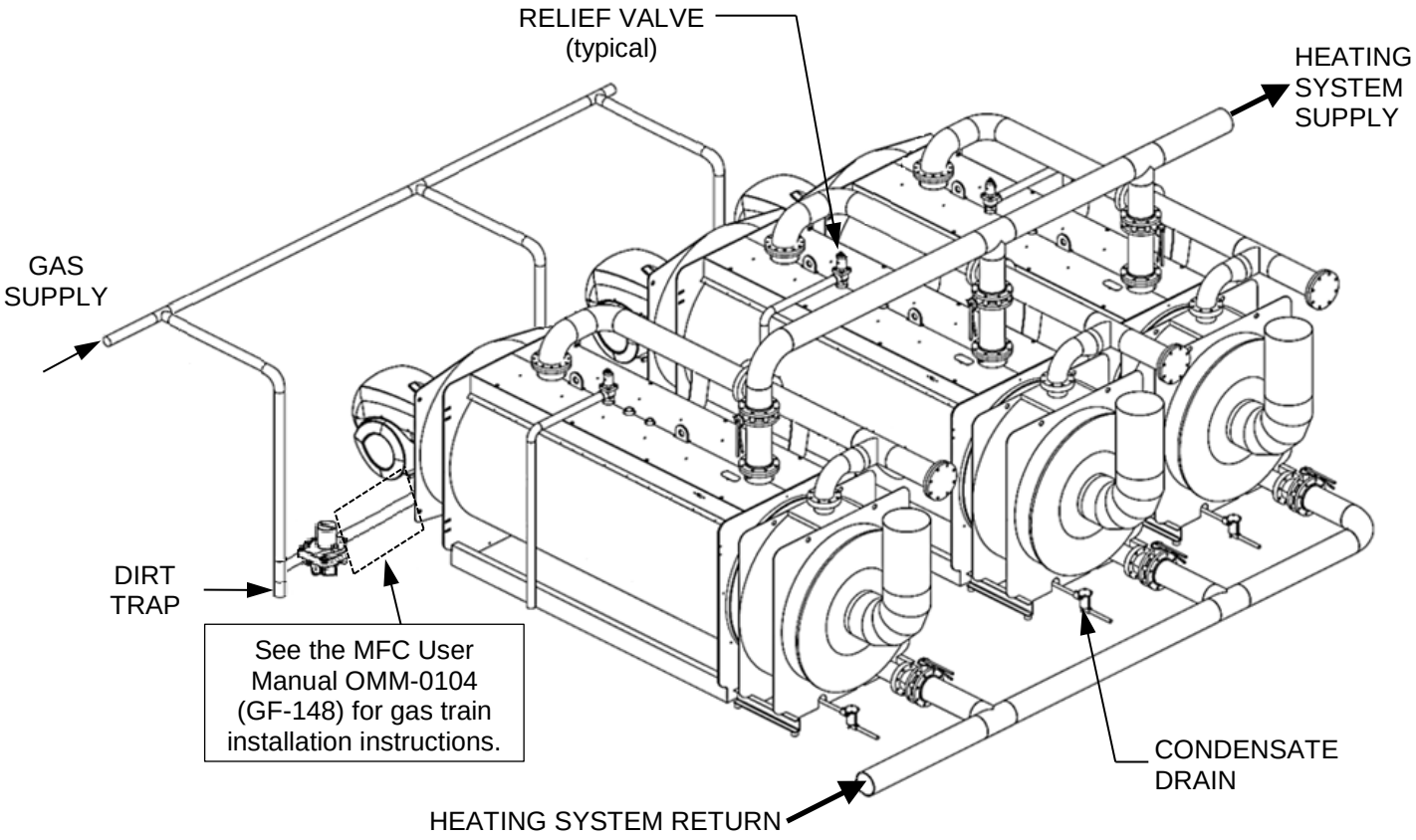


Diagram 3: Multiple Boiler Gas Pipe Connections Guidelines

NOTE:
See Table 1 and 2 for minimum gas pressure requirements.

The following are AERCO's recommendations for installation of gas pressure regulator, unless superseded by state and local codes and the regulator manufacturer's specifications:

- Horizontal installation of gas pressure regulators is recommended unless stated otherwise by the regulator manufacturer. Consult the manufacturer for additional recommendations and installation options.
- For MFC units, when installed horizontally, the recommended distance between the gas pressure regulator and the nearest pipe fitting, elbow or valve is **5 to 10 pipe diameters**.
- When pipe size reduction is required, use only bell reducers.

SECTION 3: OIL TRAIN

Refer to NFPA 31: "Standard for the Installation of Oil-Burning Equipment" and local codes for specific requirements in your area.

3.1 Oil Train Components (2 Stage)

AERCO MFC series of boilers can come equipped with multi-fuel (gas/oil) burners supplied by Riello. The burners are UL approved and comes with a complete burner side oil delivery system. The oil supply components were carefully selected in order to operate efficiently by closely controlling the fuel/air ratio throughout the firing range. These components include:

- **Fuel Pump** – The fuel oil train system consists of a pump which brings in fuel oil at a low pressure (less than 10 PSI for the burners supplied with the MFC 3000 and 75 PSI for all other burners) and pressurizes the oil up to 290 PSI to atomize the oil for proper combustion. The fuel pump is directly connected to a motor that is separate from the fan motor and is only in use when the burner is set to fire on oil. The pump has a built in regulator to adjust the pressure throughout the pump range. It is important to set the pump pressure properly, because varying the pressure changes the flow rate to the nozzle, and thus changes the firing rate.
- **Solenoid Valves** – There are three solenoid valves located on the oil train of the burner after the pump. Two of these solenoids are piped in parallel and the third is piped in series between the pump and the second two solenoids. The first solenoid acts as a double blocking solenoid when no heat is required on the oil system. The remaining two solenoids are enacted separately and control the flow of oil to either the stage 1 or stage 2 nozzle.
- **Oil Nozzle** – The oil nozzles are located on the drawer assembly of the burner. The nozzles are sized so as to provide the correct flow rate for stage 1 and stage 2 firing, Many times these nozzles are sized the same giving you a 2:1 turndown. The nozzles are marked with a flow rate, spray angle and spray pattern from the manufacturer. It is important to replace the nozzles with nozzles of the same specification as different nozzles can affect the properties of combustion.
- **Low Oil Pressure Switch** – The low pressure oil switch is located on the pressure side of the pump prior to any oil solenoid valve. This switch is used to prove that oil is being pressurized and is ready for delivery to the oil nozzles.

3.2 Oil Pressure Requirements

AERCO MFC boiler, with Riello burner, requires a steady supply of oil to the burner.

The pump is designed to provide a limited amount of suction of the oil line. The maximum suction that the pump can be subjected to is 13" Hg. Going beyond this limit can damage internal components as well as cause cavitation in the pump. This type of design is seen in Diagram 4, part B below.

Double-pipe circuit

The burner is equipped with a self-priming pump which is capable of feeding itself within the limits listed in the table at the side.

The tank higher than the burner A

Distance "P" must not exceed 33 ft in order to avoid subjecting the pump's seal to excessive strain; distance "V" must not exceed 13 ft in order to permit pump self-priming even when the tank is almost completely empty.

The tank lower than the burner B

Pump suction values higher than 13 ft must not be exceeded because at higher levels gas is released from the fuel, the pump starts making noise and its working life-span decreases.
It is good practice to ensure that the return and suction lines enter the burner from the same height; in this way it will be less probable that the suction line fails to prime or stops priming.

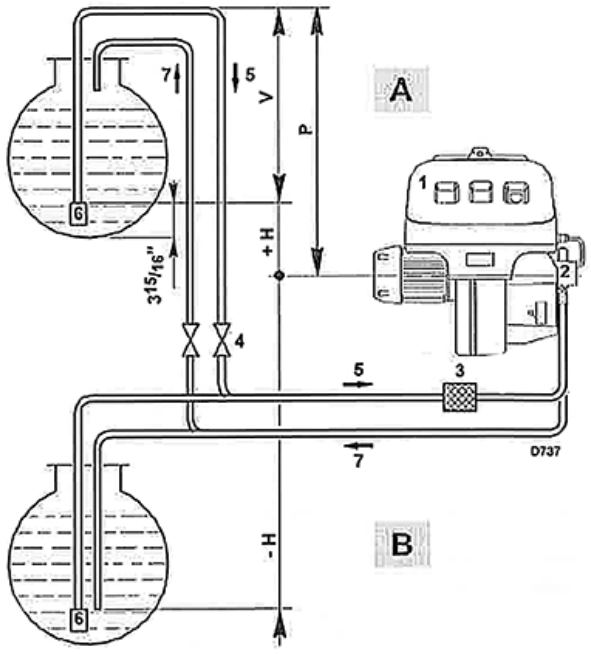
The loop circuit

A loop circuit consists of a loop of piping exiting and returning to the tank with an auxiliary pump that circulates the fuel under pressure.

A branch connection from the loop goes to feed the burner.

This circuit is extremely useful whenever the burner pump does not succeed in self-priming because the tank distance and/or height difference are higher than the values listed in the table below.

+ H - H (ft)	L (ft) Ø (inch) 1/2"	 5/8"
+ 13	197	263
+ 10	164	230
+ 6.6	132	197
+ 4.8	115	181
+ 3.3	99	164
+ 1.6	82	148
0	66	132
- 1.6	59	115
- 3.3	49	99
- 4.8	43	82
- 6.6	33	66
- 10	16	33
- 13	-	20



H Pump/foot valve height difference
L Piping length
Ø Inside pipe diameter
1 Burner
2 Pump
3 Filter
4 Manual on/off valve
5 Suction line
6 Foot valve
7 Return line
V Max distance 13 ft

Diagram 4: Oil Fuel Supply Design and Function

The pump can be used on supply lines that are pressurized. The maximum pressure the pump inlet can be subjected to is 10 PSI for the burners supplied with the MFC 3000 and 75 PSI for all other burners. Going beyond this limit can damage internal components and could blow the pump seals which can cause the oil to leak. Pressurized lines can be found when the tanks are located above the burner. This type of design can be seen in Diagram 4, Part A, above. Pressurized lines can also be found on systems which use a separate pump set to run oil in to the building. This is usually done in cases where there will be long runs of pipe which the suction of the burner pump cannot overcome.

3.3 Custom Oil Trains

Some utilities, insurance carriers, and industrial customers have special requirement of oil components that are beyond what is normally supplied with AERCO boilers. It is mandatory that a designer or installer comply with these requirements. AERCO assumes no liability when these requirements are not satisfied for any location or installation. Contact your local code enforcement agencies for their specific requirements before installing AERCO equipment.

3.4 Oil Supply Sizing

Oil pipe sizing for a single boiler or a multiple boiler installation shall be sized for the maximum flow rate of the unit(s). It is required that burners are install in a two-pipe configuration. By installing the oil piping in this way, the maximum flow of oil will exceed the burner flow rate.

Before sizing oil piping, a survey of all connected oil devices should be made and the pump size and oil connection method (1-pipe or 2-pipe) should be noted. Once this is determined, the pump manufacturer should be consulted to determine maximum flow rates for pumps in 2 pipe systems and the oil flow rate input to the unit can be used for any appliance utilizing a 1-pipe system. There is approximately 140,000 BTU's per gallon of oil.

TABLE 9: Burner Pump Capabilities

MFC Model	MAX FLOW RATE (Gal. Per Hour)		MAX PRESSURE (P.S.I.)		MAX INLET SUCTION	
	SUPPLY	RETURN	INLET	RETURN	PSI	IN HG
3000	115	95	10	10	6.5	13
4000	150	125	75	75	6.5	13
5000	150	125	75	75	6.5	13
6000	150	125	75	75	6.5	13
8000	225	170	75	75	6.5	13
10000	225	170	75	75	6.5	13

For applications that will utilize an oil distribution system, safety devices must be installed so that the burner cannot fire unless the distribution pump is energized. Care should also be taken to insure that the pressure to the individual units pump is not greater than recommended by the pump manufacturer, use of a pressure reducing valve or other device may be necessary to decrease the pressure to within the allowable inlet range of the burner pump.

Main oil pipe sizing should be developed for the total plant. Oil piping sizing is determined by the maximum flow rate of the system. The table below indicates maximum flow rates for Black Iron and Copper Tubing. Other materials may be able to be used as long as the materials selected are approved for use with #2 Fuel Oil. Material selection needs to be determined based upon pressures and flow rate of the oil distribution system.

TABLE 10: Maximum Flow Rates for Black Iron and Copper Tubing

PIPE SIZE	MAXIMUM FLOW RATE GPH	
	BLACK IRON	COPPER TUBE
3/8"	103	103
1/2"	184	184
3/4"	410	
1"	730	
1-1/4"	1145	
1-1/2"	1650	
2"	2925	

NOTE: This table assumes a maximum velocity of 5 ft./sec.

Change Log:

Date	Description	Changed by
02/08/2016	**Rev C**: Removed AHRI pending cert., replaced with new AERCO logos, and reformatted cover, headers, and footers to match manuals	Curtis Harvey
2/28/2018	**Rev D**: **DIR 17-004**: Updated burner model numbers for Riello burners, updated minimum and maximum gas pressures (Table 1 & 2), moved gas regulator in Figures 1-3 & added not to look in Section 3.13 Gas Train Installation of OMM-0104, GF-148 for gas train installation instructions. **DIR 17-069**: Reformatted per current standard.	Chris Blair