Gas Fuel System

The generator set will operate on either natural gas or LP fuel in a gaseous state. Manual shutoff valves and primary regulators are installed by the fuel supplier.

A secondary regulator and 12VDC solenoid valve are located in the front inlet air compartment. The solenoid valve is energized from the controller to open at start and deenergize at shutdown. A 1/2 in. NPT inlet is provided. See Figure 1.

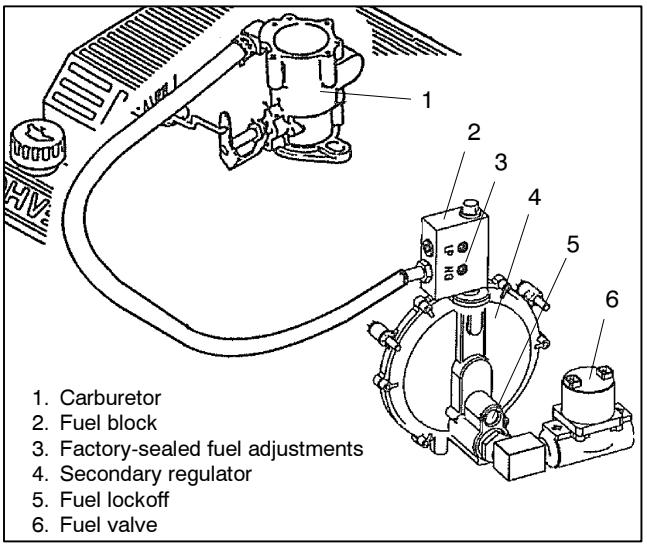

Figure 1 Gas Fuel System

Inlet gas pressure to the regulator should not exceed 6 oz (11 in. water column). The regulator controls the pressure on engine demand. A plug is provided at the regulator input for installation of a gauge or manometer if a pressure check is required. A fuel lockoff, also located in the regulator, prevents fuel flow when the engine is not operating. This is adjusted at the factory and should not be used in an attempt to adjust fuel mixture or engine speed.

The fuel system uses a fuel block that allows the use of either natural gas or LP fuel. Fuel changeover is completed by switching inlet ports and, if necessary, changing the ignition timing connection. The fuel block adjustments are factory-set for optimum engine performance with both natural gas and LP fuel. The adjustment screws are sealed at the factory and should not be modified.

Natural Gas System

Natural gas is supplied from the utility in a vapor state. The utility supplying the natural gas is responsible for the primary regulator for the natural gas system.

The heating value of natural gas should be 1000 Btu/cubic foot. When heating content falls below 1000 Btu, the generator set will not produce rated power and will need to be derated. Always check the specification sheet for the rating of the generator set while running on natural gas. Many applications require derating of the full load power on natural gas.

When installing or troubleshooting the fuel system, consider the following factors:

1. Pressure loss due to the length of pipe.
2. Pressure loss due to other appliances on the same fuel supply.
3. Pressure loss due to the number of fittings or elbows.

Measured pressure at the inlet to the secondary regulator should be 4–6 oz./sq. in. or 7–11 in. water column.

Physical Property @ 15°C (60°F)	Natural Gas
Normal atmospheric state	Gas
Boiling point, end, °C (°F)	-162 (-259)
Heating value, Btu/ gal. (net—LVH) ft.^{3} (gas)	63310 1000
Density, ft.^{3} gas/gal. (liquid)	57.75
Weight/gal. liquid, lb.	2.65
Octane number: Research	 110+

Figure 2 Natural Gas Properties

LP Gas System

LP gas is supplied as a liquid in pressure tanks, which makes it easily adaptable to stationary generator set applications where complete independence of a fuel source is required.

LP gas is propane, butane, or a mixture of the two gases. The ratio of butane to propane is especially important when an outdoor tank is used. LP gas suppliers may supply the tank in warm summer months with a mixture composed mostly of butane. This mixture may work well in summer but may not provide sufficient vaporized pressure at cold temperatures (below 32°F) to start and run the engine. Check with your LP gas supplier for mixture content when hard starting symptoms exist.

The heating value for propane is 2516 Btu/cu. ft. with a boiling point of -44°F and butane is 3264 Btu/cu. ft. with a boiling point of 32°F. See Figure 3. Inlet pressure into the secondary regulator should be 4-6 oz./sq. in. or 7-11 in. water column.

Physical Property @ 15°C (60°F)	Butane	Propane
Normal atmospheric state	Gas	Gas
Boiling point, initial/end, °C (°F)	0 (32)	-42 (-44)
Heating value, Btu/ gal. (net—LVH) gal. (gross) ft.^{3} (gas)	 94670 102032 3264	 83340 91547 2516
Density, ft.^{3} gas/gal. (liquid)	31.26	36.39
Weight/gal. liquid, lb.	4.81	4.24
Octane number: Research Motor	 94 90	 110+ 97

Figure 3 Butane/Propane Properties

Gas Fuel System Pipe Size Requirement

When installing the generator set and laying the pipe for a gaseous system, consider the following: type of fuel, distance it must travel from gas meter or tank to the fuel shutoff solenoid, and amount of fuel consumed by the engine. To determine the correct pipe size for a specific installation, refer to Figure 5 and follow the procedure outlined.

1. Determine the length of pipe between gas meter/tank and fuel shutoff solenoid at the generator set. Example: 35 ft.

2. Find the number closest to the pipe length in Length of Pipe column in Figure 5. Example: For 35 ft., use the 40 ft. column.

3. Refer to fuel consumption from the generator set specification sheet. Note the type of fuel and consumption of fuel at 100% load. Example: The 8.5RES with natural gas operating at 100% full load uses 132 cfh (cubic feet per hour).

4. Refer to the correction factors in Figure 4. Locate the factor for specific gravity of fuel used. Example: natural gas specific gravity is 0.65 with a correction factor of 0.962.

5. Divide the consumption (132 cfh) by the correction factor (0.962). 132 = 0.962 = 137 cfh

6. Move vertically across table to determined point in Length of Pipe column (40 ft.), go down column and stop at first number equal to or greater than corrected consumption (137 cfh). Example: 170 is the first number equal to or greater than 137.

7. Move to left column from figure (170 cfh) to determine correct pipe size. The correct pipe size for a 8.5RES with a pipe run of 35 ft. is 3/4 in.

Fuel	Specific Gravity	Factor
Sewage gas	0.55	1.040
Natural gas	0.65	0.962
Air	1.00	0.775
Propane	1.50	0.633
Butane	2.10	0.535

Figure 4 Gas Fuel Specific Gravities and Correction Factors

A pressure drop of 0.5 in. water column has been calculated into the chart to make allowances for a nominal number of fittings.

Nominal Iron Pipe Size, in.	Internal Diameter, in.	Length of Pipe, ft.													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/4	0.364	43	29	24	20	18	16	15	14	13	12	11	10	9	8
3/8	0.493	95	65	52	45	40	36	33	31	29	27	24	22	20	19
1/2	0.622	175	120	97	82	73	66	61	57	53	50	44	40	37	35
3/4	0.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1 1/4	1.380	1400	950	770	990	580	490	460	460	430	400	360	325	300	280
1 1/2	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430
2	2.067	3950	2750	2200	1900	1680	1520	1400	1300	1220	1150	1020	950	850	800
2 1/2	2.469	6300	4350	3520	3000	2650	2400	2250	2050	1950	1850	1650	1500	1370	1280
3	3.068	11000	7700	6250	5300	4750	4300	3900	3700	3450	3250	2950	2650	2450	2280
4	4.026	23000	15800	12800	10900	9700	8800	8100	7500	7200	6700	6000	5500	5000	4600
Maximum capacity of pipe in cubic feet of gas per hour for a gas pressure of 0.5 PSIG or less.															

Figure 5 Pipe Sizing for Corrected Fuel Consumption (cfh) Based on 0.60 Specific Gravity Gas