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Guide to Delivering Gas to Gas Fueled Generator Sets

Information Sheet # 26

1.0 Introduction

Gas is a common choice of fuel for standby generator sets. The two types of gas used are Natural Gas (NG) or Liquefied Petroleum Gas (LPG). To ensure proper operation the gas piping must be installed correctly.

This information sheets discusses the advantages of gas, recommends piping sizes, and installation procedures. *(Continued over)*

Chart One - Cubic Feet Per Hour Gas Flow Rates (cu.ft/hr with a specific gravity of 1 and line pressure 4 to 6 oz/sq. in)

Length of	Iron Pipe Size (inches)										
Pipe (Feet)	½	¾	1	1-¼	1-½	2	2-½	3	4	6	8
15	76	172	345	750	1220	2480	3850	6500	13880	38700	79000
30	52	120	241	535	850	1780	2750	4700	9700	27370	55850
45	43	99	199	435	700	1475	2300	3900	7900	23350	45600
60		86	173	380	610	1290	2000	3450	6800	19330	39500
75		77	155	345	545	1120	1750	3000	6000	17310	35300
90		70	141	310	490	1000	1560	2700	5500	15800	32250
105		65	131	285	450	920	1430	2450	5100	14620	29850
120			120	270	420	860	1340	2300	4800	13680	27920
150			109	242	380	780	1220	2090	4350	12240	25000
180			100	225	350	720	1120	1950	4000	11160	22800
210			92	205	320	660	1030	1780	3700	10330	21100
240				190	300	620	970	1680	3490	9600	19740
270				178	285	580	910	1580	3250	9000	18610
300				170	270	545	860	1490	3000	8500	17660
450				140	226	450	710	1230	2500	7000	14420
600				119	192	390	600	1030	2130	6000	12480

Diagram one - Typical pipe connection of a gas fueled generator set

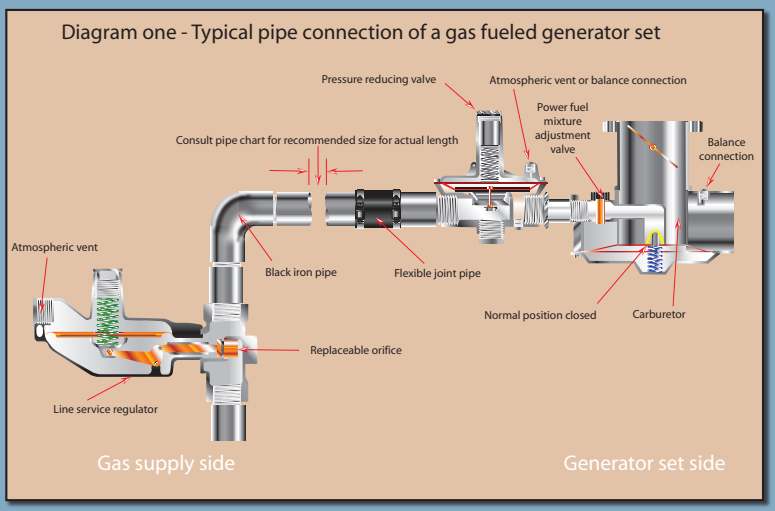

Chart Two - Pressure vapors

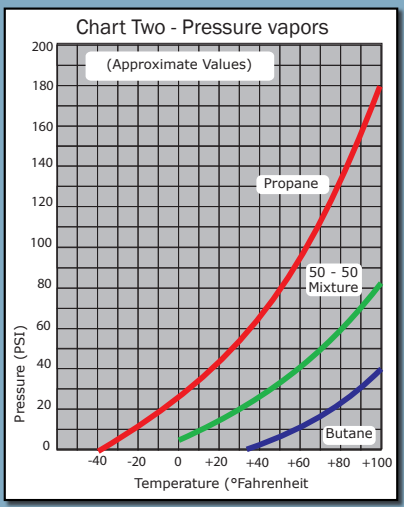

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Chart Three - Guide to engine vapor pressure requirements

kW Band	Engine	Fuel Supply Pressure	
		kPa	Inches of Water Column
25 - 100 kW	GM	1.74 - 2.4	7" - 11"
125 - 150 kW	PSI	1.7 - 2.7	7" - 11"
180 - 400 kW	Doosan		

Chart Four - Correction factors for specific gravity and pressure drop

Specific Gravity	Multiplier	Specific Gravity	Multiplier	Pressure Drop	Multiplier
.5	1.1	1	.755	0.1	.577
.55 Sewage gas	1.04	1.2	.707	0.2	.815
.6	1	1.4	.655	0.3	1.00
.65 natural gas	.962	1.5 propane	.633	0.5	1.29
.7	.962	1.7	.594	1.0	1.83
.8	.867	1.9	.565	2.0	2.58
.9	.817	2.1 butane	.535	5.0	4.08

Local codes governing gas fueled generator sets vary widely and a system designer should always refer to a local gas distributor or authorized installer when installing gaseous fueled generator sets.

2.0 Characteristics of gas types to consider:

NG is piped in by the utility; with LPG stored locally in tanks.

Natural Gas - NG is lighter than air and highly explosive in its gaseous state at normal ambients. As such, codes specify strict standards for ventilation and leak free piping. Local codes restrict the gas pressure entering a structure so a pressure regulator has to be fitted to bring the pressure within code.

LPG - LPG, like NG, is highly explosive but heavier than air and requires adequate ventilation to stop it collecting in low spots. LPG is converted to its vapor state before it enters the engine carburetor. LPG is gaseous at normal temperatures and pressures. LPG can be a mixture of butane and propane, but in colder temperatures will require more propane to provide adequate vapor pressure.

3.0 Delivery of gaseous fuel to the generator set:

Refer to local codes and note the differences for fuel types.

Natural Gas - The gas utility will provide piping from their distribution system to the generator location. A primary regulator (usually supplied by the utility) will reduce pressure to the code level required to enter a structure. The gas utility must keep pressure at a level to enable operation of the regulator.

Outlet pressure from the regulator to the generator's shut off valve should not exceed 0.5lbs PSI. The shutoff valve will not operate if pressure is higher than its rating. (Diagram one - sample gas system)

A flexible pipe should be fitted between the solid gas pipe and the generator sets gas connections.

On most installations the fuel shutoff valve is solenoid operated. Usually on smaller generator sets the engine operates on the same pressure as that delivered from the primary regulator.

LPG - Ambient temperatures around the storage tank enable vapors to be formed inside the tank for piping to the generator set. However in some cases vaporization and/or the length of pipe run can result in cooling that reduces vaporization. In this case a vaporizer-regulator is mounted in the air flow of the engine for heat that ensures fuel vaporization within the generator regulator and allows liquid withdraw not vapor withdraw from the storage tank. (See chart two for vapor pressures)

4.0 Gaseous fuel piping for generator sets:

Refer to local and NFPA codes #54 and #58 before selecting piping. As a guide the piping used should be mounted in a manner to reduce vibration, be of black iron, have a code specified flexible hose between the generator set connection and rigid pipe inlet, and all piping has to be purged and leak tested within local codes. For NG and vapor drawn LPG systems, the piping should have the diameter to deliver the required pressure. (See chart three for generator set vapor pressure requirements)

5.0 Sizing of gas piping:

Full generator power relies on the gas being delivered in the volumes and pressures as given by the manufacturer, which requires the correct pipe sizing. The following can effect gas pipe delivery:

1. Thickness of pipe and overall distance of generator from primary regulator
2. Pipe bends (90 degree elbow equates to an extra 10 feet of pipe and 45 degree an extra 5 feet)
3. Total equipment connected to the line and number of fittings

Chart one details the gas flow rates (cu.Ft/hr) that can be delivered for a given pipe size and length based on a specific gravity of 1.0 (air), it also allows for a pressure drop of 0.3 for a normal amount of restriction from fittings. The flow rates are based on line pressures of 4 to 6 oz per sq. in. The specific gravity of gaseous fuels varies, chart four details the correction factor multiplier for the various specific gravities. To determine the pipe size multiply the gas flow rates in chart one by the specific gravity multiplier detailed in chart two. Chart four also details the multiplier for pressure drops made in the pipe system.