

# Piping for Natural Gas-Fired Emergency Generators

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Emergency generators can be found almost anywhere. They are required in hospitals, healthcare facilities, and nursing homes for emergency life safety. In high-rise buildings with elevators, buildings that house telecommunications or 911 facilities, and buildings with cable-provided 911 service, they are legally required for provision of standby power. Emergency generators often are used in laboratories, data centers, communication companies, process industries, restaurants, grocery chains, and banks.

An emergency generator can be powered by diesel fuel, gasoline, propane, or natural gas. Natural gas (not to be confused with gasoline) has some advantages. It gives a rich and lean burn that produces low nitrogen-oxide emissions and higher compression, so it is more efficient and produces fewer emissions with more power. There are fewer environmental concerns with gas than with other fuels. Gas also is more convenient to use and offers an unlimited run time. Natural gas is the prevalent fuel in 8 KW–125 KW generators; higher-value generators typically are diesel driven.

Plumbing designers are responsible for natural gas piping to emergency generators.

## Code Provisions

Natural gas brings specific code restrictions into play (as does propane). For liquefied petroleum applications, NFPA 58 Liquefied Petroleum Gas Code, Section 8-5, applies.

### Life safety (NFPA 110, Emergency and Standby Power, Section 5-9):

NFPA 110 requires the fuel supply to be connected ahead of the building's main shutoff valve and marked as supplying an emergency generator. The building's main gas valve must be marked or tagged with an alert as to the presence of a separate emergency power supply shutoff valve. So if the



A 200-KW natural gas-fired emergency generator

(Photos courtesy of Generac Power Systems, Inc.)

A 1,000-KW natural gas-fired emergency generator



generator is located 200 ft from the meter and shutoff valve, a separate run of piping and valve needs to be run dedicated to that generator.

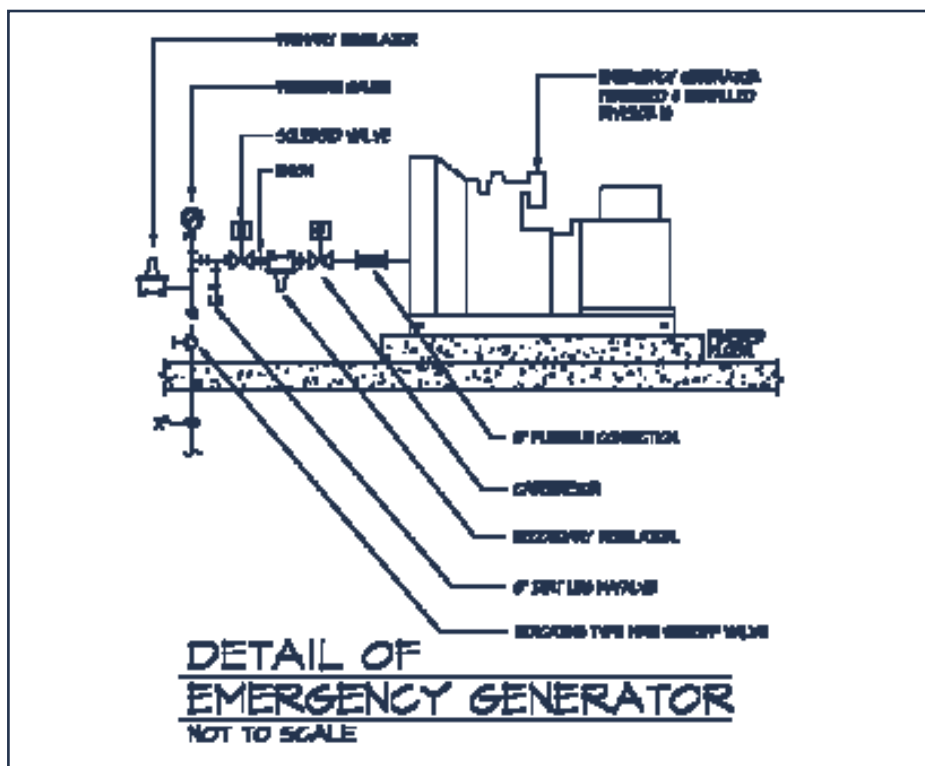
It's critical that the fuel-supply piping distribution system—including the manual shutoff valve, battery-powered solenoid valve, gas regulators, and regulator vent piping—is designed to supply the demands of the prime mover.

**Natural gas engines (NFPA 37, Stationary Combustion Engines and Gas Turbines, Section 4-1):** NFPA 37

requires that gas piping not exceed 125 psig. Most building codes allow a maximum of 5–10 psig. The stricter of the conflicting codes prevails. It's unsafe to run high-pressure gas piping inside a building or occupied space.

## Gas Piping

Piping typically is Schedule 40, black steel. Pipe joints and fittings should be welded to minimize piping failure. The piping needs to be designed to deflect with the engine in any direction; flexible connectors can assist with this task.



Plastic pipe is not allowed because it is flammable, susceptible to cracking, and subject to damage because of heat, physical contact, or vibration.

### Gas Pressure Regulators

For stable operation, gas regulators provide a steady stream of gas pressure to the engine. Pressure spikes or dips due to external loads from the gas supply system have less effect on an engine provided with its own regulator. Gas regulators inside the building should be vented to the exterior at least 5 ft away from any structural opening or intake (10 ft is more common and represents good engineering practice). When the gas pressure on the upstream side of the regulator is more than 0.5 psig, a relief valve must be installed on the downstream side of the regulator. Usually when a regulator fails, high pressure results. If high pressure is a concern, a manual-reset switch is required. The failed component must be identified and replaced before other items are also damaged by repeated high-pressure conditions.

### Shutoff Switches or Valves

If the gas pressure falls below the required pressure, a low-pressure switch shuts down the engine. The switch re-

duces the risk of an unburned-gas discharge through the exhaust, which would create a safety hazard. A manual or electronic resettable switch is allowed. If the automatic control valve fails, a safety shutoff valve shuts off the fuel.

### Gas Trains

The gas train is usually the last component installed on the gas piping system. The numerous valves and devices on the gas train are prone to leaks. A manual leak-test valve provides a means to leak test the gas train. This valve is a requirement. ■



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This article is meant to provide some basic guidelines. Always check all relevant codes and resources for a particular project.

## Checklists

### Piping for Natural Gas-Fired Emergency Generators

#### 1. NFPA 110

- On-site fuel or waiver run time
- Natural gas piping shutoff in front of building
- Engine shutdown valve bypass

#### 2. Gas Piping

- Only NFPA-54 approved piping materials
- No plastic pipe
- Approved metallic flexible connectors
- Approved nonmetallic connectors

#### 3. Gas Trains

The following are required:

- Manual shutoff valve
- Gas regulator with vent and applicable control line
- Low-pressure switch (except for engines < 2,500 MBH)
- Automatic safety shutoff valve (except for engines < 400 MBH input)
- Automatic control valve
- Manual leak-test valve (except for engines < 400 MBH)
- High-pressure switch or manual reset (except for engines < 2,500 MBH)

#### 4. Gas Pressure Regulators

- Vented regulator, if located inside building
- Relief valve, if gas pressure is > 1/2 psi on downstream side of regulator
- Relief valve connected to outside of structure, 5 ft away from any structure opening
- Relief valve sized to vent the required volume of gas

#### 5. Shutoff Valves

- Approved manual shutoff valve in a remote location for each engine
- Shutoff valve located closer to each engine in a multiple-engine installation than the first takeoff or branch pipe serving only that engine
- Valve that will stop fuel in event of engine stop
- Carburetion, fuel-control, zero-governor (not allowed alone), or auxiliary valve