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Installation of Propane Systems

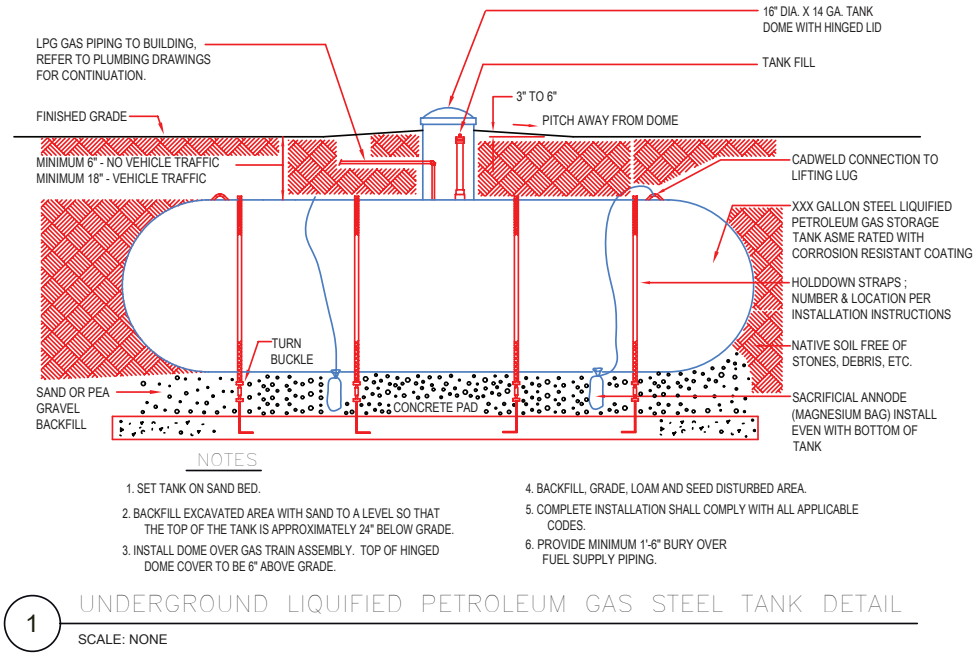

Figure 1 Propane storage tank detail

Figure 2 Aboveground propane tank installation
Photo courtesy of Highland Tank Company

Energy markets are changing at an unprecedented pace, and these changes are having a dramatic impact on the propane market, which has been transformed by the combined effects of volatile energy prices, evolving environmental and energy policies, swings in the economic outlook, advancements in propane and competitive technologies, and improvements in energy efficiency. Many people are working to position themselves for economic recovery; in various parts of the country many propane wholesalers are increasing their capacity, and long-time petroleum distributors are adding propane to their product mix.

The benefits of propane are as follows:

- An abundant supply is available in the United States.
- It is clean burning (does not leave residuals) and nontoxic.
- It is desirable when natural gas is not available.
- It can be used as fuel for standby generators, and generators automatically start when electricity fails.
- The fuel supply is kept on site, which is independent from regional pipeline interruptions.
- It offers immediate, warm, and even heat.
- High-efficiency propane appliances are available.
- Rebates and tax incentives are available.
- The energy savings payback period is short, and its use offers long-term energy savings.

REGULATORY AND INDUSTRY ADVANCEMENTS

Many forces impact energy consumption in the world today. From environmental regulations to the world economy and fluctuation in energy prices, propane has many opportunities for growth in the next decade. Given projected long-term shifts in world energy markets, propane prices are expected to become more competitive relative to diesel and fuel oil prices over time. This change is expected to create unique opportunities in the residential and commercial heating markets, especially in the northeast United States.

National energy policies and regulations can have both positive and negative impacts on the propane market. Certain policies, such as alternative fuel tax credits and energy-efficiency tax credits, make propane applications more attractive in the marketplace.

Markets for internal combustion engines offer long-term potential for large growth in propane sales, especially as clean propane applications such as commercial lawn mowers, irrigation pumps, and propane vehicles become more widely available.

Propane also has become a premium fuel in numerous buildings that are not on a natural gas main. Designers are specifying propane for water heaters, boilers, dual-fuel requirements, generators, kitchen equipment, and other applications in new construction.

The natural gas industry is beginning to use propane in the fracturing process when drilling into Marcellus Shale deposits. This development could really offer expanded demand for propane in the coming years as drilling for natural gas in Marcellus Shale expands in Pennsylvania, New York, and other areas in the northeast.

CHECKLIST FOR PROPANE SYSTEMS

Tank Size Considerations

- ❒ Soil temperature
- ❒ Vaporization capacity
- ❒ Depth of burial
- ❒ Delivery frequency
- ❒ Usage
- ❒ Climate

Vaporization Concerns

- ❒ Outside surface of tank
- ❒ Level of liquid propane in tank
- ❒ Temperature surrounding tank
- ❒ Location of tank
- ❒ Depth of soil frost penetration

Location of Containers

- ❒ Containers shall be located outside buildings unless they are specifically allowed to be located inside buildings.
- ❒ Containers shall be located with respect to adjacent containers, important buildings, groups of buildings, or the line of the adjoining property that can be built upon in accordance with NFPA 58 Table 6.3.1 (see Table 1).
- ❒ Distances shall be measured from the container surface.
- ❒ No part of a container shall be less than 10 feet from a building or the line of an adjoining property that can be built upon.
- ❒ Cylinders shall not be located and installed underneath any building unless the space is open to the atmosphere for 50 percent of its perimeter or more.

Installation of Aboveground Containers

- ❒ Aboveground containers shall be painted.
- ❒ Containers shall be placed on masonry or other noncombustible structural supports located on concrete or masonry foundations (see Figure 2).
- ❒ Saddles to support the container shall allow for expansion and contraction and prevent an excessive concentration of stresses.

Installation of Belowground Containers

- ❒ Follow distance requirements to the nearest important building and adjacent property line (see Table 1).
- ❒ Maintain an appropriate distance from any exterior sources of ignition or stored flammable materials, intakes of appliances or ventilation systems, as well as openings to buildings that are below the level of the relief of the valve.
- ❒ Maintain an appropriate distance from other propane tanks in multiple tank installations.
- ❒ Coordinate with other underground utilities (e.g., septic tanks, cesspools, water or sewer lines).
- ❒ Containers installed in areas with no vehicular traffic shall be installed at least 6 inches below grade.
- ❒ In areas where vehicular traffic is expected, a non-interchangeable underground container shall be installed at least 18 inches below grade (see Figure 3), or the container shall be protected from damage from vehicles.
- ❒ Protection against vehicular damage also shall be provided for the fitting housing, housing cover, container connections, and piping.
- ❒ Prior to digging, the location of underground and mounded containers and piping in the vicinity of construction and excavation activities shall be determined, and the installation shall be protected from damage.
- ❒ Discharge of the regulator vent shall be above the highest probable water level.
- ❒ Provide 6 inches of sand or crushed stone at the bottom of the tank.
- ❒ Attach magnesium anode bags to the tank and piping to prevent electrolysis and corrosion.
- ❒ Backfill with sand and landscaping.
- ❒ Trench depth shall be 18 inches minimum for piping.
- ❒ Ensure that only the top of the dome is visible upon final installation.
- ❒ Provide filling connections and valves.

Container Appurtenances

- ❒ Pressure-relief devices
- ❒ Rain caps
- ❒ Shutoff valves
- ❒ Pressure regulators

Corrosion Protection System

- ❒ A corrosion protection system shall be installed on new installations of underground steel containers
- ❒ Include a sacrificial anode or an impressed current anode.
- ❒ Include a means to test the performance of the cathodic protection system.

Aboveground Tank Safety

- ❒ Tank-handling equipment shall be of adequate size and reach for proper tank setting.
- ❒ Tank design has centered lift points for self-centering and easy handling.
- ❒ Safety guide ropes shall be used to prevent tank spin.
- ❒ Footings along with concrete or steel saddles shall be properly spaced per manufacturer's guidelines.
- ❒ All necessary permits shall be in place.
- ❒ Regulatory guidelines for pressure-relief value, gauging, monitoring, and other accessories shall be followed.
- ❒ Lockable chainlink fencing shall follow regulatory guidelines.
- ❒ Pipe pressure test must be completed.

Underground Propane Safety

- ❒ Utilize an excavation depth that allows the piping chamber and pressure-relief valve to protrude above grade.
- ❒ Tank-handling equipment shall be of adequate size and reach for proper tank setting.
- ❒ Tank design has centered lift points for self-centering and easy handling.
- ❒ Safety guide ropes shall be used to prevent tank spin.
- ❒ A quality coating system and anodes shall be installed.
- ❒ Bedding and backfill shall be homogenous clean sand, pea gravel, or #8 crushed stone.
- ❒ All necessary permits shall be in place.
- ❒ Regulatory guidelines for pressure relief values, gauging, monitoring, and other accessories shall be followed.
- ❒ Lockable chainlink fencing shall follow regulatory guidelines.
- ❒ Pipe pressure test must be completed.

Figure 3 Belowground propane tank installation
Photo courtesy of Highland Tank Company

FLOW OF PROPANE

Propane, or LPG, is a liquefied petroleum gas that comes out of both oil and gas wells but does not occur naturally. Raw crude oil or raw natural gas is refined to make different types of petroleum products, one of which is propane. Following its refinement, propane is stored as a liquid under pressure until utilized, at which point it becomes a gas.

Propane is delivered to the building as a liquid and is pumped into the storage tank (see Figure 1). The liquid changes to gas vapor before it leaves the tank. The visible portion of the underground tank, the cover, protects the shutoff valve, regulator, safety relief valve, and tank gauge.

Propane flows through a gas piping system from the tank to appliances inside and outside the building. The gas piping system is pressure regulated at the tank with gas piping running underground, where further pressure regulation usually is needed to meet final appliance pressure requirements. If the regulator is mounted on the outside of the building, it must meet applicable distance requirements from possible ignition sources.

PROPANE VAPORIZERS

Vaporization is the process of a liquid being converted into a gas (or vapor). As propane boils, it is in the process of vaporizing. Water boils at 212°F, at which point it converts to a vapor we know as steam. Propane works the same way, but at a much lower boiling point. One might refer to propane vapor as "LP gas steam." Vaporization is affected and influenced by the actual size of the propane tank.

Commercial and industrial propane applications using high-demand LP gas equipment often incorporate propane vaporizers to satisfy appliance British thermal unit (Btu) requirements. Vaporizers are used when equipment or appliance demand exceeds the vaporizing capacity of the tank. In other words, vaporizers are used to supply the required amount of propane gas when the tank can't keep up with the downstream appliance demand on its own and placing a much larger tank with a higher vaporization capacity would not be practical. LP gas vaporizers work with liquid propane at a location apart from the tank, with liquid being piped to the vaporizing equipment for gas vaporization.

PROPANE TANKS

Propane tanks are the storage containers for propane in its liquid form. Tanks are available in many different sizes that are engineered and designed for propane containment at high pressures. Propane tanks are designed for both stationary and mobile use. The propane tank itself is what allows propane and its usable energy to be portable.

General Installation of Containers

Regardless of size, any ASME tank filled on site must be located so that the filling connection and fixed liquid level gauge are at least 10 feet from external sources of ignition (i.e., open flame, window air-conditioner, compressor), the intake to a direct-vented gas appliance, and the intake to a mechanical ventilation system.

Consideration should be given to the owner's desire, but typically the tank should be located within 75–100 feet of driveway access for delivery, with emergency access also provided. Consideration also should be given to the ease of exchanging cylinders or refilling storage tanks via the delivery truck.

PROPANE REGULATORS

The propane gas regulator is one of the most important parts of a propane gas system. The purpose of the regulator is to control the flow of gas and lower the pressure from the tank to the appliances in the gas system. The regulator acts not only as a control regarding the flow and distribution of propane, but also as a safety barrier between the high pressure of the tank and the end-use appliances. Most will rightfully argue that the LP gas regulator is the heart of any propane gas system. PSD

RESOURCES

1. NFPA 58 (2011): *Liquefied Petroleum Gas Code*
2. CAN/CSA B149.1: *Natural Gas and Propane Installation Code*
3. Local codes and standards

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TABLE 1 SEPARATION DISTANCES BETWEEN PROPANE CONTAINERS AND IMPORTANT BUILDINGS AND LINE OF ADJOINING PROPERTY THAT CAN BE BUILT UPON

Water Capacity per Container, gallons	Minimum Distances		
	Mounded or Underground Containers, feet	Aboveground Containers, feet	Between Containers, feet
<125	10	0	0
125–250	10	10	0
251–500	10	10	3
501–2,000	10	25	3
2,001–30,000	50	50	5
30,001–70,000	50	75	¼ of sum of diameters of adjacent containers
70,001–90,000	50	100	
90,001–120,000	50	125	
120,001–200,000	50	200	
200,001–1,000,000	50	300	
>1,000,000	50	400	

Source: NFPA 58 Table 6.3.1