



## LPG Terminals & Carousels

Several engineering disciplines are associated with the design of LPG terminals. The four (4) main documents that govern the standards of LPG terminal design are, API 2510 (Design and Construction of LPG terminals), API 2510A (Fire Protection Considerations for the Design and Operation of LPG Terminals), NFPA 58 (Liquefied Petroleum Gas Code) and ASME III (Rules for the Construction of Pressure Vessels).

The main process objective is to keep LPG in the liquid phase by pressurizing it due to the fire hazard that the gaseous phase causes. Blending Propane and Butane in the right quantities will also prevent the risk of fire. Odorizing LPG shall be the first step in the design process.

- LPG terminals consist of receiving manifolds, pressurized spherical or bullet tanks, a pumping system, truck racks, compressors, a piping system, bottling carrouseles and a returned bottles refurbishment warehouse.
- Zoning and orientation of the terminal elements shall serve security, safety, smooth traffic and the ability to easily manage the terminal.
- LPG storage tanks design and placement shall comply with API/ASME standards and requirements. The tanks should also be located downstream for the prevailing wind.
- Piping systems are designed according to ANSI/ASME B31.3 and/or ANSI/ASME B31.4. Piping material will be in accordance to ASTM A 53/A 53A. Piping systems run in parallel groups, above ground when possible or underground if crossing a road or area where traffic occurs. Pipe diameters are determined according to the flow rate. Velocity of the LPG inside the pipe shall be below the level of velocity which generates static electricity. The pipe wall's thickness is determined so that it withstands 1.5x the working pressure. Computer modeling software's are utilized to determine the piping system is able to bear pressure surge and hydraulic chocks. Underground piping is protected by cathodic protection and an overhead layer that is able to withstand the weight of traffic. The piping is coated in accordance to NACE standards and marked according to API.

The operation requirements, cost of pipes/pumps and harmful effects of excessive fluid velocity, fatigue or failure are the main factors considered when developing the piping system design for the terminal.

- The LPG terminal's pumping system shall be sufficient to transfer the product between tanks and distribution outlets such as truck loading racks and marketing pipelines. The pumps shall be designed according to API 610 (Centrifugal Pumps for Petroleum, Petrochemicals and Natural Gas Industries). Every pump will be capable of achieving 110% of the head required in the correct working temperature range. All pumps are installed on concrete foundations. When taking into consideration the number of pumps necessary spare pumps per each capacity used will always be considered. Pumps are equipped with strainers, valves and bypass lines. Electrical and diesel drives shall be considered in the design.

- The trucks loading and unloading racks shall be capable of transferring up LPG from or to the trucks without generating static electricity. The trucks loading and unloading racks are installed on a concrete mat and have a weather cover to protect the trucks and workforce. The loading and unloading racks are positioned according to NFPA standards.
- The terminals will be powered by an electrical system consisting of two (2) sources of electrical power, a primary and secondary source. The primary source is most often the national grid while the secondary source consists of diesel power generators used in case of a primary source failure. The power supply's distribution system shall give management strong operation and maintenance capabilities.
- The terminal's control system shall be utilizing the SCADA system in the field and the LPC system in the control room. Field data should be transmitted from the field to the control system where the program is able to handle it without human interference.
- A fire suppression system is necessary as the presence of LPG among oil and gas terminals presents a fire safety hazard, potential to pollute the environment and endanger human lives. In order to prevent and extinguish fires the facility will be protected by a fire suppression system. A fire suppression system starts with a monitoring and alarm system to alert the workforce in case of a fire. The fire suppression system also includes heat/flame detectors, gas/vapor sensors and an alarm control panel. A water based fire suppression system does not extinguish LPG fires, but it is used to cool containers and pipes. ESV are used to stop the gas feed to the location of the fire. Dry chemical can also be used to extinguish LPG fires. Time is the main factor in responding to LPG fires.
- The earthing and lightning protection system is designed to prevent fires caused by lightning or static electricity. The system assures that any stray electrical charges are passed to the earth avoiding any chance of creating sparks.

