Liquefied Carbon Dioxide (CO₂) Requirements

Where there are less than two 50lb DOT approved high pressure cylinders used inside or outside the structure, per system, gas detection and alarm systems shall not be required.

Gas Detection and Alarms

1. Rooms or areas where container systems are filled and used indoors or in enclosed outdoor locations shall be provided with a gas detection and alarm system that is capable of detecting and notifying the building occupants of a gas release that creates carbon dioxide vapors in excess of its PEL. (NFPA 55, 13.2.2)

2. Carbon Dioxide gas detection shall be as follows:
   Pre-alarm (15,000 ppm) notification may include, but not limited to the building owner, working supervisor, or maintenance company.
   Alarm (30,000 ppm) evacuation shall sound for the occupancy and shall transmit off-site as a gas specific alarm when the facility has a system capable of monitoring signals off site or established protocols are in place to call 911 and notify the Phoenix Fire Department.

3. Carbon Dioxide detection shall be located at all point of use locations inside the building. (Phoenix Fire Code Regulation R3000.1)

4. A warning sign shall be posted at the entrance to the building, room, enclosure, or confined area where the container is located. (NFPA 55, 13.2.3)

5. Provide minimum of two notification devices, one near the area/room where cylinder is located, one in the common area where the public gathers. Devices shall be rated at 100 cd for visual effect and 75 db for audible effect unless full fire alarm is present. (Phoenix Fire Code Regulation R3000.1)

6. Gas detection system shall be tied into Monitoring system if provided (Phoenix Fire Code Regulation R3000.1)

This summary is not a complete review of the Phoenix Fire Code or other City of Phoenix requirements, laws and ordinances. It is the responsibility of the owner and design professional to ensure that a diligent design and application of the Fire Code requirements is accomplished. This summary is only intended to offer basic information about particular Fire Code requirements and is not a comprehensive analysis of all of the requirements contained in the Phoenix Fire Code. It is not an official interpretation or an approval to install a CO₂ system and it is not a Phoenix Fire Department or Planning and Development Department permit.
**Signage**

1. Provide NFPA 704 Fire Diamond on each tank and/or outdoor cabinet that stores carbon dioxide. (Phoenix Fire Code 2703.5)

2. The warning sign shall be at least 8 inches (200 mm) wide and 6 inches (150 mm) high and state the following: CAUTION — CARBON DIOXIDE GAS. Ventilate the area before entering. A high carbon dioxide (CO₂) gas concentration in this area can cause suffocation. (NFPA 55, 13.2.3.1)

**Pressure Relief Piping**

1. The termination point of pressure relief vent discharge piping shall be outdoors and a minimum of 10 feet from operable openings into the building.

**Piping and Fittings**

1. Provide label on piping to indicate exact contents and direction of flow. These labels shall be placed every 20 feet, major change in direction and where piping enters and leaving walls. (Phoenix Fire Code 2703.2.2.1)

2. Piping, tubing, pressure regulators, valves, and other apparatus shall be kept gastight to prevent leakage. A soap test of all joints will be conducted at the time of inspection by the building owner or contractor and witnessed by the Fire Inspector. (NFPA 55, 7.3.1.3.1)

3. Piping systems shall be designed to a bursting pressure of at least four times the system design pressure.

4. Acceptable piping for Carbon Dioxide shall be the following:
   - Stainless steel A269 grade, which is either seamless or welded drawn over mandrel, the following connection types: flare, welded, brazed or bites type compression.
   - Copper K grade, hard-drawn seamless, with the following connection types; flared, welded, brazed, bite type compression.
• Copper ACR grade (1/2 in OD or less) annealed seamless with the following types of connections some appraised, flared or bite that can pressure compression.

• Additional approved piping and fittings can be found in CGA G6.1 Standard for Insulated Liquid Carbon Dioxide System for Consumer Site. A special report, stamped by an Arizona Registered Engineer, on the piping material shall be submitted to the City of Phoenix Fire Department for the installation of material that is not listed in CGA G6.1 standard, including plastic tubing. (See form on our website): www.phoenix.gov/fire/prevention/formsapps/index.html

• Rigid plastic piping shall not be allowed.

5. All fittings used in the piping system shall be designed for a working pressure not to exceed 125% of designed pressure of the hose.

**Ventilation**

1. Tanks located inside a building shall be provided with mechanical ventilation. Plans shall be submitted to the Planning and Development Department in order to obtain a permit for the installation of the ventilation system. (Phoenix Fire Code Regulation R3007)

2. Ventilation systems shall discharge a minimum of 10 ft from intakes of air-handling systems, air-conditioning equipment, and air compressors and shall be located 10 feet from property lines, 3 feet from exterior walls and roofs, 10 feet from operable openings into the building, and 10 feet above adjoining grade. (Phoenix Fire Code Regulation R3007)

3. For gases that are heavier than air, exhaust shall be taken from a point within 12 in. (304.8 mm) of the floor. (NFPA 55, 6.15.7.2)

4. The termination point of exhaust outlets and ducts discharging to the outdoors shall be located 10 feet from property lines, 3 feet from exterior walls and roofs, 10 feet from operable openings into the building, and 10 feet above adjoining grade. (International Mechanical Code Section 501.2.1)

5. A manual activation switch shall be provided at the entrance of the area where the ASME vessel or DOT cylinders are located. This manual activation switch shall be clearly marked with its function.
Emergency Shutoff

1. Emergency shutoffs shall be located at the point of use and at the tank, cylinder, or bulk source. These shutoffs shall be clearly marked. When hazardous materials are stored outside of buildings in stationary above-ground tanks or pressure vessels and are piped into a building, an emergency shutoff valve shall be installed at an approved location outside of the building. (NFPA 55, 7.1.11.1 and 7.1.11.2)