# CITY OF HENDERSON
# FIRE SAFETY GUIDELINE

| | | | |
|---|---|---|---|
| **Effective Date:** | **February 4, 2019** | **HFS#** | **018** |
| **Supersedes:** | **All Others** | | |
| **Updated:** | **July 20, 2023** | **Page 1** | **of 4** |

**TITLE:** **LIQUIFIED CARBON DIOXIDE ($CO_2$)**

**PURPOSE:**

In accordance with the provisions of the 2021 International Fire Code, as adopted by the City of Henderson, section 5307.3 Liquefied Carbon Dioxide systems shall be installed in accordance with the 2021 IFC.

**REFERENCE:** 2021 IFC & 2020 NFPA 55 as amended

**RULES & REGULATIONS:**

**I. Permits:**

A. Construction and operational permits shall be obtained for liquefied carbon dioxide containers or systems where the system capacity exceeds 100lbs as indicated in table 105.5.9 as amended.

**II. Submittal Package:**

A. Provide the following electronic documents at the time you submit your application for permit. Each of these documents shall be uploaded as separate file. Refer to the City of Henderson PDF Standards for Electronic Plan Submittals.

i. A completed fire permit application (1 permit type per application)

ii. Plans shall be submitted to the fire code official for review and approval prior to construction. (1 digital set)

iii. Product data submittal including a cover index sheet itemizing the products used by make and model number and manufacturer data sheets (highlighted or marked) information for equipment, devices, and materials used. (1 digital set)

**III. Plan Contents:**

A. Provide general project information including project name and street address.

B. Provide Contractor's name, address, phone number, license numbers, license classification, and license limit.

C. Applicable codes and standards.

D. Written narrative providing intent and system description.

E. Site plan, indicating building orientation.

F. Symbol legend with equipment description (manufacture's name and model number) and mounting description (surface, semi-flush, flush, and exterior).

G. Signature of the licensee (contractors Master or Qualified Employee) or seal and signature of a Professional Engineer licensed in the state of Nevada. Professional Engineers signatures must be digitally signed.
H. Sheet index.
I. Type and use of container, equipment, or device.
J. Sequence of operation in either an input/output matrix or narrative form.
K. Description showing dimensions and materials used in construction.
L. Design pressure, maximum operating pressure and test pressure.
M. Type, size and setting of pressure relief devices.
N. Design number and detail of penetration fire stop system when required.
O. Floor plan drawn to an indicated scale (1/8" minimum) on sheets of a uniform size showing:
    i. Point of compass (north arrow).
    ii. Walls, doors, windows, openings, stairs, elevators, passageways, high-piled storage racks, etc., as applicable to depict the facility.
    iii. Room use identification labels (i.e., kitchen, dining room, storage room, etc.)
    iv. Location of CO2 container including CO2 container size, weight, state of contents (liquid or gas) and quantity. Location of vaporizer if used.
    v. Gas piping distribution systems, manifolds, routing and sizes, and material types. Piping hangers and slopes.
    vi. Valves and valve boxes, outlets, gages, and other components.
    vii. Location including mounting height of CO2 sensors. (sensors to be provided where tank, piping, or equipment leaks could result in CO2 accumulation)
    viii. Electrical warning systems (local alarm audible/visual appliance), conductor/conduit size, type, and routing, power panel and circuit connection.
    ix. Location of warning signs. Details for warning signs depicting content, size, color, and attachment method.

**IV. Ventilation / Gas Detection:**

A. 2021 IFC - 5307.3 Insulated liquid carbon dioxide systems used in beverage dispensing applications. Insulated liquid carbon dioxide systems with more than 100 pounds (45.4 kg) of carbon dioxide used in beverage dispensing applications shall comply with Section 5307.3.1.
B. 2021 IFC - 5307.3.1 Ventilation. Where insulated liquid carbon dioxide storage tanks, cylinders, piping, and equipment are located indoors, rooms or areas containing storage tanks, cylinders, piping and equipment, and other areas where a leak of carbon dioxide is expected to accumulate, shall be provided with mechanical ventilation in accordance with Section 5004.3 and designed to maintain the room containing carbon dioxide at a negative pressure in relation to the surrounding area.

    Exception: A gas detection system complying with Section 5307.3.2 shall be permitted in lieu of mechanical ventilation.

C. 2021 IFC - 5307.3.2 Gas detection system. Where ventilation is not provided in accordance with Section 5307.3.1, a gas detection system shall be provided in rooms or indoor areas and in below-grade outdoor locations with insulated carbon dioxide systems. Carbon dioxide sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is expected to accumulate or other approved locations. The system shall be designed as follows:

   i. Activates an audible and visible supervisory alarm at a normally attended location upon detection of a carbon dioxide concentration of 5,000 ppm (9000mg/m3).

   ii. Activates an audible and visible alarm within the room or immediate area where the system is installed and stops the flow of carbon dioxide into the piping system upon detection of a carbon dioxide concentration of 30,000 ppm (54 000 $mg/m^3$).

D. Approved sensors shall be connected to local visible and audible alarms which will alert building occupants at the space containing the liquefied carbon dioxide tank, cylinder, or container when the carbon dioxide level within the room reaches 3% v/v.

   i. The audible devices and monitoring systems do not need to be tied into the fire alarm or sprinkler monitoring system. (1) Device shall be placed within the room housing the ($CO_2$) tank and (1) device shall be located at each entrance to the room warning those that enter of the hazard within. Devices are required to be distinctive in sound and color from fire alarm warning appliances. (We recommend the use of a yellow or amber strobe and constant tone horns.) Audible and visible notification devises shall have the ability to be perceived above the levels of ambient levels per OSHA 1910.

## V. Signage:

A. Rooms required to be equipped with carbon dioxide sensors/alarms, must display signage at each entrance to the room that warns occupants not to enter when alarms are activated.

B. 2020 NFPA 55 - 13.7.3 – A warning sign shall be posted at the entrance to the building, room, enclosure, or confined area where the container is located.

C. 2020 NFPA 55 – 13.7.3.1 – The warning sign shall be at least 8” wide and 6” high and state the following:

**CAUTION – CARBON DIOXIDE GAS**
**Ventilate the area before entering. A high carbon dioxide ($CO_2$) gas concentration in this area can cause suffocation.**

D. 2021 IFC - 5003.5 Hazard identification signs. Unless otherwise exempted by the fire code official, visible hazard identification signs as specified in NFPA 704 for the specific material contained shall be placed on stationary containers and above-ground tanks and at entrances to locations where hazardous materials are stored, dispensed, used, or handled in quantities requiring a permit and at specific entrances and locations designated by the fire code official.

E. 2021 IFC - 5003.5.1 Markings. Individual containers, cartons or packages shall be conspicuously marked or labeled in an approved manner. Rooms or cabinets containing compressed gases shall be conspicuously labeled: COMPRESSED GAS.

F. 2021 IFC - 5003.6 Signs. Signs and markings required by Sections 5003.5 and 5003.5.1 shall not be obscured or removed, shall be in English as a primary language or in symbols allowed by this code, shall be durable, and the size, color and lettering shall be approved.

**VI. Additional Requirements:**

A. Even though the piping for the distribution of the $CO_2$ may be installed by a different provider than the monitoring equipment provider our inspectors will be verifying the routing and support of, to determine if additional sensors will be required to be installed.

B. 2020 NFPA 55 – 13.4.1 – Pressure Relief Devices. Containers used for liquid carbon dioxide shall be equipped with pressure relief devices piped from the uppermost part of the containers and communicating with the vapor space.

C. 2020 NFPA 55 – 13.4.1.2.2 – Vent piping systems serving pressure relief devices shall be protected from water intrusion to prevent moisture or solid carbon dioxide from collecting and freezing and interfering with the operation or the pressure relief device. The termination point of pressure relief vent discharge piping shall be outdoors and a minimum of 10 feet from operable openings into the building.

D. 2020 NFPA 55 – 13.4.2.1 – Containers, cylinders, and tanks shall be provided with a pressure gauge and level gauge or device for indicating the quantity of liquid carbon dioxide.

E. 2020 NFPA 55 – 13.4.2.3 – Where cylinders, containers, and tanks are in locations remote from the filling connection, a means to determine when the containers have been filled to their design capacity shall be provided and shall be verifiable from the filling connection.

F. 2020 NFPA 55 – 13.4.3.1 – Carbon dioxide piping shall be located and supported to protect against damage from strain on piping and fittings; the effects of expansion, contraction, and vibration; mechanical damage; and heat sources.

G. 2020 NFPA 55 – 13.4.3.2 – Piping, tubing, and hoses and fittings shall be designed to a bursting pressure of at least four times the system design pressure.

H. 2020 NFPA 55 – 13.5 – Materials of construction shall be employed for potential exposure to a temperature of -109.3 F.

The items listed in this document are basic information only, and do not contain all code requirements. Codes are subject to change. Additional requirements may apply.