AMENDMENT PROPOSAL

Please provide all of the following items in your amendment proposal.

Code Sections/Tables/Figures Proposed for Revision:
Add NEW section 5307.6.

Proposal:

New text as follows:

(NEW) Section 5307.6 Inert Gas Systems Used in Commercial, Manufacturing or Industrial Applications is added as follows:

5307.6 General. Inert gas systems with more than 100 pounds (45.4 kg) of an inert gas or any system using any amount of an inert gas below grade used in a commercial, manufacturing or industrial application, such as breweries, water treatment with pH balancing, food processing or laboratories shall comply with Sections 5307.6.1 through 5307.6.7. Inert gases include but are not limited to argon, helium, nitrogen and carbon dioxide. Provisions of Section 5307.3 are applicable where CO₂ is used.

Exceptions:

1. Medical gas systems
2. Gaseous Fire suppression systems
3. Carbon dioxide gas enrichment systems in accordance with Section 5307.4

5307.6.1 Permits. Permits shall be required in accordance with Sections 105 and in accordance with Denver Fire Department policy.

5307.6.2 Equipment. The storage, use, and handling of inert gases shall be in accordance with IFC Chapters 53 and 55, as amended, and the applicable requirements of NFPA 55. All equipment utilized in compressed gas systems shall be compatible with the intended gas and use.

5307.6.2.1 Containers, cylinders and tanks. Gas storage containers, cylinders and tanks shall be designed, fabricated, tested and labeled with manufactures’ specifications and shall be maintained in accordance with the regulations of DOTn 49 CFR, Parts 100-185 or the ASME Boiler and Pressure Vessel Code, Section VIII.

5307.6.2.1.1 Location. Location of gas storage containers, cylinders and tanks, inside or outside the building, shall be at an approved location.

5307.6.2.1.2 Security. Gas storage containers, cylinders and tanks shall be secured in an approved manner to prevent overturning. Containers, cylinders and tanks located outside shall be secured and safeguarded against tampering and protected from physical damage if exposed to vehicle traffic.

5307.6.2.1.3 Design and construction. Bulk tank installations over 2,000 pounds will require an engineered foundation and construction permit in accordance with the Denver Building Code or other approved engineered solutions.

5307.6.2.2 Piping systems. Piping, tubing, fittings, valves and pressure regulating devices shall be designed and installed in accordance with approved standards and manufacturers’ recommendations. PVC/ABS and other types of rigid plastic piping are not approved materials. Piping systems shall be marked in accordance with Chapter 53. Valves and controls shall be readily accessible at all times. Normal and emergency shut-off valves shall be clearly identified. Pressure relief valves shall be provided and piped to the outdoors. Each appliance or piece of equipment shall be provided with a shutoff valve within 3 feet of the appliance or piece of equipment. Automatic system shutoff valves shall be provided as near to the supply pressure regulator or container as possible and designed to fail to a closed condition closing on loss of electrical power to the valve and gas detection. All valves shall be designed or marked to indicate clearly whether it is open or closed. All fittings and joints shall be exposed and located adjacent to the supply source or points of use and shall be protected by a detector.

5307.6.2.3 Venting. Venting of gases shall be directed to an approved location outside the building. Insulated liquid gas systems shall have pressure relief devices vented in accordance with NFPA 55.

5307.6.3 Protection from damage. Inert gas systems shall be installed so the storage tanks, cylinders, piping and fittings are protected from damage by occupants or equipment during normal facility operations.
**5307.6.4 Required protection.** Where inert gas storage tanks, cylinders, piping and equipment are located indoors, rooms or areas containing inert gas storage tanks, cylinders, piping and fittings and other areas where a leak of an inert gas system can collect shall be provided with ventilation in accordance with Section 5307.6.4.1 and a gas detection system in accordance with Section 5307.6.4.2.

**5307.6.4.1 Ventilation.** Mechanical ventilation shall be in accordance with the *International Mechanical Code* and shall comply with all of the following:

1. Mechanical ventilation in the room or area shall be at a rate of not less than 1 cubic foot per minute per square foot \([0.00508 \text{ m}^3/(s \cdot \text{m}^2)]\).

2. Exhaust ventilation shall be designed to consider the density of the potential vapors released. For vapors that are heavier than air, exhaust shall be taken from a point within 12 inches (305 mm) of the floor. For vapors that are lighter than air, exhaust shall be taken from a point within 12 inches (305 mm) of the highest point of the room.

3. The ventilation system shall be designed to operate at a negative pressure in relation to the surrounding area.

4. Ventilation shall run continuously or be activated by a sensor or detector to maintain an atmosphere of not less than 19.5% oxygen in the room.

5. A mechanical permit is required in accordance with the *Denver Building Code*.

**5307.6.4.2 Gas detection system.** A gas detection system shall comply with all of the following:

1. Continuous gas detection shall be provided to monitor areas where a leak of an inert gas system can collect and create an oxygen deficient atmosphere. Detection equipment shall be provided at each point of use and in each storage area/room.

2. Detectors shall be:
   a. Listed or approved devices.
b. Permanently mounted.

c. Installed at a height consistent with the vapor density of the gas.

d. Directly connected to the building electrical supply and fire alarm system and protected from accidental disconnection or damage.

e. Auto calibrating and self “zeroing” devices are not permitted unless they can be zeroed and spanned.

f. Located within manufactures’ specified detection range for each point of use and storage location.

3. Activation of the gas detection system shall initiate amber horn/strobes provided in the vicinity of each interior storage container, cylinder or tank and at each point of release. Additional amber horn/strobes shall be placed at the entrances to below grade locations and confined spaces. The notification appliances shall be rated a minimum of 80cd for a visible and 75 dBA for audibility. Notification appliances shall be mounted per NFPA 72 requirements with the entire lens mounted between 80 inches and 96 inches above finished floor. Notification appliances shall be listed to operate in special environments, such as outdoors, indoors, high or low temperatures, and high humidity. Provide notification appliances at the following locations:

4. Alarm set points shall be set at:

a. Oxygen levels below 19.5% – Self re-setting (non-latching) alarm
   ● Visual notification only in approved locations

b. Oxygen levels below 17% – Latching Alarm
   ● Visual and audible notification in approved locations
   ● Activation of automatic system shutoff valve
   ● Evacuate room/area and call 911
   ● Alarm signal*

*In buildings with a monitored sprinkler or fire alarm/detection system, the gas detection system shall be connected to the building fire alarm control panel. A fire alarm permit is required in accordance with the Denver Building Code.
5. Signage shall be required adjacent to each horn/strobe as follows.

*Outside the Storage Area/Room:* “DO NOT ENTER WHEN LIGHT IS FLASHING – OXYGEN DEFICIENT ATMOSPHERE DETECTED – CALL 911”

*Inside the Storage Area/Room or at point of use:* “FLASHING LIGHT MEANS OXYGEN DEFICIENT ATMOSPHERE DETECTED – EVACUATE IMMEDIATELY AND CALL 911”

The sign shall have a minimum 1-inch block lettering with a minimum ¼-inch stroke. The sign shall be on a contrasting surface of black on yellow and shall be of durable construction.

*On the door of the Storage Room:* Signage shall be provided on each storage area entry door stating:

![DANGER]

NFPA 704 placards for simple asphyxiants shall also be provided at the main entrance to storage rooms/areas.

**5307.6.5 Transfilling.** Filling and transfilling of gases between storage containers, cylinders and tanks and delivery vehicles shall be performed by qualified personnel using equipment and operating procedures in accordance with CGA P-1. Interior storage containers, cylinders and tanks shall be filled via remote fill ports on the exterior of the building at grade level. Exterior remote fill ports shall be fitted with a vent line to the outside. Delivery personnel shall have access to interior storage areas to inspect valves and piping prior to initiating filling operations.

**5307.6.6 Inspection and testing.** All piping installations shall be visually inspected, calibrated, and pressure tested to determine that the materials, design, fabrication and installation practices comply with the requirements of this code.
5307.6.6.1 Records. A written record of all required inspections, testing, calibration, and maintenance shall be maintained in a log book on the premises containing the three most current years of records and be available for review by fire inspection personnel.

5307.6.6.2 Required inspections and testing. All piping installations shall be tested and inspected in accordance with Sections 5307.6.6.2.1 through 5307.6.6.2.5.

5307.6.6.2.1 Acceptance testing. Appliances and equipment shall not be placed in operation until after the piping system has been checked for leakage and detectors, notification appliances and automatic shutoff valves have been tested by a qualified service company. All piping installations shall be visually inspected and pressure tested prior to initial operation. The test pressure downstream of the pressure regulator shall be not less than 1½ times the proposed operating pressure. Joints shall be checked with a bubble-forming solution. Acceptance testing is required to be witnessed by Fire and/or Building Code Officials. Provide an inspection report to the fire and/or building officials for the piping and joint visual inspection and pressure test.

5307.6.6.2.2 Daily inspections. All detectors and alarms shall be visually inspected daily. These inspections are permitted to be conducted by trained employees.

5307.6.6.2.3 Monthly inspections. All storage vessels, piping, and appurtenances shall be visually inspected monthly. These inspections are permitted to be conducted by trained employees.

5307.6.6.2.4 Semi-annual inspections. Systems shall be visually inspected, gas detectors calibrated in accordance with manufacturer specification, alarms tested, and tested for leaks semi-annually by a qualified service company.

5307.6.6.2.5 Alterations and repair. In the event alterations, repairs or additions are made, the affected piping shall be retested in accordance with Section 5307.6.6.2.1.

5307.6.6.3 Reserved.

5307.6.6.4 Calibration. Detectors shall be checked for accuracy, calibrated to a reference gas concentration, and span reset.

5307.6.6.5 Pressure testing. Pipe joints shall be exposed for examination during the test.

5307.6.6.5.1 Test medium. The test medium shall be air, nitrogen, carbon dioxide, or an inert gas.

5307.6.6.5.2 Section testing. Piping systems shall be permitted to be tested as a complete unit or in sections. A valve shall not be subjected to the test pressure unless it can be determined that the valve, including the valve-closing mechanism, is designed to safely withstand the test pressure.

5307.6.6.5.3 Regulators and valve assemblies. Regulator and valve assemblies fabricated independently of the piping systems in which they are to be installed shall be permitted to be tested with inert gas or air at the time of fabrication. Test records shall be maintained in accordance with Section 5307.6.6.2.1.

5307.6.6.5.4 Test preparation. All joints and fittings shall be exposed for examination during and after the test.

5307.6.6.5.4.1 Pipe clearing. Prior to testing, the interior of the pipe shall be cleared of all foreign material.

5307.6.6.5.4.2 Appliance and equipment isolation. Appliances and equipment that are not to be included in the test shall be disconnected from the piping by closing the isolation shutoff valve.

5307.6.6.5.4.3 Test pressure measurement. Test pressure shall be measured with a pressure-measuring device designed and calibrated to read, record or indicate a pressure loss caused by leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made. Mechanical gauges used to
measure test pressures shall have a range such that the highest end of the scale is not greater than five times the test pressure.

### 5307.6.6.5.4 Test pressure

The test pressures shall be as specified in Section 5307.6.6.2.1. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe or tubing. Pressures shall be adjusted smoothly and slowly to avoid pressure spikes.

### 5307.6.6.5.5 Test duration

The test duration shall be not less than 1/2 hour for each 500 cubic feet (14 m³) of pipe volume or fraction thereof. When testing a system having a volume less than 10 cubic feet (0.28 m³) the test duration shall be not less than 10 minutes. The duration of the test shall not be required to exceed 24 hours.

### 5307.6.6.5.6 Visual inspection and cleaning

After testing is complete and the pressure is reduced to at or below operating pressure, all joints shall be cleaned of bubble-forming solution and visually inspected.

### 5307.6.6.5.7 Detection of leaks and defects

The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gauges shall be deemed to indicate the presence of a leak.

### 5307.6.6.5.8 Corrections

Where leakage or other defects are located, the affected portion of the piping system shall be repaired or replaced and retested.

### 5307.6.7 Training

All employees shall receive annual training in hazard identification, physical properties, inspection, and emergency procedures. Training records shall be maintained on site and be available to inspectors upon request.

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**Note:** Show the proposal using **strikeout**, underline format. At the beginning of each section, one of the following instruction lines are also needed:

- Revise as follows
- Add new text as follows
- Delete and substitute as follows
- Delete without substitution

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### Supporting Information:

Carry over Denver Fire 2015 IFCA amendments as adopted by policy in October 2017. This provides specific language.

**Note:** The following items are required to be included:

**Purpose:** The proponent shall clearly state the purpose of the proposed amendment to physical, environmental and customary characteristics that are specific to the City and County of Denver (e.g., clarify the Code; revise outdated material; substitute new or revised material for physical, environmental and customary characteristics; add new requirements to the Code; delete current requirements, etc.)

**Reasons:** The proponent shall justify changing the current Code provisions, stating why the proposal is necessary to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver. Proposals that add or delete requirements shall be supported by a logical explanation which clearly shows why the current does not reflect physical, environmental and customary characteristics that are specific to the City and County of Denver and explains how such proposals will improve the Code.

**Substantiation:** The proponent shall substantiate the proposed amendment based on technical information and substantiation. Substantiation provided which is reviewed and determined as not germane to the technical issues addressed in the proposed amendment shall be identified as such.

**Bibliography** (as needed): The proponent shall submit a bibliography when substantiating material is associated with the amendment proposal. The proponent shall make the substantiating materials available for review.

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### Referenced Standards:
None

List any new referenced standards that are proposed to be referenced in the code.

**Impact:**
It has no effect. Same amendments from 2015 IFCA.

**Note:** The proponent shall discuss the impact of the proposed amendment and indicate one of the following for each point below regarding the amendment proposal:

- **The effect of the amendment proposal on the cost of construction:**
  - ☒ No Effect

- **The effect of the amendment proposal on the cost of design:**
  - ☒ No Effect

- **Is the amendment proposal more- or less-restrictive than the I-Codes:**
  - ☒ Same

**Departmental Impact:**
Click or tap here to enter text.

**Note:** The proponent shall discuss the impact of the proposed amendment and indicate one of the following for each point below regarding the amendment proposal:

- **The effect of the amendment proposal on the cost of review:**
  - ☒ No Effect

- **The effect of the amendment proposal on the cost of enforcement/inspection:**
  - ☒ No Effect