

SEMI F14-93 (Reapproved 0699) GUIDE FOR THE DESIGN OF GAS SOURCE EQUIPMENT ENCLOSURES

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Editorial changes were made to sections 3.1.1, 6.2.1, and 6.2.2.

1 Purpose

1.1 This document summarizes gas source equipment enclosure design considerations. It is intended for use by manufacturers and purchasers.

2 Scope

2.1 Design considerations pertaining to gas source equipment enclosures are described herein. Modifications required to accommodate specific gases, cylinders, or unusual applications (e.g., process equipment) are not addressed.

3 Referenced Documents

3.1 Various codes and ordinances apply in different municipalities. These documents must be followed for the installation and operation of these systems. These codes may include:

3.1.1 NFPA Standards¹

NFPA 13 — Installation of Sprinkler Systems

NFPA 69 — Explosion Prevention Systems

NFPA 70 — National Electrical Code

NFPA 91 — Exhaust Systems for Air Conveying Materials

3.1.2 ICBO Model Code²

Uniform Fire Code, 1991 Edition

3.1.3 SEMI Safety Guideline

SEMI S4 — Safety Guideline for the Segregation/ Separation of Gas Cylinders Contained in Cabinets

3.1.4 Other Publications

Industrial Ventilation, A Manual of Recommended Practice³

BOCA National Building Code⁴

BOCA National Fire Prevention Code⁴

Standard Building Code⁵

3.1.5 Local Ordinances

As applicable.

4 Terminology

4.1 *gas cylinder* — Usually means a high pressure compressed gas cylinder governed by Department of Transportation (DOT) regulations. It also refers to non-DOT low pressure containers used for liquid product having low vapor pressure.

4.2 *gas source equipment enclosure (enclosure)* — An enclosure for the storage of gas containers and associated equipment.

5 Functions

5.1 Five important functions are provided by an enclosure and its associated safety devices.

5.1.1 *Leaking Gas Containment* — Personnel, equipment, and the immediate working environment are protected from the hazards of leaking gases.

5.1.2 *Fire Protection* — Personnel and equipment are protected from the consequences of internal and external fires.

5.1.3 *Mechanical Protection* — The cylinder and associated equipment are protected from impact and seismic forces. (For further information, see UFC 51, *Workstations and Fabrication Areas*.)

5.1.4 *Access Control* — Unauthorized persons are inhibited from using gases and operating associated

¹ National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

² International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, CA 90601

³ American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211

⁴ Building Officials & Code Administrators International, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60477

⁵ Southern Building Code Congress International, 900 Montclair Road, Birmingham, AL 35213

equipment.

5.1.5 Gas Separation — Gases that are chemically incompatible or belong to dissimilar hazard classes should be separated.

6 Design Considerations

6.1 Regulatory Requirements — The enclosure should conform to local, state, and federal regulations.

6.2 Materials

6.2.1 Enclosure top, sides, and doors should be constructed of 2.7 mm (12 gage) or thicker cold-rolled sheet steel or other suitable material so as to provide adequate mechanical stability.

6.2.2 Floors should be constructed of cold-rolled sheet steel or other suitable material, typically 3.4 mm (10 gage) or thicker, so as to adequately resist deformation by the heaviest intended cylinder.

6.2.3 Windows and skylights should be 6.5 mm (0.25 in) thick wired safety glass or other suitable material.

6.2.4 All materials should be noncombustible.

6.3 Dimensions — The enclosure should completely surround the gas cylinders and requisite accessory equipment. The design should incorporate minimum internal dimensions while still allowing safe and easy access to cylinders and equipment.

6.3.1 Heights of shelves for short cylinders should be adjustable so that cylinder valves and associated equipment are readily accessible through the limited-area access port.

6.3.2 Distances above cylinders should be adequate for installation and operation of associated equipment.

6.4 Enclosure Interior Access

6.4.1 Door — A gasketed door should enable safe and convenient installation and removal of intended cylinders, and installation, removal, and maintenance of associated equipment. The door should be self-closing and self-latching. The threshold should not interfere with cylinder installation and removal.

6.4.2 Limited-Area Access Port — The enclosure should have one or more limited-area ports that enable access to controls and associated equipment within the enclosure without compromising the air velocity across the face of the access port(s). The average air velocity across the faces of access ports should not be less than 1 m/s (200 fpm); a minimum air velocity of 0.75 m/s (150 fpm) should exist at any point.

6.4.2.1 Access ports should be self-closing.

6.4.3 Window — One or more windows should be provided to enable observation of equipment within the enclosure without compromising enclosure integrity.

6.4.4 Security — Lockable doors and access ports should be provided when unauthorized access to the enclosure interior must be precluded.

6.5 Ventilation — The enclosure should enable removal of leaking gas by local exhaust ventilation. The advantages of local exhaust ventilation over general ventilation are more fully described in NFPA 69, NFPA 91, and in Industrial Ventilation.

6.5.1 Exhaust Connection — The enclosure should enable connection to an exhaust system that will handle the required exhaust at an average duct velocity that does not exceed 8.5 m/s (1,700 fpm). The total exhaust flow includes that across open access ports as well as that through any supplementary air inlets.

6.5.2 Air Flow Path — In addition to access ports, the enclosure should include an air inlet located at the extremity of the enclosure opposite from the exhaust connection, so that ventilation of the entire enclosure is provided. The air flow path should adequately scavenge gas from all regions within the enclosure.

6.5.2.1 Structures (e.g., brackets or shelves) within the enclosure should not adversely affect exhaust capability.

6.5.2.2 Gaskets should be provided on all doors, access ports, and other penetrations.

6.6 Fire Protection

6.6.1 Sprinklers — Provisions for internal sprinklers should be made when necessary.

6.6.1.1 Sprinklers should be capable of providing adequate cooling to maintain cylinders and associated equipment at a temperature that will not actuate relief devices in the event of an internal or external fire.

6.6.1.2 Sprinkler actuation temperature should be greater than the anticipated maximum operating temperature of the enclosure interior under typical operating conditions, but less than the cylinder pressure relief device actuation temperature.

6.6.1.3 When the enclosure may be exposed to corrosive atmospheres, corrosion-resistant sprinklers should be provided. (For further information, see NFPA 13, *Corrosion-Resistant, Wax-Coated, or Similar Sprinklers*.)