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Liquefied natural gas (LNG) vehicular fueling systems code

液化天然气（LNG） 车辆燃料加注系统规范

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Standardization Administration of the People's Republic of China.

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Foreword

This Standard is drafted in accordance with the rules given in GB/T1.1-2009.

This Standard uses the re-drafting method to modify USA National Fire Protection Association NFPA 52 “Vehicle Fuel System Specification”, English version of 2006. For the purpose of comparison, a list of the comparison between the clause of this Standard and the clause of NFPA 52:2006 is given in Annex A; a list of the technical differences and between the clause of this Standard and the clause of NFPA 52:2006 and their causes is listed in Annex B.

For ease of use, this Standard has also made the following modifications:

a) MODIFY the name;

b) DELETE the clauses not related to LNG and Annexes A to E, mainly use the clauses related to LNG fueling facilities and relevant clauses in NFPA 52:2006;

c) In normative reverences, use China’s national standard to replace relevant foreign standards.

This Standard is proposed by National Technical Committee on Petroleum of Standardization Administration of China (SAC/TC 355).

Responsible drafting organizations of this Standard: CNOOC Gas & Electricity Group Co., Ltd., CNOOC Deep Combustion Energy Co., Ltd.

Participating drafting organizations of this Standard: Shanghai Jiaotong University, Shaanxi Gas Design Institute.

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Liquefied natural gas (LNG) vehicular fueling systems code

1 Scope

This Standard specifies the reasonable protection measures for the prevention of fire and explosion in the fueling facilities of liquefied natural gas (LNG) vehicular fueling system.

This Standard apply to the design, installation, operation and maintenance of various types of fueling facilities, with a container capacity of not more than 265 m^3, of liquefied natural gas (LNG) vehicular fueling system and LNG-CNG (compressed natural gas) conversion facilities.

This Standard does not apply to facilities, equipment and structural devices that have been built or approved for construction and installation prior to the entry into force of this Standard, unless otherwise stated.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated edition applies to this document. For undated references, the latest edition (including all modifications) applies to this document.

GB 150-1998 Steel pressure vessels

GB 8624-2006 Classification for burning behavior of building materials and products

GB/T 8923-1988 Rust grades and preparation grades of steel surfaces before application of paints and related products

GB 9448-1999 Safety in welding and cutting

GB 12955-2008 Fire resistant door sets

GB 16809-2008 Fire resistant windows

GB 18442-2001 Cryo-insulation pressure vessels

GB/T 20368-2006 Production, storage and handling of liquefied natural gas (LNG)

GB/T 20801-2006 Pressure piping code

GB 50016-2006 Code of design on building fire protection and prevention

GB 50058-1992 Electrical installations design code for explosive atmospheres and fire hazard

GB 50191-1993 Design code for anti-seismic of special structures

GB 50235-1997 Code for construction and acceptance of industrial metallic piping

JB/T 4711-2003 Coating and packing for pressure vessels transport

JB/T 6697-2006 Basic specifications of electric equipment for motor vehicles and internal-combustion engine

ISO 15500 Compressed natural gas (CNG) fuel system components

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1

labeled

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, AND the labeling indicates compliance with appropriate standards or performance in a specified manner.

3.2

listed

Equipment, materials, or services included in a list published by an organization, which is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.3

building

The operating pressure set in a LNG equipment or a container during normal use.

3.11

dike

A structure used to establish an impounding area.

3.12

emergency shutdown device (ESD)

A device that disconnects LNG from one point to the rest from either local or remote locations.

3.13

fail-safe

A design feature that provides for the maintenance of safe operating conditions in the event of a malfunction of control devices or an interruption of an energy source.

3.14

fixed liquid level device

A device that indicates when the container is filled to its maximum permitted filling volume.

3.15

fuel dispenser system

All the pumps, meters, piping, hose and controls used for the delivery of LNG to, and the removal of vapor from, a vehicle.

3.16

fueling connector

A device connects to the vehicular fueling system through the fueling hose or the fueling arm, including a shut-off valve for delivering LNG or vaporized gas.

3.17

fueling facility

A device delivers LNG as an engine fuel to a vehicle.

3.25

noncombustible material

A material that, in the form in which it is used and under the conditions anticipated, does not meet the definition of combustible material.

3.26

point of transfer

A connector for LNG transferring between the containers (bottles).

3.27

pressure relief device

A device designed to open to prevent a rise of internal pressure in excess of a specified value due to emergency or abnormal conditions. The device can be of the reclosing or other type, such as one having a rupture disk or fusible plug that requires replacement after each use.

3.28

vaporizer

A device other than a container that receives LNG in liquid form and adds sufficient heat to convert the liquid to a gaseous state, or a device used to add heat to LNG.

3.29

ambient vaporizer

A vaporizer that derives heat for vaporization from a naturally occurring heat source such as the atmosphere, seawater or geothermal waters. If the naturally occurring heat source is separated from the actual vaporizing heat exchanger and a controllable heat transport medium is used between the heat source and the vaporizing exchanger, the vaporizer shall be considered to be a remote heated vaporizer.

3.30

heated vaporizer

A vaporizer that derives heat for vaporization from the combustion of fuel, electric power or waste heat, such as from boilers or internal combustion engines.

3.31

structurally sound, suitable for the service, and otherwise in compliance with this Standard.

4.2.1.6 LNG fueling sites utilizing or fueling saturated LNG with personnel in the immediate vicinity shall provide barrier walls or equal protection in order to protect the fueling operator and vehicle. All facility piping other than the fueling hose to the vehicle shall be behind a barrier, which in the case of an equipment or device malfunction deflects the saturated LNG upward.

4.2.2 Siting

4.2.2.1 LNG containers and their associated equipment shall not be located where exposed to failure of overhead electric power lines operating over 380 V. Vaulted or underground installations shall be deemed to provide engineered protection from overhead power lines.

4.2.2.2 If other combustible or hazardous liquids can encroach on the LNG fueling facility, protection facilities shall be provided.

4.2.2.3 Fired equipment shall be located in accordance with Table 4 from any impounding area or container drainage system.

4.2.2.4 Points of transfer shall be located not less than 7.6 m (25 ft) from the nearest important building not associated with the LNG facility, from the line of adjoining property that can be built upon or from fixed sources of ignition. Points of transfer shall include the maximum length of fueling hose, loading and unloading hoses of LNG transport container.

4.2.3 LNG spill containment

4.2.3.1 Site preparation shall include provisions for retention of spilled LNG within the limits of plant property and for surface water drainage.

4.2.3.2 Enclosed drainage channels for LNG shall be prohibited.

4.2.3.3 In LNG transfer area, the minimum volumetric capacity of the impounding area shall equal to the greatest volume of LNG or flammable liquid that could be discharged into the area during a 10-minute period from any single accidental leakage source or a lesser time period based on demonstrable surveillance and shutdown provisions acceptable to the competent department.

4.2.3.4 Flammable liquid storage containers shall not be located within an impounding area serving LNG containers.

4.2.3.5 Impounding areas serving LNG containers shall have a minimum volumetric holding capacity, V, including any useful holding capacity of the drainage area and with

system in the event of failure of the ventilation system. Failures of any controllers used by the system shall result in a safe condition.

4.2.4.4 he ventilation rate shall be at least 1 m^3/min/12 m^3 (1 ft^3/min/12 ft^3) of room volume.

4.2.4.5 Reactivation of the fueling system shall be by manual restart conducted by trained personnel and in accordance with a process safety analysis.

4.2.4.6 A gas detection system shall be provided in all buildings containing LNG and shall activate a latched alarm when a maximum of 20 % of the lower flammable limit is reached. The alarm shall be clearly audible and visible both inside and outside the whole building and potential affected area. The gas detection system shall not be shut down during fueling operations.

4.2.4.7 Fueling facilities located inside or attached to buildings used for other purposes shall comply with the following:

a) The fueling room shall have a minimum of one external wall. Interior walls or partitions shall be continuous from floor to ceiling, shall be anchored securely, and shall have a fire resistance rating of at least 2 hours;

b) The interior finish of the fueling room shall be constructed of noncombustible or limited combustible materials.

c) In the interior walls of the fueling room, doors shall be listed as 1.5-hour self-closing fire doors and shall be installed in accordance with GB 12955 and GB 16809.

d) A ventilation system for a fueling room within or attached to another building shall be separated from any ventilation system for the other building.

e) Access to the fueling room shall be from outside the primary structure only.

Exception: Access from within the primary structure shall be permitted where such access is made through a barrier space having two vapor-sealing, self-closing fire doors having a fire resistance rating equal to that of the wall.

4.2.4.8 Access doors or fire doors shall be kept unobstructed at all times. Appropriate signs and markings and the words “WARNING - NO SMOKING” shall be clearly legible in bright red letters at least 25 mm high on a white background.

4.2.4.9 LNG piping entering a building shall be provided with shutoff valves located outside the building.

4.2.4.10 Buildings and rooms used for storage, fueling or installations of electrical equipment shall be classified in accordance with Table 1.

		Zone 2	Beyond 1.5 m (5 ft) of entire room and beyond ventilation vent
	Outdoors in open air at or above grade	Zone 1	Within 1.5 m (5 ft) in all directions from the point of transfer
		Zone 2	Beyond 1.5 m (5 ft) but within 15 ft (4.6 m) in all directions from the point of transfer
[a] See Subclause 2, Clause 2, “Division of environmental hazard zone of explosive gas” and Subclause 3, Clause 2, “Range of environmental hazard zone of explosive gas”, in GB 50050-1992, for definitions of zone and range divisions. [b] The classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition. [c] Ventilation is considered adequate when provided in accordance with the provisions of this code.			

4.3 Unloading of LNG transport container

4.3.1 Subclause 4.3 shall apply to the transfer of LNG between cargo transport containers and fueling facility containers.

4.3.2 When transfers are made into fueling facility containers, the LNG shall be transferred at a pressure that shall not over-pressurize the receiving container. Venting of onsite containers shall only be done under emergency conditions and in a manner acceptable to the authority having jurisdiction.

4.3.3 The transfer piping shall have isolation valves at both ends. On facility containers with a capacity greater than 7.6 m^3 (2000 gal), one remotely operated valve, automatic closing valve, or check valve shall be used to prevent backflow.

4.3.4 If the fueling facility container or transfer equipment is located in a remote area, operating status indicators, such as those that indicate container level, shall be provided in the unloading area.

4.3.5 At least one qualified person shall be in continuous attendance and shall have an unobstructed view of the transfer point while unloading is in progress.

4.3.6 Sources of ignition shall not be permitted in the unloading area while transfer is in progress. Offloading site methane detection and fire protection shall be provided. The methane detection system shall be capable of detection at multiple locations beyond the full radius of the transfer hose, measured at each point of transfer and receipt of LNG.

4.3.7 Bleed or vent connections shall be provided so that loading arms and hoses can

leakage.

4.4.9 The fueling connector either shall be equipped with an interlock device that prevents release while the line is open or shall have self-closing ends that automatically close upon disconnection.

4.4.10 The transfer of LNG into vehicular fuel containers shall be performed in accordance with manufacturer's instructions. The spacing of LNG fueling equipment relative to other equipment, activities, nearby property lines, and other exposures in a fuel fueling forecourt shall be approved by the competent department.

4.4.11 The provisions of Subclause 12.4 shall not apply to fueling from vehicle-mounted containers located at commercial and industrial facilities used in connection with their business where the following conditions are met:

a) An inspection of the premises and operations shall have been made and approval granted by the competent department.

b) The vehicle-mounted container shall comply with requirements of GB 18442.

c) The fueling hose shall not exceed 15 m (50 ft) in length.

d) Nighttime fueling shall be made only in lighted areas.

4.5 Piping systems and components

Piping shall be in accordance with 5.9.

4.6 Safety and relief valves

4.6.1 Pressure relieving safety devices shall be so arranged that the possibility of damage to piping or appurtenances is reduced to a minimum. The means for adjusting relief valve set pressure shall be sealed. Stationary containers shall be equipped with pressure relief devices in accordance with ISO 15500.

4.6.2 A thermal expansion relief valve shall be installed as required to prevent overpressure in any section of a liquid or cold vapor pipeline that can be isolated by valves.

4.6.2.1 Thermal expansion relief valves shall be set to discharge above the maximum pressure normally expected in the line but less than the rated test pressure of the line it protects.

4.6.2.2 Discharge from thermal expansion relief valves shall be directed so as to minimize hazard to personnel and other equipment.

4.7 Corrosion resistant

4.9.4 Relief valves on heated vaporizers shall be located so that they are not subjected to temperatures exceeding 60°C (140°F) during normal operation unless they are designed to withstand higher temperatures.

4.9.5 The combustion air required for the operation of integral heated vaporizers or the primary heat source for remote heated vaporizers shall be taken from outside an enclosed structure or building.

4.9.6 Vaporizers for purposes other than pressure building coils or LNG-CNG systems shall be in accordance with the requirements of GB/T 20368.

4.10 LNG-CNG systems

4.10.1 Subclause 4.10 shall apply to the design, construction, installation, and operation of equipment used to produce CNG from LNG. The process shall be permitted to be accomplished by pumping LNG to high pressure and vaporizing it or by compressing vapor from an LNG container.

4.10.2 This Standard does not cover CNG containers and CNG containers and equipment located downstream of CNG containers.

4.10.3 In addition to the emergency shutdown systems described in ISO 15500, the emergency shutdown system also shall shut off the liquid supply and power to the LNG transfer equipment necessary for producing CNG from LNG.

4.10.4 Compressors, vaporizers and CNG storage cylinders shall not be located inside the facility impounding area.

Exception: Ambient and remotely heated vaporizers shall be permitted to be located inside the facility impounding area.

4.10.5 Transfer piping, pumps, and compressors shall be protected from vehicle collision damage.

4.11 Instruments

4.11.1 Pressure gauge

Pressure gauges shall be installed on each pump and compressor outlet.

4.11.2 Temperature gauge

4.11.2.1 Vaporizers and heaters shall be provided with instruments to monitor outlet temperatures.

Exception: Ambient pressure-building coil vaporizers that are fed with liquid from, and return vapor to, a container.

4.12.7 Where primary seals are installed, drains, vents, or other devices shall be provided for monitoring purposes to detect flammable fluids and leakage.

4.12.8 Static protection shall not be required when cargo transport containers are loaded or unloaded by conductive or nonconductive hose, flexible metallic tubing or pipe connections of tight and reliable metallic couplings.

4.13 Maintenance

4.13.1 A preventive maintenance program shall be in place and shall include a written regular schedule of procedures for test and inspection of facility systems and equipment. The maintenance program shall be carried out by a qualified representative of the equipment owner. Maintenance shall be performed based on the component manufacturers' recommendations and not less than every 6 months. The fueling site shall have a maintenance program or process safety analysis program in place. Maintenance records shall be kept permanently.

4.13.2 Each component in service, including its support system, shall be maintained in a condition that is compatible with its operation or safety purpose by repair, replacement or other means.

4.13.3 If a safety device is taken out of service for maintenance, the component being served by the device shall be taken out of service unless the same safety function is provided by an alternative means.

4.13.4 If the inadvertent operation of a component taken out of service could cause a hazardous condition, that component shall have a tag attached to its controls bearing the words “Do Not Operate” or a similar warning.

4.13.5 LNG fueling facilities shall be free from rubbish, debris and other material that present a fire hazard. Grass areas on the LNG fueling facility grounds shall be maintained in a manner that does not present a fire hazard.

4.13.6 Safety and fire protection equipment shall be tested or inspected at intervals not to exceed 6 months.

4.13.7 Maintenance activities on fire control equipment shall be scheduled so that a minimum of equipment is taken out of service at any one time and fire prevention safety is not compromised. Access routes for movement of fire control equipment to an LNG fueling facility shall be maintained at all times.

5 Installation requirements for containers

5.1 Application

This Clause provides requirements for the installation, design, fabrication and siting of LNG containers of not more than 265 m^3 (70 000 gal) capacity and their associated equipment for use in applications such as vehicular fueling facilities and dedicated fuel supply for commercial and industrial applications, which are designed and constructed in accordance with the requirements of GB 150 and GB 18442.

5.2 General requirements

Storage and transfer equipment at unattended facilities shall have security measures be designed to prevent misuse.

5.3 Containers

5.3.1 All piping of an LNG container, including piping between the inner and outer containers, shall be in accordance with the requirements of GB 150 and GB/T 20801.

5.3.2 Internal piping within the insulation space between the inner container and the outer container shall be designed for the maximum allowable working pressure of the inner container, with allowance for the thermal stresses. Bellows shall not be permitted within the insulation space.

5.3.3 Containers shall be double-walled with the inner container holding LNG surrounded by insulation contained within the outer container.

5.3.4 The inner container shall be of welded construction and in accordance with the requirements of GB 150 and GB 18442.

5.3.5 The inner container supports shall be designed for shipping, seismic and operating loads. The support system to accommodate the expansion and contraction of the inner container shall be designed so that the resulting stresses imparted to the inner and outer containers are within allowable limits.

5.3.6 The outer container shall be of welded construction and meet the following requirements:

a) Carbon steel materials for outside container shall meet the requirements of GB 150 and GB 18442;

b) For containers using vacuum insulation, the design of the outer container shall meet the requirements of GB 150 and GB 18442;

c) Any portion of the outer container surface that could be exposed to LNG temperatures shall be suitable for such temperatures or protected from the effects of such exposure.

d) The outer container shall be equipped with a relief device or other device to release internal pressure. The discharge area shall be at least 0.07 mm^2/kg

NOTE 3: T - structure self-vibration period(s) (see 14.2.6 in GB 50191-1993);
NOTE 4: T_g - characteristic period(s) (see 5.1.5.2 in GB 50191-1993).

Figure 2 Seismic impact coefficient curve

The container and its supports shall be designed for the resultant seismic forces in combination with the operating loads, using the allowable stress increase shown in the code or standard used to design the container or its supports.

5.3.8 Each container shall be identified by the attachment of a nameplate marked with the information required by the Nameplate Identification Code and all the following:

a) Manufacture's name and date of manufacture;

b) Nominal liquid capacity;

c) Design pressure at the top of the container;

d) Maximum permissible liquid density;

e) Maximum filling level;

f) Minimum design temperature;

5.3.9 All penetrations on storage containers shall be identified and legible.

5.4 Container foundations and supports

5.4.1 LNG container foundations shall be designed and constructed in accordance with recognized structural and geotechnical engineering practices including provisions for seismic loading as specified in 5.3.7. Saddles and legs shall be designed in accordance with recognized structural engineering practice, including for shipping loads, erection loads, wind loads, and thermal loads. Foundations and supports shall be protected to have a fire resistance rating of not less than 2 hours. If insulation is used to achieve this requirement, it shall be resistant to dislodgment by fire hose streams.

5.4.2 Where the LNG storage container is installed in an area subject to flooding, the container shall be secured in a manner that will prevent release of LNG or flotation of the container in the event of a flood.

5.5 Container installation

5.5.1 The minimum separation distance between LNG containers and exposures shall be in accordance with Table 4.

Exception: Approved by the competent authority, these devices are allowed to be installed

with two backflow valves, in series, to meet the requirements in 5.6 a) to c). These valves shall be installed as close to the container as possible so that a break resulting from strain shall occur on the external connecting piping while maintaining intact with the valve and piping on the container side.

5.7 Inspection

5.7.1 Prior to initial operation, containers shall be inspected to ensure compliance with the engineering design and material, fabrication, assembly, and test provisions of the clause. The operator shall be responsible for this inspection.

5.7.2 Performance of any part of the inspection shall be permitted to be delegated to inspectors who are employees of the operator's own organization, an engineering or scientific organization, or a recognized insurance or inspection company. Inspectors shall be qualified in accordance with relevant standards.

5.8 Testing and purging of LNG containers

5.8.1 LNG containers shall be leak-tested in accordance with the governing construction code or standard. All leaks shall be repaired.

5.8.1.1 Testing shall be performed in accordance with the GB 150 and GB 18442. Container vacuum shall meet the requirements of GB 18442.

5.8.1.2 Shop-built containers shall be pressure tested by the manufacturer prior to shipment to the installation site. The inner container shall be tested in accordance with GB 150. The outer container shall be leak-tested. Piping shall be tested in accordance with Clause 6 of GB/T 20368-2006.

5.8.1.3 Containers and associated piping shall be leak-tested prior to filling the container with LNG.

5.8.1.4 Containers shall be shipped with a minimum internal pressure of 169 kPa (10 psi) inert gas.

5.8.2 After acceptance tests are completed, there shall be no field welding on the LNG containers. Retesting by a method appropriate to the repair or modification shall be required only where the repair or modification is of such a nature that a retest actually tests the element affected and is necessary to demonstrate the adequacy of the repair or modification.

Exception 1: Field welding shall be permitted on saddle plates or brackets provided for the purpose.

Exception 2: Field welding shall be permitted where such repairs or modifications comply with the code or standard under which the container was fabricated originally.

Instrumentation for LNG facilities shall be designed such that, in the event of power or instrument air failure, the system will go into a fail-safe condition that can be maintained until the operators can take action to reactivate or secure the system.

5.10.2 Liguid level gauge

LNG containers shall be equipped with two independent liquid level devices. One shall be a fixed-length dip tube, and the other shall be a continuous indication from full to empty and shall be maintainable or replaceable without taking the container out of service.

Exception: Containers smaller than 3.8 m^3 (1000 gal) shall be permitted to be equipped with a fixed-length dip tube only.

5.10.3 Pressure gauge

5.10.3.1 Each container shall be equipped with a pressure gauge connected to the container at a point above the maximum liquid level. The pressure gauge dial shall have a permanent mark indicating the maximum allowable working pressure (MAWP) of the container.

5.10.3.2 Vacuum-jacketed equipment shall be equipped with instruments or connections for checking the pressure in the annular space.

5.11 Pressure control

5.11.1 Safety relief valves shall be provided to maintain the internal pressure of LNG containers in accordance with Annex B of GB 150-1998, including under conditions resulting from operational upset, vapor displacement, and flash vaporization during filling; flash vaporization resulting from pump recirculation; and fire. The valves shall communicate directly with the atmosphere. The valves shall be sized in accordance with 4.7.3 of GB/T 20368-2006.

5.11.2 Each pressure- and vacuum-safety relief valve for LNG containers shall be able to be isolated from the container for maintenance or other purposes by means of a manual full-opening stop valve. This stop valve (or valves) shall be lockable or sealable in the full-open position. Sufficient pressure and vacuum relief valves shall be installed on the LNG container to allow each relief valve to be isolated individually for testing or maintenance while maintaining the full capacities determined in 4.7.3 of GB/T 20368-2006. When only one relief device is required, a full-port-opening three-way valve shall be permitted to be used under the relief device and its required spare in lieu of individual valves beneath each relief device.

5.11.3 Stop valves under individual safety relief valves shall be locked or sealed when opened and shall not be opened or closed except by an authorized person.

6.3 Ignition source control

6.3.1 Smoking and ignition sources shall be prohibited, except in accordance with 6.3.2.

6.3.2 Welding, oxygen–acetylene cutting and similar operations shall be conducted only when and where specifically authorized and in accordance with the provisions of GB 9448-1999 “Safety in welding and cutting”.

6.3.3 Vehicles and other mobile equipment that constitute a potential ignition source shall be prohibited except where specifically authorized and under constant supervision or when at a transfer point specifically for the purpose of transfer.

6.3.4 Vehicles delivering LNG to the facility or vehicles being fueled from the facility shall not be considered sources of ignition. Vehicles containing other fuel equipment shall be considered a source of ignition unless all sources of ignition (including pilot lights, electric igniters, burners, electrical appliances and engines) located on the fueling vehicle are shut off completely before entering an area where ignition sources are prohibited.

6.4 Personnel safety and training

6.4.1 Qualification of personnel

All persons employed in handling and fueling LNG shall be trained in proper handling and operating duties and procedures. The procedure shall be written. The training document shall be available at the time of verification by the competent authority.

6.4.2 Protective clothing, face shield/goggles and gloves shall be provided for all operators of fueling and handling LNG.

Exception: Where equipment is demonstrated to operate without release of LNG or cold gases.

6.4.3 Training shall be conducted upon employment and every 2 years thereafter. Training shall include the following:

a) Information on the nature, properties and hazards of LNG in both the liquid and gaseous phases;

b) Specific instructions on the facility equipment to be used;

c) Information on materials that are compatible for use with LNG;

d) Use and care of protective equipment and clothing;

e) Standard first aid and self-aid instruction;

f) Response to emergency situations such as fires, leaks, and spills;

g) Good housekeeping practices;

h) Emergency response plan as required in 6.2.3;

i) Evacuation and fire drills.

6.5 Security

The LNG fueling facility shall provide protection to minimize unauthorized access and damage to the facility. Security procedures shall be posted in readily visible areas near the fueling facility.

6.6 Hazard detection

Gas leak detection and fire detection devices shall be installed based on the evaluation requirement in 6.2.1.

6.7 Parking of LNG vehicles

LNG vehicles shall be permitted to be parked indoors, provided such facilities or vehicles are equipped to prevent an accumulation of gas in a combustible mixture or the onboard fuel storage container and fuel system are drained of LNG and purged with inert gas or depressurized.

6.8 Warning signs

For all LNG fueling facilities, the following signs shall be displayed in letters not less than 152 mm (6 in.) high:

a) “No Smoking” or “No Smoking within 7.6 m (25 ft)”;

b) “Stop Motor”;

c) “No Open Flames Permitted”;

d) “Cryogenic Liquid or Cold Gas”;

e) “Flammable Gas”.

Bibliography

[1] NFPA Publications

National Fire Protection Association, 1 Batterymarch Park, P. O. Box 9101, Quincy, MA 02296-9101.

NFPA 30A, Code for Motor Fuel Fueling Facilities and Repair Garages, 1996 edition.

NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, 1998 edition.

NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, 1999 edition.

NFPA 52, Compressed Natural Gas (CNG) Vehicular Fuel Systems Code , 1998 edition.

NFPA 57, Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code, 2002 edition.

NFPA 59A, Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG), 1996 edition.

NFPA 70, National Electrical Code, 1999 edition.

NFPA 80, Standard for Fire Doors and Fire Windows, 1999 edition.

NFPA 220, Standard on Types of Building Construction, 1999 edition.

NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, 1996 edition.

[2] ANSI Publications

American National Standards Institute, Inc., 11 West 42nd Street, 13th Floor, New York, NY 10036.

ANSI Z87-1, Practice for Occupational and Educational Eye and Face Protection, 1991.

ANSI Z89-1, Personal Protection - Protective Headwear for Industrial Workers - Requirements, 1997.

[3] API Publication

American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005.

API 620, Design and Construction of Large, Welded, Low-pressure Storage

Containers, 1996.

[4] ASME Publications

American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ASME B31.3, Process Piping, 1996.

ASME, Boiler and Pressure Vessel Code.

[5] ASTM Publications

American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

IEEE/ASTM SI 10, Use of the International System of Units (SI): The Modern Metric System, 1987.

ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube at 750 °C, 1996.

[6] CGA Publications

Compressed Gas Association, 1725 Jefferson Davis Highway, Chantilly, VA 22202-4100.

CGA S-1.1, Pressure Relief Device Standards - Part 3 - Stationary Storage Containers for Compressed Gases, 1995.

CGA 341, Standard for Insulated Cargo Container Specification for Nonflammable Cryogenic Liquids, 1995.

[7] ICBO Publication

International Conference of Building Officials, 5360 Workman Mill Road, Whitter, CA 90601.

ICBO, Uniform Building Code, 1997.

[8] NACE Publication

National Association of Corrosion Engineers, 1440 South Creek Drive, Houston, TX 77084.

NACE RP 0169, Control of External Corrosion of Underground or Submerged Metallic Piping Systems, 1996.

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