Public Input No. 21-NFPA 37-2021 [Section No. 1.3.1]

1.3.1*

This standard applies to stationary combustion engines and gas turbines. This standard also applies to portable engines that remain connected for use in the same location for a period of one week or more.
This standard does not apply to engines used to propel mobile equipment.

For engines used to drive fire pumps, see also NFPA 20 .

For engines used in essential electrical systems in health care facilities, see also NFPA 99 .

For engines used in emergency power supplies, see also NFPA 110 .

For engines installed on marine vessels for purposes other than propulsion, NFPA 37 should be used as a guide.

Statement of Problem and Substantiation for Public Input

This proposal essentially moves the A.1.3.1 annex material into the body of the code. The requirement for this standard not applying to engines used to propel mobile equipment should be in the body of the standard, not the annex.

Submitter Information Verification

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Submittal Date: Thu Dec 30 11:38:00 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-34-NFPA 37-2022

Statement: Because of the nature of NFPA 20, NFPA 99, and NFPA 110 to reference NFPA 37 as well, leaving the language in the annex is more appropriate. The language would have to be changed to mandatory language to be added to the requirements section, which is not appropriate in these cases.

The last sentence was changed to clarify that NFPA 37, which is a standard, should not be considered as a guide. The first sentence was changed to the last sentence such that it did not make the section look like a charging statement.

Public Input No. 1-NFPA 37-2021 [Section No. 2.2]

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2018 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2021 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2021 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2021 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2019 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2017 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2021 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2021 edition.

NFPA 54, *National Fuel Gas Code,* 2021 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2020 edition.

NFPA 70®, National Electrical Code®, 2020 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2019 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2019 edition.

NFPA 770, *Standard on Hybrid (Water and Inert Gas) Fire Extinguishing Systems,* 2021 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2021 edition.

NFPA 2010, *Standard for Fixed Aerosol Fire Extinguishing Systems* , 2020 edition.

Statement of Problem and Substantiation for Public Input

The use of Fixed Aerosol Fire Extinguishing systems as a "Total Flooding" method of protection for Combustion Turbines has been demonstrated and implemented on a limited basis. This is a precedent for application to Internal Combustion Engine installations as well. Additionally, the use of Fixed Aerosol Fire Extinguishing systems was recognized in NFPA 850 with the 2015 edition; hence, this change aligns NFPA 37 with existing guidance in NFPA 850.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2-NFPA 37-2021 [Section No. 11.4.1.1]	
Public Input No. 3-NFPA 37-2021 [Section No. 11.4.6]	

Submitter Information Verification

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Committee: INT-AAA

Committee Statement

Resolution: FR-26-NFPA 37-2022

Statement: The references are updated to comply with the NFPA Manual of Style. The proposed additions identified in the Public Inputs for this chapter were not included because they were resolved with committee statements.

Public Input No. 7-NFPA 37-2021 [Section No. 2.2]

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2018 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2021 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2021 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2021 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2019 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2017 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2021 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2021 edition.

NFPA 54, *National Fuel Gas Code,* 2021 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2020 edition.

NFPA 70®, National Electrical Code®, 2020 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2019 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2019 edition.

NFPA 770, *Standard on Hybrid (Water and Inert Gas) Fire Extinguishing Systems,* 2021 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2021 edition.

NFPA 2010, Standard for Fixed Aerosol Fire-Extinguishing Systems, 2020 edition

Statement of Problem and Substantiation for Public Input

NFPA 2010 standard for Fixed Aerosol Fire-Extinguishing Systems are equivalent to the fire protection systems listed in NFPA 37, 2.2 NFPA Publications and the fire suppression systems listed in NFPA 37, 11.4.1.1. NFPA 2010 fire suppression systems are listed and tested to the same requirements as NFPA 2001 clean agent systems. NFPA 2010 is listed in the International Fire Code and International Building Code, and approved for use by various state fire codes. These systems are also listed in the US EPA SNAP list.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 6-NFPA 37-2021 [Section No. 11.4]	Addition of NFPA 2010 standard
Public Input No. 6-NFPA 37-2021 [Section No. 11.4]	

Submitter Information Verification

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Committee: INT-AAA

Committee Statement

Resolution: FR-26-NFPA 37-2022

Statement: The references are updated to comply with the NFPA Manual of Style. The proposed additions identified in the Public Inputs for this chapter were not included because they were resolved with committee statements.

Public Input No. 23-NFPA 37-2021 [Section No. 2.3.5]

2.3.5 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, 2010, revised 2021 .

UL 429, *Electrically Operated Valves*, 2013, revised 2021 .

UL 900, *Standard for Air Filter Units*, 2015.

UL 959, *Medium Heat Appliance Factory-Built Chimneys*, ~~2010~~ 2019 .

UL 1489 Fire Resistant Pipe Protection Systems Carrying Combustible Liquids, 2016, revised 2021.

UL 2200 Stationary Engine Generator Assemblies, 2020.

Statement of Problem and Substantiation for Public Input

Update UL edition references. Added UL 1489 and UL 2200, see associated public input. Remove "Standard for" since the term is redundant and unnecessary. All references to UL publications are standards.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 24-NFPA 37-2021 [Section No. 6.8.2]	
Public Input No. 29-NFPA 37-2022 [Section No. 4.5.1]	

Submitter Information Verification

Submitter Full Name: Kelly Nicolello
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Submittal Date: Thu Dec 30 11:42:23 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-26-NFPA 37-2022

Statement: The references are updated to comply with the NFPA Manual of Style. The proposed additions identified in the Public Inputs for this chapter were not included because they were resolved with committee statements.

Public Input No. 13-NFPA 37-2021 [Chapter 3]

Chapter 3 Definitions

3.1 General.

The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved.

Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled.

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

3.2.4* Listed.

Equipment, materials, or services included in a list published by an organization that 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.

3.2.5 Shall.

Indicates a mandatory requirement.

3.2.6 Should.

Indicates a recommendation or that which is advised but not required.

3.2.7 Standard.

An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Class I Fuel.

For the purpose of this standard, any liquid fuel having a flash point below 37.8°C (100°F).

3.3.2 Combustible (Material).

A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible or limited-combustible. [***101,*** 2021]

3.3.3* Enclosure.

A cover or housing intended to protect an engine and related equipment.

3.3.4 Engines.

Prime movers such as internal combustion engines, external combustion engines, gas turbine engines, rotary engines, and free piston engines using either gaseous fuels or liquid fuels or combinations thereof.

3.3.4.1 Combustion Gas Turbine Engines.

An engine that produces shaft power utilizing the Brayton (joule) cycle, where atmospheric air is drawn in and compressed and the compressed air then flows into a combustion chamber where fuel is injected and continuous combustion occurs, resulting in high-pressure hot gas to the expansion section (turbine) where the heat energy is converted to rotating, mechanical energy.

3.3.4.2* Engines for Emergency Use.

Engines that operate under limited-use conditions to support critical operations in the protection of life, property, or both.

3.3.4.3 Portable Engines.

Engines mounted on skids, wheels, or otherwise arranged so that they can be moved from place to place as the required service dictates.

3.3.4.4* Reciprocating Engines.

An engine that uses a spark plug to ignite a fuel–air mixture (e.g., Otto cycle engine) or an engine in which high-pressure compression raises the air temperature to the ignition temperature of the injected fuel (e.g., diesel cycle engine).

3.3.5 Flue Gas Temperature.

The temperature of the flue products at the point or points of passing close to or through combustible materials or at the entrance to a chimney, whichever is applicable.

3.3.6 Gas Train.

The portion of the fuel gas supply piping starting with and including the equipment isolation valve and extending to the point at which the fuel enters the prime mover.

3.3.7 Hazardous Location.

An area where flammable or combustible gases or liquids or combustible dusts or flyings usually exist.

3.3.8* Horsepower Rating (Reciprocating Engines).

The power of an engine measured at the flywheel or output shaft at standard SAE conditions of 752.1 mm Hg (29.61 in. Hg) barometer and at 25°C (77°F) inlet air temperature.

3.3.9 Inlet Gas Pressure.

The pressure at the outlet of the equipment isolation valve.

3.3.10 Line Pressure Regulator.

A pressure regulator placed in a gas line between the service regulator and the appliance [engine] regulator. [**54**, 2021]

3.3.11 Overpressure Protection Device.

A pressure-limiting or pressure-relieving device that prevents the downstream pressure from exceeding its set point.

3.3.12 Rated Pressure.

The maximum internal and external pressures that the materials, devices, or components are designed to contain or control.

3.3.13 Remote Location.

A location suitably separated from the engine installation so as to be accessible during an engine fire.

3.3.14 Service Regulator.

A pressure regulator installed by the serving gas supplier to reduce and limit the service line gas pressure to delivery pressure. [**54**, 2021]

3.3.15 Spark Protected.

Electrical equipment enclosed in a tight case or protected by shields, screens, or insulation that contains sparks or prevents their emission.

3.3.16 Tank.

3.3.16.1 Engine-Mounted Tank.

A fuel tank furnished and mounted on the engine or engine-frame by the engine manufacturer.

3.3.16.2* Fuel Tank.

A tank containing fuel for an engine(s).

3.3.16.3 Secondary Containment Tank.

A tank that has an inner and outer wall with an interstitial space (annulus) between the walls and that has a means for monitoring the interstitial space for a leak. [**30**, 2021]

3.3.17 Valve.

3.3.17.1* Automatic Safety Shutoff Valve (ASSV).

A valve that, upon shutdown conditions, will automatically stop the flow of gas to the engine or turbine. *(See 5.4.4 and 5.4.5.)*

3.3.17.2 Automatic Safety Vent Valve.

A valve that, upon closing of the automatic safety shutoff valves (ASSVs), automatically vents the volume of gas between the two ASSVs to atmosphere.

3.3.17.3 Carburetion Valve.

A control valve that meets the functional requirements of an automatic safety shutoff valve (ASSV) by being capable of automatically stopping the flow of gas to the engine.

3.3.17.4* Equipment Isolation Valve.

The manually operated valve that isolates the balance of the gas train and the prime mover from the gas supply.

3.3.17.5 Vent Valve.

A valve used to allow venting of air or gas from the system to the atmosphere. [**85**, 2019]

3.3.18 Zero Governor Regulator.

A gas pressure regulator equipped with a counter spring beneath the valve that requires an external impulse signal such as top loading with pressure or generating vacuum in the downstream piping.

3.3.19 ***Proof-of-Closure Switch.*** A switch installed in a safety shutoff valve that activates only after the valve is fully closed.

Statement of Problem and Substantiation for Public Input

The term is used in the current edition, and it's a unique term with a specific design intent. The proposed definition is the same language used in NFPA 85, 86, and 87.

Submitter Information Verification

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Submittal Date: Wed Dec 22 13:18:17 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-36-NFPA 37-2022

Statement: The term is used in the current edition, and it is a unique term with a specific design intent. The proposed definition is the same language used in NFPA 85, 86, and 87, and this definition is extracted from NFPA 86. The term is also defined in FM 7400 and ANSI Z21.21.

Public Input No. 32-NFPA 37-2022 [New Section after 3.3.4]

Exhaust System.

An assembly of connected ducts, plenums, fittings, registers, grilles, or hoods installed on or through a structure, that are used to convey combustion gas byproduct from an engine.

Statement of Problem and Substantiation for Public Input

Chapter 8 includes requirements for exhaust systems. A new definition is proposed to provide clarity on what an exhaust system is.

Submitter Information Verification

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Submittal Date:	Wed Jan 05 15:15:01 EST 2022
Committee:	INT-AAA

Committee Statement

Resolution: Exhaust systems may consist of many types of components and this definition could be limiting. For example, there could be carbon capture systems that may require additional processing. There are already requirements in Chapter 8 that describe exhaust systems. The definition, to be all inclusive, could be too general to be useful. The definition should also include the disposition of heat as well as exhaust.

Public Input No. 14-NFPA 37-2021 [Chapter 4]

Chapter 4 Engines — General Requirements

4.1 Engine Locations.

4.1.1 General Requirements.

4.1.1.1

Engines shall be situated so that they are readily accessible for maintenance, repair, and fire fighting.

4.1.1.2*

The air supply shall be designed to meet at least the minimum requirements for combustion, cooling, and ventilation and to prevent flue gas products from being drawn from stacks or flues of boilers or other combustion devices.

4.1.1.3*

Combustible materials shall not be stored in rooms or enclosures housing engines, other than those combustible materials required for day-to-day operations/maintenance. Such materials shall be stored properly.

4.1.1.4

Engines fueled by a Class I fuel or by liquid-phase LP-Gas shall not be installed in rooms containing fired equipment or open flames.

4.1.1.5

Combustion air filters mounted directly on engines or turbines shall be listed in accordance with ANSI/UL 900, *Standard for Air Filter Units*.

4.1.2 Engines Located in Structures.

4.1.2.1* Engine Rooms.

4.1.2.1.1

Engine rooms located within structures shall have interior walls, floors, and ceilings of at least 1-hour fire resistance rating, unless otherwise permitted by 4.1.2.1.2.

4.1.2.1.2

The ceiling of rooms located on the top floor of a structure shall be permitted to be noncombustible or protected with an automatic fire suppression system.

4.1.2.1.3*

Engine rooms shall have ventilation that is adequate to prevent a hazardous accumulation of vapors, gases, or heat, both when the engine is operating and when it is shut down.

4.1.2.1.4

Engine rooms attached to structures shall comply with 4.1.2.2.1 and 4.1.2.2.3 except that the common wall shall have a fire resistance rating of at least 1 hour.

4.1.2.1.5*

Openings from an engine room to other sections of the structure shall be provided with automatic or self-closing fire doors or dampers corresponding to the rating of the walls in which they are located.

4.1.2.1.6

Rooms containing engines utilizing a Class I fuel shall be located on an exterior wall, the construction of which shall provide ready accessibility for fire-fighting operations through the provision of doors, access openings, windows, louvers, or lightweight, noncombustible wall panels.

4.1.2.2 Dedicated Detached Structures.

4.1.2.2.1*

Dedicated detached structures shall be of noncombustible or fire-resistive construction.

4.1.2.2.2

Dedicated detached structures shall be located at least 1.5 m (5 ft) from openings in walls and at least 1.5 m (5 ft) from structures having combustible walls. A minimum separation shall not be required where any of the following conditions exist:

(1) The exposing wall of the detached structure has a fire resistance rating of at least 1 hour.

(2) The exposed wall of the adjacent structure has a fire resistance rating of at least 1 hour.

(3) The detached structure is protected by an automatic fire protection system.

4.1.2.2.3*

Dedicated detached structures shall have ventilation designed to prevent a hazardous accumulation of vapors, gases, or heat, both when the engine is operating and when it is shut down.

4.1.3 Engines Located on Roofs.

4.1.3.1

Engines and, if provided, their weatherproof housings that are installed on roofs of structures shall be located at least 1.5 m (5 ft) from any openings in the walls of structures.

4.1.3.2

Engines and, if provided, their weatherproof housings that are installed on roofs or structures shall be located at least 1.5 m (5 ft) from structures having combustible walls, except as provided in 4.1.3.2.1through 4.1.3.2.4.

4.1.3.2.1

A clearance less than 1.5 m (5 ft) shall be permitted where all portions of the structure that are closer than 1.5 m (5 ft) from the engine enclosure have a fire resistance rating of at least 1 hour.

4.1.3.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures.

4.1.3.2.3

If an engine assembly includes a nonrated fuel tank, the testing in 4.1.3.2.2 shall include the fuel tank.

4.1.3.2.4

A clearance less than 1.5 m (5 ft) shall be permitted where calculations performed under engineering supervision demonstrate that a fire originating at the engine or within its weatherproof housing will not ignite combustible structures.

4.1.3.3*

An oil containment system consisting of a curb or dike having a capacity at least equal to the total capacity of the lubricating oil system or the liquid fuel system, whichever is greater, shall be provided.

4.1.3.3.1

This system shall also comply with applicable requirements of Chapter 6.

4.1.3.4*

The surface beneath the engine and beyond the engine and the oil containment dike shall be noncombustible to a minimum distance of 300 mm (12 in.).

4.1.4 Engines Located Outdoors.

4.1.4.1

Engines and, if provided, their weatherproof housings that are installed outdoors shall be located at least 1.5 m (5 ft) from any openings in the walls of structures.

4.1.4.2

Engines and, if provided, their weatherproof housings that are installed outdoors shall be located at least 1.5 m (5 ft) from structures having combustible walls except as provided in 4.1.4.2.1through 4.1.4.2.4.

4.1.4.2.1

A clearance less than 1.5 m (5 ft) shall be permitted where all portions of structures that are closer than 1.5 m (5 ft) from the engine enclosure have a fire resistance rating of at least 1 hour.

4.1.4.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures.

4.1.4.2.3

If an engine assembly includes a nonrated fuel tank, the testing in 4.1.4.2.2 shall include the fuel tank.

4.1.4.2.4

A clearance less than 1.5 m (5 ft) shall be permitted where calculations performed under engineering supervision demonstrate that a fire originating at the engine or within its weatherproof housing will not ignite combustible structures.

4.2* Support of Engines.

Engines shall be supported in accordance with the manufacturer's instructions.

4.3* Hazardous Locations.

In hazardous locations, engines that neither compress a flammable gas nor pump a flammable liquid shall meet the following three criteria:

(1) They shall be installed in an enclosure or room of fire-resistive construction.

(2) They shall be ventilated from a nonhazardous outside area.

(3) They shall have a defined emergency egress path(s) acceptable to the authority having jurisdiction.

4.4 Engines Handling Hazardous Materials (Other Than Their Own Fuel Supply).

4.4.1

The use of an engine-driven unit to compress a flammable gas or to pump a flammable liquid shall be permitted provided the combination unit or groups of such combined units are isolated from areas not having a similar hazard.

4.4.2*

Isolation shall be permitted to be achieved by either locating the unit outdoors or employing indoor structural separation in accordance with 4.1.2, except as modified by all of the following:

(1) Provision shall be made for the venting of an explosion.

(2) Rooms containing combustion engines located within structures shall have interior walls, floors, and ceilings of at least 2-hour fire resistance rating.

(3) The rooms or structures described in 4.4.2(2) shall be ventilated in an approved manner from a nonhazardous area.

4.4.3 Engine Accessories for Hazardous Locations.

4.4.3.1

Each spark-ignition engine comprising part of a unit that compresses a flammable gas or pumps a flammable liquid shall have magnetos or distributors and coils of the spark-protected type. All leads shall be positively attached.

4.4.3.2

Ventilation openings in such devices shall be protected by a fire screen unless the device is purged, pressurized, or otherwise protected in an approved manner.

4.4.3.3

Ignition wires shall be positively attached at each end by use of the outer sheath of the insulation.

4.4.3.4

Spark plugs shall be fully shielded against flashover. Fully radio-shielded spark plugs or spark plugs provided with insulating boots shall be permitted.

4.4.3.5

Flame-arresting equipment shall be attached to the engine air intake to avoid blowoff or rupture. A mechanically attached air filter shall be permitted to meet this requirement.

4.4.3.6

Starter, generator, and associated electrical equipment attached to engines shall be of the spark-protected type.

4.4.3.7

Fan belts shall be electrically conductive (nonsparking).

4.5 Electrical Installations.

4.5.1

Electrical installations shall comply with *NFPA 70*.

4.5.2*

Engine rooms, enclosures, or other locations shall not be classified as hazardous locations as defined in Article 500 of *NFPA 70* solely by reason of the engine fuel, lubricating oil, or hydraulic fluid.

4.5.3 Engine Wiring.

Wire and insulation materials shall have all of the following characteristics:

(1) Capacity to remain flexible over typical engine operating temperature ranges

(2) Capacity to have the minimum possible absorption of oils, fuels, and other fluids commonly found on or near the engine

(3) Rated for continuous use at the maximum range of temperatures that will occur where installed

4.5.3.1

Wiring shall be protected by either fuses or circuit breakers in accordance with its ampacity.

4.5.3.2

The wire shall be stranded annealed copper.

4.5.3.3

The ground circuits on engine wiring shall be permitted to be any of the following:

(1) Green

(2) Green with yellow trace

(3) Braided uninsulated cable

4.5.3.4*

Electrical control circuits on engines not for emergency use shall be designed to shut down the engine automatically in the event of breaking, disconnecting, or cutting of the control wire.

4.5.3.5

The requirements of 4.5.3 shall not apply to ignition wiring, thermocouples, or microprocessor wiring.

4.5.4

Batteries, wiring, and electrical devices shall be protected against arcing and accidental shorting.

4.6* General Installation Requirements.

Engines and their appurtenances shall be installed in accordance with the following:

(1) Applicable NFPA codes and standards

(2) Industry standards

(3) User requirements

(4) Manufacturer's installation instructions

(5) * Applicable local building codes with respect to wind and seismic design requirements.

4.7 Commissioning and Testing

Commissioning.

Commissioning shall be required for all new installations or for any changes that affect the safety system.

All apparatus shall be installed and connected in accordance with the system design.

During commissioning, all gas piping that shall be tested for leaks.

Annex: leak testing should be according to NFPA 54 or similar methods

The engine or turbine shall not be released for operation before the installation and testing of the required safety systems have been successfully completed.

Safety system logic and safety interlocks shall be tested and verified for compliance with the design criteria when the safety system logic or any safety interlock is installed, replaced, repaired, or updated.

Documentation shall be provided that confirms that all related safety devices and safety logic are functional.

Any changes to the original design made during commissioning shall be reflected in the documentation.

Set points of all safety interlock settings shall be documented.

A confirmed source of flammable gas shall be provided to the inlet of the equipment isolation valve(s) each time a flammable gas supply is placed into service or restored to service (see NFPA 56).

Inspection, Testing, and Maintenance.

It shall be the responsibility of the engine or turbine manufacturer to provide instruction for inspection, testing, and maintenance.

Safety devices shall be maintained in accordance with the manufacturer's instructions.

It shall be the responsibility of the user to establish, schedule, and enforce the frequency and extent of the inspection, testing, and maintenance program, as well as the corrective action to be taken.

All safety interlocks shall be tested for function at least annually.

The set point of temperature, pressure, or flow devices used as safety interlocks shall be verified at least annually.

Safety device testing shall be documented at least annually.

Statement of Problem and Substantiation for Public Input

Recommend adding a section in NFPA 37 regarding the commissioning and testing of the engine or turbine. Most of the language is copied from NFPA 86.

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Submittal Date:	Wed Dec 22 13:20:59 EST 2021
Committee:	INT-AAA

Committee Statement

Resolution: The proposed language does not include a definition of commissioning, which can carry liability. Requirements on commissioning is available in other codes and standards. Annex B is already available with additional information. Installation and acceptance testing for emergency power is already covered in NFPA 110. NFPA 20 also has acceptance testing requirements as well.

Public Input No. 35-NFPA 37-2022 [Section No. 4.1.3.2.2]

4.1.3.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures. Weatherproof housings supplied with the engine or intended to be installed on the engine shall be included in the fire test.

Statement of Problem and Substantiation for Public Input

The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. For instance if there is a combustible within the engine or its weatherproof housing, is it always available? Sometimes a combustible within the engine or its weatherproof housing is not available if the design includes measures taken to protect that combustible from the fire. Also text is modified to provide clarity that the fire is to originate at the engine regardless of the final configuration. Open or enclosed. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its weatherproof housing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 30-NFPA 37-2022 [Section No. 4.1.4.2.2]	
Public Input No. 30-NFPA 37-2022 [Section No. 4.1.4.2.2]	

Submitter Information Verification

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Submittal Date: Wed Jan 05 18:09:39 EST 2022

Committee: INT-AAA

Committee Statement

Resolution: FR-15-NFPA 37-2022

Statement: The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. "Weatherproof housings" was removed to prevent the requirement from being limited to only weatherproof housings. Enclosure is a defined term that includes housings. Sometimes a combustible within the engine or its enclosure is not available if the design includes measures taken to protect that combustible from the fire. This clarifies that the fire is to originate at the engine regardless of the final configuration. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its enclosure.

Public Input No. 11-NFPA 37-2021 [Section No. 4.1.4.2.2]

4.1.4.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures.

Informational Note: Available combustibles- Those combustibles consumed during the fire test that were not protected due to the inherent design of the generator.

Statement of Problem and Substantiation for Public Input

The word available is not defined which adds confusion to requirement 4.1.4.2.2. A reasonable interpretation of the existing requirement is combustible materials will be considered available if burning within the engine or engine compartment propagates and exposes the item to flames. Should an item not burn during testing due to the inherent design of the generator, i.e. a battery protected with insulation, a barrier inside the generator compartment, or if the burning within the engine or engine compartment does not propagate and ignite the item, then it will not be considered an available combustible.

Submitter Information Verification

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Submittal Date: Tue Dec 21 19:10:01 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-16-NFPA 37-2022

Statement: The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. "Weatherproof housings" was removed to prevent the requirement from being limited to only weatherproof housings. Enclosure is a defined term that includes housings. Sometimes a combustible within the engine or its enclosure is not available if the design includes measures taken to protect that combustible from the fire. This clarifies that the fire is to originate at the engine regardless of the final configuration. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its enclosure.

Public Input No. 27-NFPA 37-2022 [Section No. 4.1.4.2.2]

4.1.4.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures.

Informational Note: Available combustibles - An item is not considered an available combustible if it does not burn during the fire test due to the inherent design of the generator.

Statement of Problem and Substantiation for Public Input

The phrase "available combustibles" is not defined anywhere in NFPA 37.

Submitter Information Verification

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Submittal Date:	Mon Jan 03 17:39:36 EST 2022
Committee:	INT-AAA

Committee Statement

Resolution: FR-16-NFPA 37-2022

Statement: The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. "Weatherproof housings" was removed to prevent the requirement from being limited to only weatherproof housings. Enclosure is a defined term that includes housings. Sometimes a combustible within the engine or its enclosure is not available if the design includes measures taken to protect that combustible from the fire. This clarifies that the fire is to originate at the engine regardless of the final configuration. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its enclosure.

Public Input No. 28-NFPA 37-2022 [Section No. 4.1.4.2.2]

4.1.4.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test involving ~~consumption~~ the majority of the ~~available combustibles,~~ combustible materials within the engine or, if provided, its weatherproof housing demonstrates that a fire originating at the engine or its weatherproof housing will not ignite combustible structures.

Statement of Problem and Substantiation for Public Input

The wording "consumption of the available combustibles" is vague and difficult to determine compliance to. Complete consumption of the combustibles will never be achieved. Additionally, what constitutes an "available" combustible? If an enclosure is designed to prevent flame spread to certain areas, then should those areas be considered "available combustibles?"

Submitter Information Verification

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Submittal Date: Tue Jan 04 13:03:09 EST 2022
Committee: INT-AAA

Committee Statement

Resolution: FR-16-NFPA 37-2022

Statement: The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. "Weatherproof housings" was removed to prevent the requirement from being limited to only weatherproof housings. Enclosure is a defined term that includes housings. Sometimes a combustible within the engine or its enclosure is not available if the design includes measures taken to protect that combustible from the fire. This clarifies that the fire is to originate at the engine regardless of the final configuration. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its enclosure.

Public Input No. 30-NFPA 37-2022 [Section No. 4.1.4.2.2]

4.1.4.2.2*

A clearance less than 1.5 m (5 ft) shall be permitted where a fire test ~~involving consumption of the available combustibles, within the engine or, if provided, its weatherproof housing~~ demonstrates that a fire originating at the engine ~~or its weatherproof housing~~ will not ignite combustible structures. Weatherproof housings supplied with the engine or intended to be installed on the engine shall be included in the fire test.

Statement of Problem and Substantiation for Public Input

The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. For instance if there is a combustible within the engine or its weatherproof housing, is it always available? Sometimes a combustible within the engine or its weatherproof housing is not available if the design includes measures taken to protect that combustible from the fire. Also text is modified to provide clarity that the fire is to originate at the engine regardless of the final configuration. Open or enclosed. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its weatherproof housing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 35-NFPA 37-2022 [Section No. 4.1.3.2.2]	
Public Input No. 35-NFPA 37-2022 [Section No. 4.1.3.2.2]	

Submitter Information Verification

Submitter Full Name: Jeff Jonas
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Submittal Date: Wed Jan 05 11:45:36 EST 2022
Committee: INT-AAA

Committee Statement

Resolution: FR-16-NFPA 37-2022

Statement: The text "involving consumption of the available combustibles" has been removed because it has caused confusion when evaluating the results of a fire test. "Weatherproof housings" was removed to prevent the requirement from being limited to only weatherproof housings. Enclosure is a defined term that includes housings. Sometimes a combustible within the engine or its enclosure is not available if the design includes measures taken to protect that combustible from the fire. This clarifies that the fire is to originate at the engine regardless of the final configuration. If the installed configuration of the engine is enclosed, the fire test should be performed with the engine mounted in its enclosure.

Public Input No. 29-NFPA 37-2022 [Section No. 4.5.1]

4.5.1

Electrical installations shall comply with *NFPA 70*.

4.5.1.1

Stationary generators 600 volts and less shall be listed and labeled in accordance with UL 2200.

Exception: One of a kind or custom manufactured generators shall be permitted to be field labeled by a field evaluation body.

Statement of Problem and Substantiation for Public Input

The 2020 Edition of NFPA 70 added a new Section 445.6 which requires stationary generators 600 volts and less to be listed with an exception for one of a kind or custom manufactured generators which are permitted to be field labeled by a field evaluation body. Section 445.6 also contains an informational note that identifies UL 2200 as the product safety standard used to evaluate stationary engine generator assemblies. This proposal will align this section with the requirements in the 2020 National Electrical Code and in addition identifies the appropriate product safety standard.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 23-NFPA 37-2021 [Section No. 2.3.5]	

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Committee: INT-AAA

Committee Statement

Resolution: The submitter's concerns are addressed in NFPA 70 article 445.6 and this requirement may place unnecessarily limits on these generators.

Public Input No. 9-NFPA 37-2021 [Section No. 4.5.2]

4.5.2*

Engine rooms, enclosures, or other locations shall not be classified as hazardous locations as defined in Article 500 or 505 of *NFPA 70* solely by reason of the engine fuel, lubricating oil, or hydraulic fluid.

Statement of Problem and Substantiation for Public Input

NFPA 70 has formally recognized both the Division and Zone methods of hazardous area classification. This change recognizes this evolution of classification in NFPA 70 and I note Articles 500 and 505 are already stated in Clause 8.2.3.3 so this also harmonizes the two clauses.

Submitter Information Verification

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Submittal Date: Mon Sep 27 13:32:43 EDT 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-28-NFPA 37-2022

Statement: NFPA 70 has formally recognized both the Division and Zone methods of hazardous area classification. This change recognizes this evolution of classification in NFPA 70 and Articles 500 and 505 are already stated in Clause 8.2.3.3 so this also harmonizes the two clauses. Additional language was added to exclude day tanks and other fuel sources directly associated with the fuel system because these sources are integral to the engine itself and therefore fall under the same classification.

Public Input No. 20-NFPA 37-2021 [Chapter 5]

Chapter 5 Fuel Supply — Gaseous

5.1* Gas Piping.

5.1.1

Gas piping shall be installed in accordance with the following methods:

(1) All fuel gas systems at service pressures equal to or less than a gauge pressure of 860 kPa (gauge pressure of 125 psi) shall be installed and tested in accordance with NFPA 54.

(2) All fuel gas systems at service pressures in excess of a gauge pressure of 860 kPa (gauge pressure of 125 psi), other than LP-Gas systems, shall be installed and tested in accordance with ANSI/ASME B31.3, *Process Piping*.

(3) LP-Gas systems, whether liquid or vapor phase, shall be installed and tested in accordance with the provisions of NFPA 58.

5.1.2*

Plastic pipe shall not be used to carry fuel within a room housing an engine(s).

5.1.3

Approved metallic flexible connectors shall be permitted for protection against damage caused by settlement, vibration, expansion, contraction, or corrosion.

5.1.4

Approved nonmetallic connectors shall be permitted for protection against damage caused by settlement, vibration, expansion, contraction, or corrosion except for LP-Gas in the liquid phase.

5.1.5*

Aluminum raised-face flanges shall be permitted in the gas train.

5.1.5.1

Raised-face flanges shall not be joined to flat-faced flanges.

5.1.6*

Connectors used for vibration dampening shall be properly anchored and installed according to manufacturer's instructions.

5.2* Gas Trains.

5.2.1

Gas trains, as defined in 3.3.6, shall contain at least the following safety components:

(1) An equipment isolation valve

(2) A gas pressure regulator, if the prime mover does not operate at the gas supply pressure

(3) Two automatic safety shutoff valves (ASSVs)

(4) A manual leak test valve for each ASSV or an alternative means of proving the full closure of the ASSV

(5)* A low-pressure limit control for engines with a 732 kW (2.5 million Btu/hr) full-load input or greater

(6)* A high-pressure limit control, requiring manual reset as specified in 9.1.2, for engines with a 732 kW (2.5 million Btu/hr) full-load input or greater

(7) A vent valve, at least one ASSV having proof of closure, or a valve proving system (VPS) for inlet gas pressures greater than a gauge pressure of 14 kPa (gauge pressure of 2 psi)

(8) A flame arrester, where biogases are used and there is risk of having oxygen in the biogas

(9) A gas filter or strainer

(10) Any other components or equipment that the manufacturer requires for safe operation

5.2.2

For engines operating at more than a gauge pressure of 14 kPa (gauge pressure of 2 psi) inlet gas pressure to the equipment isolation valve, one of the following shall be provided:

(1) A vent valve, located between the two automatic safety shutoff valves, that shall fail open without an externally applied source of power and that shall discharge outdoors

(2) At least one safety valve shall be fitted with a proof-of-closure switch

(3) A listed valve proving system (VPS) to prove the two automatic safety shutoff valves upon each startup or after each shutdown

5.3 Regulators.

5.3.1

Except as provided for in 5.3.1.1, a gas pressure regulator shall vent to the atmosphere outside the structure at a point at least 1.5 m (5 ft) away from any structure opening.

5.3.1.1

The following devices shall not be required to be vented to the outside when installed in accordance with their listing:

(1) Any regulator or zero governor that operates with gas pressure on both sides of the diaphragm

(2)* A full lock-up regulator

(3) A listed regulator incorporating a vent-limiting device

(4) A regulator incorporating a vent-limiting system with an orifice sized for 0.07 m^3/hr (2.5 ft^3/hr) or less, based on natural gas

5.3.2

When the gas pressure on the upstream side of a non-full lock-up regulator is more than a gauge pressure of 3.5 kPa (0.5 psi), a relief valve shall be installed on the downstream side of the regulator. This relief valve shall vent to the outside of the structure at a point at least 1.5 m (5 ft) away from any structure opening.

5.3.2.1

Such relief valves shall be sized to vent the required volume of gas.

5.4 Valves.

5.4.1* Manual Shutoff Valves.

5.4.1.1

Multiple manual shutoff valves shall be permitted in the gas train to allow additional isolation for maintenance reasons.

5.4.1.2

If the shutoff valve is locked open, the key shall be secured in a well-marked, accessible location near the valve.

5.4.1.3*

A manual shutoff valve in a remote location shall be provided to isolate the fuel supply.

5.4.2* Equipment Isolation Valves.

In multiple-engine installations, the equipment isolation valve shall be located no further from the engine than the first takeoff or branch pipe that serves only that engine.

5.4.3 Automatic Safety Shutoff Valves (ASSVs).

The ASSVs, where required, shall be listed in accordance with ANSI Z21.21, *Automatic Valves for Gas Appliances*, or UL 429, *Electrically Operated Valves*, or be specified by the engine or turbine manufacturer for the particular application.

5.4.4* Automatic Safety Shutoff Valves (ASSVs) for Engines Other Than Gas Turbines.

The ASSVs shall stop the flow of fuel within 2 seconds in the event the engine stops from any cause. The ASSV shall fail closed without an externally applied source of power.

5.4.4.1*

When the fuel gas is supplied at a gauge pressure of 14 kPa (gauge pressure of 2 psi) or less, it shall be permissible to replace one of the ASSVs required by Section 5.2 with one of the following devices, provided the device is mounted downstream of an ASSV and the device will automatically shut off the flow of fuel within 2 seconds if the engine stops from any cause:

(1) Carburetion valve

(2) Zero governor–type regulating valve

(3) Auxiliary valve

5.4.4.1.1

The ASSV shall be permitted to be located downstream from one of the three devices listed in 5.4.4.1 if that device is vented outside the structure at a point at least 1.5 m (5 ft) away from any structure opening.

5.4.4.2*

Where a carburetion valve or zero governor–type regulating valve is used as one of the required ASSVs, the downstream manual leak test valve shall not be required.

5.4.5 Automatic Safety Shutoff Valves (ASSVs) for Gas Turbines.

The two ASSVs required by Section 5.2 shall operate as follows:

(1) One of the ASSVs shall stop the flow of fuel when the engine is shut down under normal conditions.

(2) Both ASSVs shall stop the flow of fuel if the engine must be shut down due to abnormal or emergency operating conditions as specified by the manufacturer.

5.4.5.1

The ASSV shall stop flow of fuel to the engine as follows:

(1) For combustion turbines supplied by piping 150 mm (6 in.) diameter or less, within 3 seconds

(2) For combustion turbines supplied by piping greater than 150 mm (6 in.) diameter, within 5 seconds

5.4.5.2

The ASSV shall fail closed without an externally supplied source of power.

5.4.5.3*

It shall be permissible to replace one of the ASSVs with a control valve, provided the device will automatically shut off the flow of fuel within the time limits specified in 5.4.5.1(1) and 5.4.5.1(2), whichever is applicable.

5.4.5.4*

If the engine is shut down for abnormal or emergency operating conditions as specified by the manufacturer, a vent valve shall open automatically to depressurize the included piping. The vent shall fail open without an externally supplied source of power and shall discharge outdoors.

5.4.5.5*

One ASSV shall be located external to the combustion turbine package and any associated building.

5.5 Pressure-Boosting Equipment.

5.5.1

Boosters or compressors, if used, shall be approved for the service intended.

5.5.2

Receivers, if used, shall be certified with a stamp that they have been designed, constructed, and tested as required by Section VIII, Division 1, "Pressure Vessels," of the ANSI/ASME *Boiler and Pressure Vessel Code*.

5.6 Overpressure Protection.

5.6.1

Overpressure protection shall be required for any fuel gas train subject to either of the following conditions:

(1) The inlet gas pressure exceeds both 14 kPa (2 psi) and the rated pressure of any downstream component

(2) The failure of a single upstream line pressure regulator results in an inlet gas pressure exceeding the rated pressure of any downstream component

5.6.1.1*

When an overpressure protection device is required in 5.6.1, it shall be set to not exceed the following pressures:

(1) The set point of the device shall not exceed 150 percent of the rated pressure of the lowest rated component when the rated pressure of any component is less than 83 kPa (12 psi).

(2) The set point of the device shall not exceed 41 kPa (6 psi) above the rated pressure of the lowest rated component when the rated pressure of any component is equal to or greater than 83 kPa (12 psi) but less than 414 kPa (60 psi).

(3) The set point of the device shall not exceed 110 percent of the rated pressure of the lowest rated component when the rated pressure of any component is equal to or greater than 414 kPa (60 psi).

5.6.1.1.1

The overpressure protection device required in 5.6.1.1(3) shall also comply with the following:

(1) The overpressure protection device shall be any one device permitted in Section 5.9 of NFPA 54.

(2)* There shall be an active or passive means by which the activation of the overpressure protection device is detectable.

(3) Where a pressure relief valve(s) is used as the overpressure protection device, the relief valve and all connected vent piping shall be sized to accommodate the maximum anticipated flow due to the failure of the nearest upstream line pressure regulator.

Additional Proposed Changes

File Name	Description	Approved
NFPA_37_inclusion_of_Hydrogen_-_Task_Group_-_TerraView_Submission.docx	The uploaded file is a consolidated update input that affects Chapters 2, 3, 5, 11 and Annex A material, Adds a new Annex C, Changes the existing Annex C to Annex D and provides additional references in Annex D.	

Statement of Problem and Substantiation for Public Input

A major effort in the power generation world is to start using Natural Gas – Hydrogen blended fuels for internal combustion engines and gas turbines. A primary example of this movement is the European Turbine Network (ETN Global) report “THE PATH TOWARDS A ZERO-CARBON GAS TURBINE” (https://etn.global/news-and-events/news/hydrogen-gas-turbines-report/) that outlines the goal of achieving a commercial power generation gas turbine installation running on 100% hydrogen by 2030. Although there currently are gas turbines that are running on fuel blends of 50% and higher Hydrogen content, these are primarily limited to refinery and gasification installations. The future vision is for pure hydrogen sources to be used for mixing with natural gas in the 20 – 50% range in the near term and transitioning to 100% hydrogen as the availability of hydrogen sources expands.

With that in mind, this proposal incorporates what we know “today” about such Hydrogen use in a manner that permits the potential users and enforcement agencies to have an initial introduction to the subject. The minimum essential requirements are being added to the Standard to ensure the safety of hydrogen fueled combustion engines and gas turbines. Additionally, an Annex devoted to hydrogen topics is being included in this first submission and, as our understanding of the subject increases, material from that annex can form the foundation of expanded requirements in subsequent editions of the Standard.

The following rationales are provided for the specific changes to the Standard as developed by the Task Group and proposed in the attachment:

- 2.2 NFPA Publications: Addition of NFPA 2, Hydrogen Technologies Code: NFPA 2 is the "go to" document for hydrogen system design and is explicitly referenced in the mandatory text proposed for NFPA 37
- 3.3 General Definitions.
  - o It is recognized that substantial discharges of Hydrogen may require a Flare System to mitigate the potential of a jet fire / deflagration to detonation event with an associated severe blast wave
  - o The expression "Hydrogen Enriched Fuel" was created to have a uniform descriptor for these fuels throughout the Standard. As explained in the added Annex A entry, the 25% "threshold" being applied is based on the highest Hydrogen concentration mixed with Natural Gas for which the mixture is considered the "same as" Natural Gas with respect to flammability and ignition characteristics in the public domain references (e.g., NFPA 497, ICE 60079-10, etc. to include known country specific versions of those standards). It is also pointed out that NFPA 2 only covers mixtures that are 95% or greater Hydrogen.
- A.5.1 Annex for Gas Piping
  - o (5) "Hydrogen" is added to the list as part of the new material with a reference to the primary piping standard for Hydrogen
  - o (6) "Mixed gas" is expanded to explicitly include Hydrogen mixtures and a reference to the added Hydrogen Annex material in that this would be for situations where the Hydrogen concentration is less than 95%
- 5.1.1 Gas piping
  - o (4) is added to refer the reader to NFPA 2 which is considered a mandatory reference for piping designs carrying Hydrogen mixtures at 95% or greater concentration. The associated annex material is provided to ensure the user is pointed to the additional information for mixtures at less than 95% Hydrogen concentration.
- 5.2.1 (9) added based on ignition experience for vents carrying hydrogen at concentrations of 25% or greater
- 5.3.1.1 Text added consistent with other Hydrogen Enriched Fuel statements above and to clearly convey that mixed fuels at less than 25% Hydrogen concentration can be considered the same as the "base" fuel.
- A.5.4.5.4 The added sentence is to ensure the reader considers the additional venting guidance provided in the Hydrogen Annex.
- A.8.1.2(3) The expanded discussion is to ensure the reader considers the differences in risk for Hydrogen Enriched Fuels and the additional guidance provided in the Hydrogen Annex.
- A.9.3.3 The current belief in the Gas Turbine community, to include situations where an HRSG or other exhaust treatment equipment is used and based on the albeit somewhat limited data from existing installations, is the existing NFPA 85 guidance is sufficient to ensure the safety of the exhaust with a Hydrogen Enriched Fuel. Discussions with a member of the NFPA 85 committee responsible for HRSG installations reveals the Hydrogen topic is currently under discussion within that committee and any guidance that may arise from those discussions will be included here.
- A.11.1(2) This is added to reinforce the awareness of how various fuel blends can affect the potential risks during unit operation
- A.11.3.1 Experience has shown "traditional" optical flame detection devices are not compatible with the radiation spectrum associated with hydrogen fires; the flame lacks the carbon element that drives the spectrum for hydrocarbon fuel fires. The additional material is provided to point the reader to the known solutions.
- 11.4.4.1* The appropriate suppressant concentration for Hydrogen Enhanced Fuels is essential for ensuring extinguishment of a fire; this is regardless of a local application or total flooding scenario and must be considered in the design.
- A.11.4.4.1 Given that the scenario for a gaseous fuel fed fire will be related to a leak of the fuel; quickly isolating the fuel is the fastest way to minimize the potential damage from the burning fuel. In fact, with an automatic double block and vent system (e.g., the dual ASSV and associate vent required under Clause 5.2.1), the ability to isolate the fuel source and effectively halt the leak can be faster than the time required to get a gaseous suppressant concentration to the target level. What remains is the "other" combustibles that may have been ignited. This is the consideration for this entry that allows for ensuring the extinguishment of the fire in a synergistic manner.
- The remaining paragraphs in section 11.4.4 are renumbered appropriately

- Annex C ---This is a compendium of information for use that has been drawn from NFPA references (Primarily NFPA 55 and NFPA 2 Annex material), and industry experience and research from various sources to include NASA, ASME, API and Sandia National Laboratories. This "first pass" inclusion is intended to provide a “baseline” from which the “lessons learned” of future experience can be built and, where appropriate, material can be transferred from the informative Annex to the formal requirements portion of the standard.

- The current Annex C becomes Annex D with appropriate renumbering based on the additional references outlined here:
- D.1.1 NFPA Publications NFPA 2 and NFPA 55 were referenced in the added Annex B material
- D.1.2.2 API Publications API 521 and API 537 were referenced in the added Annex B material
- D.1.2.4 ASME Publications ANSI/ASME B31.12 and ASME “Hydrogen Standardization Interim Report for Tanks, Pipes and Pipelines” were referenced in the added Annex B material
- D.1.2.9 National Aeronautics and Space Administration. NASA NSS 1740.16 was referenced in the added Annex B material
- D.1.2.10 National Association of Corrosion Engineers (NACE International). MR0175/ISO 15156-1 and MR0103/ISO 17945 were referenced in the added Annex B material
- D.1.2.13 Sandia National Laboratories. SAND2012-7321 was referenced in the added Annex B material
- D.2.2 Other References. Shepherd, J. E. Report FM2006-00X was referenced in the added Annex B material

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Submittal Date: Tue Dec 28 08:20:20 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-37-NFPA 37-2022

Statement: Hydrogen fuel is being introduced into Europe with the goal of power plants demonstrating 100% use by 2030. Within the next two years, gas turbines using fuels

with up to 25% hydrogen concentration are expected for European power plants. A power plant in Florida is expected to use hydrogen as an alternate fuel within the next two years. There are Japanese power plants that are also pursuing using hydrogen that will be extracted from imported ammonia.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 2, *Hydrogen technologies Code*, 2020 edition

3.3 General Definitions.

3.3.X Flare System. A gas combustion device used to provide for the safe disposal of flammable gases. Also referred to as a gas flare or flare stack.

3.3.X* Hydrogen Enriched Fuel. A gas fuel that contains a hydrogen concentration greater than **25**% by volume.

A.3.3.X The 25% threshold is based on the minimum public domain guidance (NFPA, IEC, etc.) regarding a hydrogen content in Natural Gas where the flammability properties of the mixture are considered the same as natural gas. The upper limit for a Hydrogen Enriched Fuel is 95% at which point it is considered as "pure" hydrogen as defined in NFPA 2.

5.1 * Gas Piping.

A.5.1 Gaseous-fueled engines are those engines in which the fuel supply is delivered to the engine in vapor form, including, but not limited to, the following:

(1) Natural gas
(2) Compressed natural gas (CNG)
(3) Propane
(4) LP-Gas
(5) Hydrogen (see ANSI/ASME B31.12, *Hydrogen Piping and Pipelines*)
(6) Mixed gas (including mixtures with hydrogen less than 95%, also see **Annex C Hydrogen Use Information**)
(7) Manufactured gas and syngas
(8) Biogas (e.g., landfill and digester gas) (for biogas applications, see ANSI/CSA B149.6-15, *Code for Digester Gas and Landfill Gas Installations for Piping Materials and Practices*)

5.1.1 Gas piping shall be installed in accordance with the following methods:

(1) All fuel gas systems at service pressures equal to or less than a gauge pressure of 860 kPa (gauge pressure of 125 psi) shall be installed and tested in accordance with NFPA 54.
(2) All fuel gas systems at service pressures in excess of a gauge pressure of 860 kPa (gauge pressure of 125 psi), other than LP-Gas systems, shall be installed **and tested** in accordance with ANSI/ASME B31.3, Process Piping.
(3) LP-Gas systems, whether liquid or vapor phase, shall be installed **and tested** in accordance with the provisions of NFPA 58.

(4)* Hydrogen systems, whether liquid or gas (95% or greater) phase, shall be installed and tested in accordance with the provisions of NFPA 2.

A.5.1.1(4) NFPA 2 is specific to hydrogen at 95% or greater purity by volume, refer to **Annex C Hydrogen Use Information** for mixtures that contain less than 95% hydrogen by volume.

5.2.1 Gas trains, as defined in 3.3.6, shall contain at least the following safety components:

(1) An equipment isolation valve

(2) A gas pressure regulator, if the prime mover does not operate at the gas supply pressure
(3) Two automatic safety shutoff valves (ASSVs)
(4) A manual leak test valve for each ASSV or an alternative means of proving the full closure of the ASSV
(5)* A low-pressure limit control for engines with a 732 kW (2.5 million Btu/hr) full-load input or greater
(6)* A high-pressure limit control, requiring manual reset as specified in 9.1.2, for engines with a 732 kW (2.5 million Btu/hr) full-load input or greater
(7) A vent valve, at least one ASSV having proof of closure, or a valve proving system (VPS) for inlet gas pressures greater than a gauge pressure of 14 kPa (gauge pressure of 2 psi)
(8) A flame arrester, where biogases are used and there is risk of having oxygen in the biogas
(9) A flame arrester where a Hydrogen Enriched Fuel is used
(10) A gas filter or strainer
(11) Any other components or equipment that the manufacturer requires for safe operation

5.3.1.1 The following devices when used with fuel gases containing less than 25% hydrogen shall not be required to be vented to the outside when installed in accordance with their listing:

(1) Any regulator or zero governor that operates with gas pressure on both sides of the diaphragm
(2)* A full lock-up regulator
(3) A listed regulator incorporating a vent-limiting device
(4) A regulator incorporating a vent-limiting system with an orifice sized for 0.07 m3/hr (2.5 ft3/hr) or less, based on natural gas

5.4.5.4 * If the engine is shut down for abnormal or emergency operating conditions as specified by the manufacturer, a vent valve shall open automatically to depressurize the in-cluded piping. The vent shall fail open without an externally supplied source of power and shall discharge outdoors.

A.5.4.5.4 The vent valve is used to depressurize the gas trapped between two ASSVs and thereby minimize the risk from any leaks that might occur in the gas train. Consequently, the valve should be sized to depressurize the trapped volume quickly. Additional guidance for venting of Hydrogen Enriched Fuels is provided in **Annex C Hydrogen Use Information** at section **C.8 Venting of Hydrogen.**

8.1.2* Exhaust systems shall be designed and constructed to withstand the intended service.

A.8.1.2 The “service” of an exhaust system includes any of the following:

(1) Exposure to heat (short-term and sustained high temperature)

(2) Corrosive atmospheres (internal or external)

(3) Internal pressure (including possible explosion of unburned fuel); the pressure rise for a Hydrogen Enriched Fuel can be significantly higher than for Natural Gas and other hydrocarbon fuels, refer to **Annex C Hydrogen Use Information** for additional information

(4) External forces (such as wind, weight of snow, dust or dirt accumulation, or seismic event)

9.3.3 * The combustion gas turbine starting sequence shall include a purge cycle that will result in a nonignitible atmosphere in the turbine and its exhaust system prior to the start of the ignition sequence and the introduction of fuel.

A.9.3.3 NFPA 85 states a minimum of 5 volume exchanges are presumed as sufficient to ensure the safety of the exhaust. This guidance should be sufficient for all fuels to include those that are hydrogen enriched. Refer to **Annex C Hydrogen Use Information** for additional information on Hydrogen Enriched Fuels.

11.1* General. A fire risk evaluation shall be performed for each engine installation, including engine auxiliary equipment, with respect to the following:

A.11.1 The fire risk evaluation should include, but not be limited to, the following:

(1) Characteristics of the engine

(2) Characteristics of the fuel

(3) Layout of the engine installation, including engine auxiliary equipment

(4) Adjacent exposures, including structures, operations, and other engine installations

11.3.1* Automatic fire detection and alarm systems, where provided, shall comply with NFPA 72.

A.11.3.1 For each enclosure requiring fire protection, fire detectors are intended to provide timely detection of a fire and might allow early intervention that can limit damage. Selection of the type of fire detector to be used should be based on the application and engine equipment arrangement. For example, the use of smoke detection might be a problem due to false actuations caused by exhaust gases during engine operation. If heat-activated fire detectors are used, temperature ratings should be based on the maximum ambient temperatures of the enclosure that can be expected under normal operating conditions, so that fire detectors do not actuate due solely to the heat produced when the engine is operating. Typically, detectors are selected to actuate at about 28°C (50°F) above the maximum expected temperature in the enclosure.

For more rapid detection of fires, the use of flame detectors can be considered for early warning, engine shutdown, or fire suppression system activation. The installation of these detectors should be evenly distributed across the hazard to allow for proper detection throughout the enclosure.

The use of UV/IR and / or multi-spectrum optical detectors is appropriate for Hydrogen Enriched Fuels with a hydrogen content greater than 50% by volume as the IR signature of hydrogen is much less than that of natural gas and other hydrocarbon fuels. However, there is a risk of false detection with the UV or UV/IR optical detectors because of the blackbody radiation emitted by hot surface equipment (GTs, heaters, exhaust systems, etc.). False detection can also occur due to direct or reflected sunlight, arc welding, and other sources and field of view restriction or shielding to mitigate these detections should be incorporated into the installation. Providing automatic actions based on UV fire detection is a matter of balancing detection reliability, limiting unit damage and ensuring a lack of false detections to meet customer requirements.

In all installations, the detectors should be strategically positioned near specific hazards but away from high-ventilation flow paths that could disperse heat and delay detection of a fire and away from heat-producing devices, such as heaters, that could unnecessarily set off detectors. The detectors should be mounted firmly to rigid structures and in areas where minimum vibration is present.

Where a fire suppression system is also being used and inadvertent actuation of the suppression system is a concern, consideration should be given to cross-zoning the detectors detection zones have to trip in order for the suppression system to activate.

In addition to the detectors, the installation of the other components of the fire detection and alarm system also need to be addressed. Visual and audible notification devices should be located where they will be easily seen and heard. Depending on the installation, this might be both inside and outside of the engine enclosure.

Hazardous vapor detection can be appropriate where vapor leaks might be expected. This type of detector can identify the need for engine fuel system shutdown and possible inerting of the engine enclosure via a fire suppression system discharge.

Components that should be considered when installing a fire detection and alarm system, especially when used in conjunction with a fire suppression system, should include at least the following:

(1) Fire alarm strobe and horns positioned in highly visible and audible areas of the engine enclosure on the inside and outside of the enclosure, where applicable

(2) Warning signs positioned on enclosure access doors where a fire suppression system has been installed

(3) Manual discharge stations positioned near enclosure access doors where a fire suppression system has been installed

(4) Manual lockout stations for engine maintenance purposes positioned near enclosure access doors where a fire suppression system has been installed

(5) Where required for the fire suppressant being used, predischarge timers, located in the fire control panel, that allow a time delay of at least 30 seconds between fire alarm strobe and horn annunciation and fire suppression system discharge

11.4.4.1* While the required gaseous suppressant concentrations for extinguishment of various hydrocarbon fuels and oils are within a fairly narrow range, Hydrogen Enriched Fuels can require a significantly higher suppressant concentration that shall be implemented in the design by reference to the applicable suppression standard.

A.11.4.4.1 Referencing CO_2 as an example, Methane requires a 34% minimum initial concentration and Ethane requires a 40% minimum initial concentration to ensure suppression of the fire. The other primary constituents of Natural Gas and potential alternate hydrocarbon fuels such as Propane and Butane fall between those values. A pure hydrogen fire requires a 75% CO_2 concentration to extinguish the combustion. The activation of the upstream automatic safety shutoff valves and vent to quickly halt and isolate the flow of the Hydrogen Enriched Fuel supply can reduce the required concentration since the gaseous Hydrogen Enriched Fuel will quickly burn off and the residual fire fed by leaked lubrication oil and / or liquid fuels or other combustible material in the protected space will be suppressed by the lower required concentration. Refer to **Annex C Hydrogen Use Information** for additional information on Hydrogen Enriched Fuels.

11.4.4.2* Total flooding gaseous agent systems shall be designed to take into consideration both of the following factors:

A.11.4.4.2 Where total flooding gaseous systems are used, the engine enclosure should be arranged for minimum leakage by automatic shutdown of fans and automatic closing of doors, ventilation dampers, and other openings. During operation of an engine, there is a need for substantial amounts of cooling and ventilation air. This air flow will not stop immediately upon engine shutdown and should be considered in the extinguishing system design.

(1) The agent concentrations required for the specific combustible materials involved

(2) The specific configuration of the equipment and enclosure

11.4.4.2.1* Total flooding gaseous suppression systems shall be designed to maintain the design concentration within the enclosure for a time sufficient to ensure that the fire is extinguished and that surface temperatures of the engine or turbine have cooled to below the autoignition temperature of combustible material present. In lieu of manufacturer or laboratory fire test data demonstrating the actual time to achieve extinguishment and cool-down, the concentration shall be maintained for a minimum of 20 minutes.

A.11.4.4.2.1 Fire suppression system design concentrations and discharge durations should be held as long as the hazards of hot metal surfaces above the autoignition temperature and uncontrollable combustible fluid flow exist. The manufacturer should be consulted for applicable engine cool-down times. Testing has shown this time requirement to be approximately 20 minutes, but for many heavy-duty industrial engines, it can be substantially longer. Conversely, thin-walled turbines based on aircraft engine designs cool very quickly, once fuel flow terminates. Just as discharge time might need to be increased for some heavy-duty designs, it is appropriate to reduce the discharge duration for aircraft engine-based turbines to less than 20 minutes, based on discharge tests. Information on fire tests that demonstrate the extinguishment time for a turbine design should also be considered in determining the minimum discharge time. It is recommended that the minimum discharge time be no less than twice the time demonstrated to achieve fire extinguishment for the suppressant used. It has been shown that the initial concentration usually will not hold for a 20-minute time period in most engine enclosures and under these circumstances an extended discharge time is necessary to prevent potential fire reignition due to smoldering and heat soak. Where design concentrations still cannot be maintained effectively, an alternative system should be provided.

11.4.4.3* Local application gaseous agent suppression systems shall be designed to operate for a time sufficient to ensure that the fire is extinguished and that surface temperatures of the engine or turbine have cooled to below the autoignition temperature of combustible material present. In lieu of manufacturer or laboratory fire test data demonstrating the actual time to achieve extinguishment and cool-down, the discharge duration shall be maintained for a minimum of 20 minutes.

A.11.4.4.3 Fire suppression system discharge durations should be held as long as the hazards of hot metal surfaces above the autoignition temperature and uncontrollable combustible fluid flow exist. The manufacturer should be consulted for applicable engine cool-down times. Testing has shown this time requirement to be approximately 20 minutes, but for industrial turbines it can be substantially longer. Conversely, thin-walled turbines based on aircraft engine design cool very quickly, once fuel flow terminates. Just as discharge time might need to be increased for industrial turbine designs, it is appropriate to reduce the discharge duration for aircraft engine–based designs to less than 20 minutes, based on discharge tests. Information on fire tests that demonstrate the extinguishment time for a turbine design should also be considered in determining the minimum discharge time. It is recommended that the minimum discharge time be no less than twice the time demonstrated to achieve fire extinguishment for the suppressant used. An extended discharge time is necessary to prevent potential fire reignition due to smoldering and heat soak.

Annex C Hydrogen Use Information

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Scope. This annex is intended to provide additional information for using Hydrogen Enriched Fuels (up to 100% hydrogen) in a Combustion Engine or Gas Turbine. The information is provided to assist in understanding the potential conditions that are unique to hydrogen use and should be considered during the design of the installation and operation of the equipment. It is not intended to be a design manual.

C.2 Physical Properties (Informative). Hydrogen is a flammable gas. It is colorless, odorless, tasteless, and nontoxic. It is the lightest gas known, having a specific gravity of 0.0695 (air = 1.0). Hydrogen diffuses rapidly in air and through materials not normally considered porous. [55:C.1]

C.2.1 Hydrogen burns in air with a pale blue, almost invisible flame. At atmospheric pressure the ignition temperature of hydrogen–air mixtures has been reported by the U.S. Bureau of Mines to be as low as 932°F (500°C). The flammable limits of hydrogen–air mixtures depend on pressure, temperature, and water-vapor content. At atmospheric pressure, the flammable range is approximately 4 percent to 75 percent by volume of hydrogen in air. [55:C.1.1]

C.2.2 Hydrogen remains a gas even at high pressures. It is liquefied when cooled to its boiling point of −423°F (−253°C). [55:C.1.2]

C.2.3 Hydrogen is nontoxic, but it can cause anoxia (asphyxiation) when it displaces the normal 21 percent oxygen in a confined area without ventilation that will maintain an oxygen content exceeding 19.5 percent. Because hydrogen is colorless, odorless, and tasteless, its presence cannot be detected by the human senses. [55:C.1.3]

C.3 Physical Properties (Informative). Liquefied hydrogen is transparent, odorless, and not corrosive or noticeably reactive. The boiling point at atmospheric pressure is −423°F (−253°C). It is only 1⁄14 as heavy as water. Liquefied hydrogen converted to gaseous hydrogen at standard conditions expands approximately 850 times. [55:C.2]

C.4 The Vision for Hydrogen use

In January 2020, The European Turbine Network (ETN Global) Hydrogen Working Group consisting of representatives from turbine manufacturers, gas suppliers, power plant operators, universities and others issued a report "The Path Towards a Zero-Carbon Gas Turbine" which is available at https://etn.global/news-and-events/news/hydrogen-gas-turbines-report/. In this report, the following key points were provided:

a) Up to 20% hydrogen is being mixed with natural gas in distribution pipelines in Europe establishing a precedent for doing so elsewhere
b) Today's gas turbines are fully capable of operating on 20% hydrogen
c) Gas turbines have demonstrated reliable operation at hydrogen concentrations of 50% and greater using "Syngas", Refinery Gas and Coke Oven Gas; these uses have been limited primarily to industrial settings that, in general, fall into the "petrochemical plant" category.
d) The gas turbine industry has committed to achieving the ability to run on 100% hydrogen by 2030

The ETN Global report concludes that transition of existing gas turbines to Hydrogen Enriched Fuel at increasing concentrations along with new gas turbines having the ability to use higher concentrations and upgrades of existing turbines to achieve the same capability is viewed as complimentary to wind and solar power in the retirement of existing coal plants and maintaining a reliable source of electric power.

Although an equivalent joint effort has not occurred in the internal combustion engine community, the efforts and declared offerings of the manufactures is on a parallel path.

C.5 Mixtures with Natural Gas

The near term vision for the use of Hydrogen Enriched Fuel for Combustion Engines or Gas Turbines is up to a 20 to 30% hydrogen by volume mixture. The long term vision is for the use of 100% hydrogen as the fuel. Regarding the possible in between mixtures the impacts of the Hydrogen Enriched Fuel on the installation is a function of whether the fuel is provided directly from the pipeline or is mixed into pipeline natural gas "on site" from a pure hydrogen source. These considerations must be evaluated on a case by case basis as appropriate.

C.5.1 Flammability considerations.

It is generally accepted that mixtures of hydrogen and natural gas with the hydrogen constituent being at 25% or below can be considered the same as natural gas with respect to flammability hazards and the creation of hazardous areas from leaks. Consequently, hazardous areas from leaks of such mixtures would be declared as a Gas Group D under NFPA 70 Article 501 or IIA under NFPA 70 Article 505 up to 25% hydrogen and transition to Gas Group B or IIB+H / IIC respectively above that concentration.

In addition to the area classification, it is important to consider the fact that the Minimum Ignition Energy (MIE) for hydrogen is 0.019 millijoules (mj) as compared to 0.28 mj for methane. Also, the Minimum Igniting Current (MIC) Ratio (ratio to methane) of hydrogen is 0.25.

The NASA NSS 1740.16 Safety Standard: Hydrogen and Hydrogen Systems (cancelled as an active document in 2004 but is still available for download and reference) stated that approximately 18% of pure hydrogen discharges and leaks ignited with no ignition sources in the area; presumed to be due to static electricity.

As the amount of hydrogen in the fuel is increased it is necessary to consider the alterations that may be appropriate for not only the types of devices that are required to be compatible with the mixture, but the impact on the potential hazardous area volume around the equipment must be assessed as well.

C.5.2 Piping and Tubing Explosion Hazards and Protection.

As outlined in NFPA 56, the best practice for introducing a flammable gas into or removing such gas from a piping system is to use an inert gas purge buffer between the air and the flammable gas. The importance of the purge step is increased with Hydrogen Enriched Fuels as the ignition characteristics are expanded (wider flammability range and a reduced Minimum Ignition Current) as the portion of hydrogen in the mixture increases. Because of this concern, it is recommended that purge in and purge out steps with an inert gas be considered essential for a Hydrogen Enriched Fuel piping. An evaluation should be conducted to determine the potential of an adverse reaction where any of the following conditions exist:

(1) Where piping can be filled with air and hydrogen (or a hydrogen blend) is introduced without a buffering purge.

(2) Where residual hydrogen (or a hydrogen blend) in piping used to deliver the gas to an "atmospheric" location (such as a combustion engine inlet or a gas turbine combustion area) and atmospheric air can mix with the hydrogen in the piping.

(3) Where piping carries hydrogen (or a hydrogen blend) and air that is premixed for delivery to another part of the system.

If the system requires the hydrogen piping or tubing to carry a flammable mixture during any stage of operation, the ability of the piping to withstand a hydrogen explosion should be evaluated and, if necessary, strengthened to prevent pipe failure.

Methods to assess the structural response of piping and tubing to deflagrations and detonations are described in "Elastic and Plastic Structural Response of Tubes to Deflagration-to-Detonation Transition", Shepherd (2006).

C.5.3 Fire Protection considerations for Hydrogen Enriched Fuels.

Regardless of the type of suppression employed (e.g., type of agent, or total flooding versus local application) it is essential to assess the hydrogen concentration in the fuel to estimate the necessary suppression system alterations necessary to ensure the effectiveness of the system.

The other consideration, as discussed in A.11.4.4.1, is for the rapid isolation and venting of the hydrogen source which will remove that fuel as a contributor to the fire and the necessary suppression concentration is then a function of residual combustibles such as pooled lubrication oil that was spilled as part of the equipment failure leading to the fire.

C.6 Material Selection

Hydrogen has the smallest molecules of any known substance and has a propensity to permeate the intermolecular spaces of materials. In doing so, the mechanical properties of the material can be affected in a manner that reduces the structural integrity of the material. This process is collectively referred to as "hydrogen embrittlement". The potential deterioration of vessels, piping systems and various system components included in the system design is a major consideration for Hydrogen Enriched Fuels and the selection of materials that provide resistance to such deterioration is essential

A primary reference for hydrogen filled components is the ASME "Hydrogen Standardization Interim Report for Tanks, Pipes and Pipelines". Additional Hydrogen compatibility and embrittlement information on various materials (to include additional background references) is provided in Sandia National Laboratories SAND2012-7321, "Technical Reference for Hydrogen Compatibility of Materials".

C.6.1 Additional requirements when Hydrogen is Sourced from Refineries and Gasifiers

While hydrogen sourced from reformers and electrolyzers is essentially pure, other sources such as biproducts of refineries and wood or coal gasification systems has significant quantities of "other" constituents such as Carbon Monoxide, Hydrogen Sulfide (H_2S), Sulfur Dioxide and other constituents. Of particular concern is the H_2S constituent that, in addition to being highly toxic (exposure is limited to 20 Parts Per Million (PPM) in accordance with 29 CFR 1910.1000 Z-2 Table), There are specific requirements for a system as defined in National Association of Corrosion Engineers (NACE) and American Society of Mechanical Engineering (ASME) standards. Under these standards, a gas composition containing 300 PPM or greater H_2S is classified as a "sour gas"

The specific guidance for these conditions is found in ASME B31.3 and ASME Section VIII, Div I under which the piping design must meet Category "M" fluid service if the H_2S concentration exceeds 700 PPM. As defined by NACE, the piping system must meet the requirement s of the following standards:

1. MR0175/ISO 15156-1 (2017) - Materials for use in H2S-containing environments in oil and gas production
2. MR0103/ISO 17945 (2010) - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments.

Additionally, purging of the piping following equipment shutdown is mandatory under the NACE guidelines.

C.7 Exhaust Purge

As the concentration of hydrogen in a Hydrogen Enriched Fuel increases, the energy released during a deflagration event increases as does the potential for a deflagration to detonation event. While the natural buoyancy of a vertical exhaust stack will act to "purge" residual gas following the unit shutdown, any "traps" in a horizontal section of the exhaust must be considered This reinforces the necessity to ensure the effective purge of the entire exhaust flow path and appropriate studies (such as Computational Fluid Dynamics) should be considered. Where such studies show the inability to reduce the hydrogen concentration in the exhaust ducting to less than 1 percent by volume, the duct and exhaust system should be designed in accordance with NFPA 69

C.8 Venting of Hydrogen

C.8.1 Where hydrogen or Hydrogen Enriched Fuel is used, the potential for a hazardous deflagration of the vented gas should be assessed. If a deflagration potential exists, a flare system or other mitigation system (such as dilution) should be used. Unlike most gases (air, Nitrogen, CO_2, etc.) that experience a reduction in temperature when released from a high pressure source due to the Joule-Thompson Effect, the hydrogen temperature increases. A calculation of the temperature rise from "room temperature" (22°C / 72°F) when released from a source at 100 MPa / 14,500 psi is such that the resulting temperature will be 75°C / 167°F. Hence, a concern for an excessive or hazardous temperature being created by the Joule-Thompson Effect is not considered a significant risk.

C.8.1.1 Tests were undertaken by Air Products in cooperation with DNVGL (formerly Advantica Ltd.) in 2008 to understand the ignition and explosion potential from high pressure hydrogen venting. The tests showed such releases result in turbulent jets which can result in "Vapor Cloud Explosions" (VCEs). The data from the tests shows the potential overpressure from the VCE increases with the vent size. An attempt to model the phenomenon using the "FLACS" software package was undertaken with results that are not well aligned with the test data, the results of the tests and modeling are available in a paper published at the American Institute of Chemical Engineers 2017 Spring Meeting / 11th Global Congress on Process Safety titled "Hydrogen jet vapor cloud explosion. Miller, Thomas, Eastwood. GCPS 2015".

A second paper developed in cooperation with Air Liquide was published at the American Institute of Chemical Engineers 2017 Spring Meeting / 13th Global Congress on Process Safety titled: "Hydrogen Jet Vapor Cloud Explosion: A Model for Predicting Blast Size and Application to Risk Assessment". The full text of the second paper is publicly available at https://www.researchgate.net/publication/316686644_Hydrogen_Jet_Vapor_Cloud_Explosion_A_Model_for_Predicting_Blast_Size_and_Application_to_Risk_Assessment

While the ability to accurately predict the ignition and potential overpressure level remains uncertain, the risk to equipment and personnel from a substantial pressure wave should be considered and weighed against the thermal radiation exposure from a flare as the alternative solution for venting hydrogen.

C.8.1.2 Where a flare system is used for vents, the appropriate separation of the flare from other equipment and personnel access areas should be included in the installation design. Additional considerations when a flare system is used:

(1) The flare system should be low pressure (< 0.5 barg / 7.25 psig)

(2) If the flare system is shared with other sources of gas discharges, consider a double block and bleed valve for the vent

(3) The pressure in the volume between the two block valves should be monitored and an increase in pressure should trigger a unit shutdown

Flare system installations should be designed and operated according to these standards:

(1) API STD 521, Pressure-relieving and Depressuring Systems

(2) API STD 537 Flare Details for General Refinery and Petrochemical Service

C.9 References.

API STD 521, *Pressure-relieving and Depressuring Systems, 6th Edition, 2014*

API STD 537, *Flare Details for General Refinery and Petrochemical Service, 3rd Edition, 2017*

ASME "*Hydrogen Standardization Interim Report for Tanks, Pipes and Pipelines*" *2005*

NASA NSS 1740.16, *Safety Standard: Hydrogen and Hydrogen Systems*

SAND2012-7321, *Technical Reference for Hydrogen Compatibility of Materials,* published by Sandia National Laboratories.

Shepherd, J. E., "Elastic and Plastic Structural Response of Tubes to Deflagration-to-Detonation Transition," California Institute of Technology Explosion Dynamics Laboratory Report FM2006-00X, 2006.

Annex D Informational References

D.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

D.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 2, *Hydrogen technologies Code*, 2020 edition

NFPA 13, Standard for the Installation of Sprinkler Systems, 2019 edition.

NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2019 edition.

NFPA 30, Flammable and Combustible Liquids Code, 2021 edition.

NFPA 54, National Fuel Gas Code, 2021 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code, 2020 edition*.

NFPA 56, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems, 2020 edition.

NFPA 68, Standard on Explosion Protection by Deflagration Venting, 2018 edition.

NFPA 92, Standard for Smoke Control Systems, 2021 edition.

NFPA 99, Health Care Facilities Code, 2021 edition.

NFPA 110, Standard for Emergency and Standby Power Systems, 2019 edition.

NFPA 220, Standard on Types of Building Construction, 2021 edition.

NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas, 2021 edition.

NFPA 555, Guide on Methods for Evaluating Potential for Room Flashover, 2021 edition.

NFPA 750, Standard on Water Mist Fire Protection Systems, 2019 edition.

D.1.2 Other Publications.

D.1.2.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI Z21.21/CSA 6.5, Automatic Valves for Gas Appliances,2019.

D.1.2.2 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API STD 521, *Pressure-relieving and Depressuring Systems, 6th Edition, 2014*

API STD 537, *Flare Details for General Refinery and Petrochemical Service, 3rd Edition, 2017*

D.1.2.3 ASHRAE Publications. ASHRAE, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.

ASHRAE and SFPE Handbook of Smoke Control Engineering, 2012.

Handbook — Fundamentals, 2017.

D.1.2.4 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ANSI/ASME B31.3, Process Piping, 2018.

ANSI/ASME B31.12, *Hydrogen Piping and Pipelines, 2014*

ASME "*Hydrogen Standardization Interim Report for Tanks, Pipes and Pipelines*" *2005*

D.1.2.5 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM SI 10-16, American National Standard for Metric Practice, 2016.

D.1.2.6 CSA Group Publications. Canadian Standards Association, 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada.

ANSI/CSA B149.6, Code for Digester Gas and Landfill Gas Installations for Piping Materials and Practices, 2015.

D.1.2.7 ICC Publications. International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001.

BOCA National Building Code, 1996.

D.1.2.8 ISO Publications. International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 21789, Gas Turbine Applications — Safety, 2009.

D.1.2.9 National Aeronautics and Space Administration. Office of Safety and Mission Assurance, Washington, DC 20546

NASA NSS 1740.16 Safety Standard: Hydrogen and Hydrogen Systems

D.1.2.10 National Association of Corrosion Engineers (NACE International). 15835 Park 10 Place, Houston, TX 77084, US.

MR0175/ISO 15156-1 (2017) - Materials for use in H2S-containing environments in oil and gas production

MR0103/ISO 17945 (2010) - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments

D.1.2.11 NIST Publications. National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.

Technical Note 1637, Modeling the Effects of Outdoor Gasoline Powered Generator Use on Indoor Carbon Monoxide Exposures, 2009.

Technical Note 1666, Modeling the Effects of Outdoor Gasoline Powered Generator Use on Indoor Carbon Monoxide Exposures — Phase II, 2010.

D.1.2.12 SAE Publications. Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J1349, Engine Power Test Code, Spark Ignition and Compression Ignition, 2011.

D.1.2.13 Sandia National Laboratories. National Technology and Engineering Solutions of Sandia, LLC, Albuquerque, New Mexico 87185 and Livermore, California 94550

SAND2012-7321, *Technical Reference for Hydrogen Compatibility of Materials*

D.1.2.14 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 2080, Fire Resistant Tanks for Flammable and Combustible Liquids, 2000.

UL 2085, Protected Aboveground Tanks for Flammable and Combustible Liquids, 1997, revised 2010.

UL 2200, Standard for Stationary Engine Generator Assemblies, 2012, revised 2015.

UL 2200A, UL LLC Outline of Investigation for Fire Containment Testing of Stationary Engine Generator Enclosures, 2019.

D.1.2.15 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 49, Code of Federal Regulations, Part 192.201, "Required Capacity of Pressure Relieving and Limiting Stations."

D.2 Informational References.

D.2.1 FM Approvals. FM Approvals LLC, 1151 Boston-Providence Turnpike, P.O. Box 9102, Norwood, MA, 02062.

ANSI/FM Approvals 5560, American National Standard for Water Mist Systems, December 2007.

FM Approvals Class 5560, Approval Standard for Water Mist Systems, November2017.

FM Approvals Class 5580, Approval Standard for Hybrid (Water and Inert Gas) Fire Extinguishing Systems, November 2012.

D.2.2 Other References.

Shepherd, J. E., “Elastic and Plastic Structural Response of Tubes to Deflagration-to-Detonation Transition,” California Institute of Technology Explosion Dynamics Laboratory Report FM2006-00X, 2006.

D.3 References for Extracts in Informational Sections. (Reserved)

Public Input No. 8-NFPA 37-2021 [New Section after 5.1.5]

Flange connections

Flanged connections shall be in accordance with the applicable provisions of the ASME standards for pipe flanges and fittings (B16 series) and gaskets or the ISO standards for pipe flanges and fittings (ISO 7005 series).

Statement of Problem and Substantiation for Public Input

ISO and ASME flanges can be equally used on gas engine gas trains.

Submitter Information Verification

Submitter Full Name: Kevin Carlisle

Organization: Karl Dungs Inc

Street Address:

City:

State:

Zip:

Submittal Date: Fri May 14 10:18:49 EDT 2021

Committee: INT-AAA

Committee Statement

Resolution: FR-35-NFPA 37-2022

Statement: There can be either ISO or ASME B16 or B31 series flanges on gas trains and this requirement allows for either be used. An additional requirement was added to prevent unnecessary examination of the gas train as these requirements could be misapplied to listed equipment.

Public Input No. 19-NFPA 37-2021 [Section No. 5.3.1.1]

5.3.1.1

The following devices shall not be required to be vented to the outside when installed in accordance with their listing:

(1) Any regulator or zero governor that operates with gas pressure on both sides of the diaphragm

(2) ~~A full lock-up regulator~~

(3) A listed regulator incorporating a vent-limiting device

(4) A regulator incorporating a metallic diaphragm or a safety diaphragm incorporating a vent-limiting ~~system~~ device with an orifice sized for 0.07 m^3/hr (2.5 ft^3/hr) or less, based on natural gas

(5) A pressure switch that incorporates a metallic diaphragm or a safety diaphragm incorporating a vent limiter with an orifice sized for 0.07 m^3/hr (2.5 ft^3/hr) or less, based on natural gas

Statement of Problem and Substantiation for Public Input

Like pressure regulators, pressure switches can also incorporate metallic diaphragm or a safety diaphragm with a vent limiter and thus limit the escape of natural gas to the ambient space.
Add of metallic diaphragm since the rupture pressure of such a diaphragm is nearly equal to the rupture pressure of the housing.
Change vent limiting system to safety diaphragm. This removes the ambiguity that was originally the reason for adding vent limiting system .

Having a full lockup type regulator does not prevent gas from leaking into the ambient space if the atmospheric diaphragm ruptures.

Submitter Information Verification

Submitter Full Name: Kevin Carlisle
Organization: Karl Dungs, Inc.
Street Address:
City:
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Zip:
Submittal Date: Wed Dec 22 13:46:30 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-11-NFPA 37-2022

Statement: Like pressure regulators, pressure switches can also incorporate a safety diaphragm with a vent limiter and thus limit the escape of natural gas to the ambient space.

The "vent limiting system" is changed to a "safety diaphragm" to remove the ambiguity on the term "vent limiting system."

Public Input No. 15-NFPA 37-2021 [Section No. 5.3.2]

5.3.2

When the gas pressure on the upstream side of a non-full lock-up regulator is more than a gauge pressure of 3.5 kPa (0.5 psi) and the dowstream devices are rated for 0.5 PSI max , a token relief valve shall be installed on the downstream side of the regulator. This token relief valve shall vent to the outside of the structure at a point at least 1.5 m (5 ft) away from any structure opening.

5.3.2.1

Such relief valves shall be sized to vent the required volume of gas.

5.3.3.Where a full lockup regulator is used to comply with 5.3.2, the regulator shall be installed so that the lockup pressure in the application is not

greater than 3.5 kPa (0.5 psi). See also Annex A.5.3.1.2

Statement of Problem and Substantiation for Public Input

Added performance based language to the lockup requirement because the actually lockup pressure is dependent only only on the regulator design but also on the application. Current NFPA 37 does not specify what the lockup pressure needs to be. It should be no more the pressure rating of the downstream devices.

Token is added to clarify that for this application, it is not required to install a full capacity relief valve.

Submitter Information Verification

Submitter Full Name: Kevin Carlisle
Organization: Karl Dungs, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Dec 22 13:27:37 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: CI-12-NFPA 37-2022

Statement: A task group was formed to review the purpose/terminology of a relief valve that does not vent the full pressure of the system. The lockup regulator performance is dependent on how it is used, so its requirements will be reviewed to see if the language should be retained or revised.

Public Input No. 18-NFPA 37-2021 [New Section after 5.6]

Manifolding of Atmospheric Vent Lines.

Vent lines from multiple engines shall not be manifolded together.

Vents from systems operating at different pressure control levels shall not be manifolded together.

Vents from systems served from different pressure reducing stations shall not be manifolded together.

Vents from systems using different fuel sources shall not be manifolded together.

Vent lines from multiple regulators and switches of a single engine , where manifolded together, shall be piped in such a manner that any gas being vented from one ruptured diaphragm does not backload the other devices.

The cross-sectional area of the manifold line shall not be less than the greater of the following:

(1) The cross-sectional area of the largest vent plus 50 percent of the sum of the cross-sectional areas of the additional vent lines

(2) The sum of the cross-sectional areas of the two largest vent lines

Statement of Problem and Substantiation for Public Input

There are no requirement for manifolding of atmospheric vents. Proposal is to add some to minimize safety hazards associated with improper manifolding of vent lines.

Submitter Information Verification

Submitter Full Name: Kevin Carlisle

Organization: Karl Dungs, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Wed Dec 22 13:41:06 EST 2021

Committee: INT-AAA

Committee Statement

Resolution: CI-8-NFPA 37-2022

Statement: There are no requirement for manifolding of atmospheric vents. A task group is formed is to add some minimal safety requirements associated with improper manifolding of vent lines. NFPA 54 has some requirements that could be used as a basis, but that code does not include stationary engines, so it would be beneficial to include atmospheric vent requirements in NFPA 37.

Public Input No. 16-NFPA 37-2021 [Section No. 5.6.1.1 [Excluding any Sub-Sections]]

When an overpressure protection device is required in 5.6.1, it shall be set to not exceed ~~the following pressures:~~

~~The set point of the device shall not exceed 150 percent of the~~

(1) the rated pressure of the lowest rated component when the rated pressure of any component ~~is less than 83 kPa (12 psi).~~

(2) ~~The set point of the device shall not exceed 41 kPa (6 psi) above the rated pressure of the lowest rated component when the rated pressure of any component is equal to or greater than 83 kPa (12 psi) but less than 414 kPa (60 psi).~~

(3) ~~The set point of the device shall not exceed 110 percent of the rated pressure of the lowest rated component when the rated pressure of any component is equal to or greater than 414 kPa (60 psi).~~

(4) on the gas train.

Statement of Problem and Substantiation for Public Input

This is proposed for the TC to consider if we should leave the current langauge (which seems to be working), or do we try to be consistent with other
NFPA standards.

The current language allows a pressure that is higher than the rating of the component.

Submitter Information Verification

Submitter Full Name: Kevin Carlisle
Organization: Karl Dungs, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Dec 22 13:33:15 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: CI-14-NFPA 37-2022

Statement: There appears to be a "grey area" on if the overpressure protection settings in some cases could be exceeding the maximum pressure that the device can withstand. The design, operating, or maximum allowable operating pressures may be confused in their application. The language will be reviewed to provide clarification.

Public Input No. 24-NFPA 37-2021 [Section No. 6.8.2]

6.8.2

Piping systems shall be supported and protected against physical damage and excessive stresses in accordance with MSS SP-58, *Pipe Hangers and Supports — Materials, Design, Manufacture, Selection, Application, and Installation*.

6.8.2.1*

Approved metallic or nonmetallic flexible connectors shall be permitted to protect the piping system against damage caused by settlement, vibration, expansion, contraction, or corrosion.

6.8.2.2

Fuel lines supplying a generator set [JB1] inside a high-rise building shall be separated from areas of the building other than the room in which the generator is located by one of the following methods:

(1) A fire resistant pipe-protection system that meets all of the following:

(a) Tested in accordance with **UL 1489**, *Fire Tests of Fire Resistant Pipe Protection Systems Carrying Combustible Liquids*

(b) Installed as tested and in accordance with the manufacturer's installation instructions

(c) Has a rating of not less than 2 hours or not less than 1 hour where the building is protected with an approved, supervised automatic sprinkler system in accordance with Section 9.7

(2) An assembly that has a fire resistance rating of not less than 2 hours or not less than 1 hour where the building is protected with an approved, supervised automatic sprinkler system. {NFPA 101:11.8.4.5}

Statement of Problem and Substantiation for Public Input

This proposal is basically an extract from NFPA 101, but does not include a reference to the type of automatic sprinkler system in question – e.g. NFPA 13, 13D or 13R. This will help verify that these requirements are not overlooked in the NFPA 37 design and installation.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 23-NFPA 37-2021 [Section No. 2.3.5]	

Submitter Information Verification

Submitter Full Name: Kelly Nicolello

Organization: UL

Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 30 11:51:22 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: The proposal references sections of NFPA 101 which applies to emergency systems, whereas NFPA 37's scope is for all engines. The protections in NFPA 101 are to protect the engine from a fire, whereas as NFPA 37 is focused on protecting the building in the case of a fire. The extract could also apply to gas lines as well as liquid lines.

Public Input No. 31-NFPA 37-2022 [Section No. 8.1]

8.1 ~~Design and Construction.~~ ~~General~~ .

This chapter applies to exhaust systems for engines installed in a structure and exhaust systems attached to a structure from engines located outdoors.

8.1.1*

~~Engines installed in structures shall have exhaust systems~~ Exhaust systems shall be designed and constructed such that the system can withstand the anticipated exhaust gas temperatures.

8.1.2*

Exhaust systems shall be designed and constructed to withstand the intended service.

8.1.2.1

Exhaust systems shall consist of metal, masonry, or factory-built chimneys where they pass through a floor, ceiling, attic, or concealed space.

8.1.2.1.1

Field fabricated or unlisted metal and masonry chimneys shall be designed and constructed to NFPA 211 or an engineered design.

8.1.2.1.2

Factory-built chimneys shall be listed in accordance with UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, for positive pressure applications or UL 959, *Medium Heat Appliance Factory-Built Chimneys*, and follow NFPA 211 guidelines.

8.1.3*

If an engine exhaust system connects to the same flue as other fuel-burning appliances, the engine exhaust shall enter the flue a distance of at least 1½ times the equivalent diameter of the exhaust pipe or duct above or below the level of the other appliance vent(s).

8.1.3.1*

An engine exhaust system that will discharge at positive pressure (greater than atmospheric pressure) shall not enter the same flue as an appliance that relies on natural draft to vent.

8.1.3.2

Common venting shall be permitted where appropriate calculations demonstrate that the exhaust from the engine does not reduce the performance of the other appliance(s).

8.1.4*

Exhaust systems shall be designed and constructed to withstand forces caused by the ignition of unburned fuel or shall have provisions to relieve those forces without damaging the exhaust system.

8.1.5*

Low points in exhaust systems shall have drains.

Additional Proposed Changes

File Name	Description	Approved
NFPA_37_2024_-_PI_for_8.1.docx	NFPA 37 (2024) - PI for 8.1	

Statement of Problem and Substantiation for Public Input

There has been misinterpretation of the intended application for this chapter in the field. There have been cases which AHJs apply the requirements of this chapter to engines installed outdoors due to the engine being in the general proximity of a structure. The updated text provides clarity for when the requirements shall apply.

Submitter Information Verification

Submitter Full Name:	Curtis Flint
Organization:	Generac Power Systems, Inc.
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Jan 05 14:31:40 EST 2022
Committee:	INT-AAA

Committee Statement

Resolution: The proposed text is not technically correct because engines installed outdoors have exhaust systems, sometimes they are pipes. Engine exhaust systems installed outdoors sometimes need a conveying system to direct the exhaust away from air intakes and potentially at elevations of up to 30 feet or greater.

8.1 ~~Design and Construction~~ General.

This chapter applies to exhaust systems for engines installed in a structure and exhaust systems attached to a structure from engines located outdoors.

8.1.1

~~Engines installed in structures shall have~~ Exhaust systems shall be designed and constructed such that the system can withstand the anticipated exhaust gas temperatures.

8.1.2

Exhaust systems shall be designed and constructed to withstand the intended service.

8.1.2.1

Exhaust systems shall consist of metal, masonry, or factory-built chimneys where they pass through a floor, ceiling, attic, or concealed space.

8.1.2.1.1

Field fabricated or unlisted metal and masonry chimneys shall be designed and constructed to NFPA 211 or an engineered design.

8.1.2.1.2

Factory-built chimneys shall be listed in accordance with UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, for positive pressure applications or UL 959, *Medium Heat Appliance Factory-Built Chimneys*, and follow NFPA 211 guidelines.

8.1.3

If an engine exhaust system connects to the same flue as other fuel-burning appliances, the engine exhaust shall enter the flue a distance of at least 1½ times the equivalent diameter of the exhaust pipe or duct above or below the level of the other appliance vent(s).

8.1.3.1

An engine exhaust system that will discharge at positive pressure (greater than atmospheric pressure) shall not enter the same flue as an appliance that relies on natural draft to vent.

8.1.3.2

Common venting shall be permitted where appropriate calculations demonstrate that the exhaust from the engine does not reduce the performance of the other appliance(s).

8.1.4

Exhaust systems shall be designed and constructed to withstand forces caused by the ignition of unburned fuel or shall have provisions to relieve those forces without damaging the exhaust system.

8.1.5

Low points in exhaust systems shall have drains.

Public Input No. 6-NFPA 37-2021 [Section No. 11.4]

11.4 Fire Suppression Systems and Equipment.

11.4.1 Fixed Fire Suppression Systems.

11.4.1.1*

Fixed fire suppression systems, where provided, shall comply with the following standards, as appropriate, unless specifically noted otherwise in this standard:

(1) NFPA 11

(2) NFPA 12

(3) NFPA 12A

(4) NFPA 13

(5) NFPA 15

(6) NFPA 17

(7) NFPA 750

(8) NFPA 770

(9) NFPA 2001

(10) NFPA 2010

11.4.1.2

Fixed fire suppression systems shall be designed to protect all areas where fuel or oil might spray, flow, or collect.

11.4.2 General.

11.4.2.1*

Automatic fuel stop valves, where required by other sections of this standard, shall be arranged to close upon activation of the fire suppression system that covers the engine installation, including auxiliary equipment.

11.4.2.1.1*

Where procedures are in place to direct operator actions upon activation of the fire suppression system that covers the engine installation, automatic fuel stop valves for engines that are for emergency use or for engines that are constantly attended shall be permitted to remain open.

11.4.2.2

Mechanical ventilation systems, where provided, shall be arranged to shut down upon activation of the fire suppression system within the engine enclosure.

11.4.2.3*

Where procedures are in place to direct operator actions upon activation of the fire suppression system within the engine installation, mechanical ventilation systems for engines that are for emergency use or engines that are constantly attended shall be permitted to remain in operation.

11.4.2.4

The positioning of the fire suppression systems and equipment shall be such that maintenance access to the engine is maintained.

11.4.3* Foam Fire Suppression Systems.

Foam fire suppression systems shall be designed to provide a foam blanket or foam submergence until it can be demonstrated that the engine has cooled to below the autoignition temperature of combustible material present.

11.4.4* Gaseous Agent Fire Systems.

11.4.4.1*

Total flooding gaseous agent systems shall be designed to take into consideration both of the following factors:

(1) The agent concentrations required for the specific combustible materials involved

(2) The specific configuration of the equipment and enclosure

11.4.4.1.1*

Total flooding gaseous suppression systems shall be designed to maintain the design concentration within the enclosure for a time sufficient to ensure that the fire is extinguished and that surface temperatures of the engine or turbine have cooled to below the autoignition temperature of combustible material present. In lieu of manufacturer or laboratory fire test data demonstrating the actual time to achieve extinguishment and cool-down, the concentration shall be maintained for a minimum of 20 minutes.

11.4.4.2*

Local application gaseous agent suppression systems shall be designed to operate for a time sufficient to ensure that the fire is extinguished and that surface temperatures of the engine or turbine have cooled to below the autoignition temperature of combustible material present. In lieu of manufacturer or laboratory fire test data demonstrating the actual time to achieve extinguishment and cool-down, the discharge duration shall be maintained for a minimum of 20 minutes.

11.4.5 Automatic Sprinkler and Water Spray Systems.

11.4.5.1*

Automatic sprinkler systems shall be designed to provide a density of 12.2 mm/min (0.3 gpm/ft^2) over the most remote 230 m^2 (2500 ft^2).

11.4.5.1.1

Sprinklers and spray nozzles shall be spaced at a 9 m^2 (100 ft^2) maximum area of coverage per sprinkler or spray nozzle.

11.4.5.1.2

Sprinkler and water spray system coverage shall be provided to all areas within the enclosure located within 6 m (20 ft) of the following:

(1) The engine

(2) The lubricating oil system

(3) The fuel system

11.4.5.2

Sprinklers and water spray nozzles shall not be directed at engine components that are susceptible to thermal shock or deformation.

11.4.6 Dry Chemical Fire Suppression Systems.

Dry chemical fire suppression systems shall be designed to operate for a minimum of 20 minutes or until it can be demonstrated that the engine has cooled to below the autoignition temperature of combustible material present.

11.4.7* Water Mist Suppression Systems.

Water mist suppression systems shall be designed and installed in accordance with their listing for the specific hazards and protection objectives specified in the listing.

11.4.8 Hybrid Fire Extinguishing Systems.

Hybrid fire extinguishing systems shall be designed and installed in accordance with their listing unless the manufacturer or laboratory fire test data demonstrate that a different discharge duration ensures extinguishment and prevents reignition of the combustible materials present.

11.4.9 Retrofit of Fire Suppression Systems.

Where retrofit of a fire suppression system is undertaken, the minimum discharge duration shall be 20 minutes, unless manufacturer or laboratory fire test data demonstrate that a different discharge duration ensures extinguishment and cool-down to below the autoignition temperature of combustible materials present.

11.4.10 Fixed Aerosol Fire Suppression Systems

Aerosol fire suppression systems shall be designed and installed in accordance with their listing for the specific hazards specified in the listing.

Statement of Problem and Substantiation for Public Input

NFPA 2010 Standard for Fixed Aerosol Fire-Extinguishing Systems is equivalent to fire suppression technologies described in NFPA 37, article 11.4.1.1.
Please also refer to the standard NFPA 850 Fire Protection for Electric Generating Plants and High Voltage Direct Current Conversions, which had incorporated NFPA 2010 as an approved Fire Protection System. NFPA 2010 compliant and listed products are currently in use (and have been in use for many years) for the fire protection of gas turbine enclosures by GT OEMs and as retrofitted fire protection systems in existing gas turbine enclosures.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 7-NFPA 37-2021 [Section No. 2.2]	Addition of NFPA 2010 standard
Public Input No. 7-NFPA 37-2021 [Section No. 2.2]	

Submitter Information Verification

Submitter Full Name:	Anthony Gee
Organization:	Fireaway Inc.
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Apr 21 11:52:34 EDT 2021
Committee:	INT-AAA

Committee Statement

Resolution: Fixed aerosol systems are not listed or tested for this type of equipment. This technology cannot be used in occupied areas because it may create a hazardous atmosphere. It could have the potential to be corrosive, and may have oxidizing capability. These aerosols could also ignite a flammable atmosphere.

Public Input No. 2-NFPA 37-2021 [Section No. 11.4.1.1]

11.4.1.1*

Fixed fire suppression systems, where provided, shall comply with the following standards, as appropriate, unless specifically noted otherwise in this standard:

(1) NFPA 11

(2) NFPA 12

(3) NFPA 12A

(4) NFPA 13

(5) NFPA 15

(6) NFPA 17

(7) NFPA 750

(8) NFPA 770

(9) NFPA 2001

(10) NFPA 2010

Statement of Problem and Substantiation for Public Input

The use of Fixed Aerosol Fire Extinguishing systems as a "Total Flooding" method of protection for Combustion Turbines has been demonstrated and implemented on a limited basis. This is a precedent for application to Internal Combustion Engine installations as well. Additionally, the use of Fixed Aerosol Fire Extinguishing systems was recognized in NFPA 850 with the 2015 edition; hence, this change aligns NFPA 37 with existing guidance in NFPA 850.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1-NFPA 37-2021 [Section No. 2.2]	Same NFPA Document reference

Submitter Information Verification

Submitter Full Name: Larry Danner
Organization: GE Power
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 19 09:15:36 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: Fixed aerosol systems are not listed or tested for this type of equipment. This technology cannot be used in occupied areas because it may create a hazardous atmosphere. It could have the potential to be corrosive, and may have oxidizing capability. These aerosols could also ignite a flammable atmosphere.

Public Input No. 10-NFPA 37-2021 [Section No. 11.4.5.1]

11.4.5.1*

Automatic sprinkler systems shall be ~~designed to provide a density of 12.2 mm/min (0.3 gpm/ft ^{2}) over the most remote 230 m ^{2} (2500 ft ^{2}).~~

~~**11.4.5.1.1**~~ –

~~Sprinklers and spray nozzles shall be spaced at a 9 m ^{2} (100 ft ^{2}) maximum area of coverage per sprinkler or spray nozzle~~

based on an Extra Hazard (Group 1) occupancy in accordance with NFPA 13 .

11.4.5.1.2

Sprinkler and water spray system coverage shall be provided to all areas within the enclosure located within 6 m (20 ft) of the following:

(1) The engine

(2) The lubricating oil system

(3) The fuel system

Statement of Problem and Substantiation for Public Input

The current language precludes the designer from utilizing certain design approached permitted by NFPA 13. As currently written, the designer must use the density/area approach. With the modified language, the designer would be permitted to utilize the room design method or other arrangements and take into account area adjustments for extra hazard occupancies when utilizing high temperature or 11.2-K or larger sprinklers. Additionally, for existing system modifications, Extra Hazard (Group 1) designs are permitted to have sprinkler spacings up to 130 sq. ft when the density is less than 0.25 gpm/sq. ft.

Submitter Information Verification

Submitter Full Name:	Kevin Hall
Organization:	American Fire Sprinkler Association
Affiliation:	American Fire Sprinkler Association
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Nov 30 13:22:29 EST 2021
Committee:	INT-AAA

Committee Statement

Resolution: In most standards where combustible liquids are stored, a sprinkler density of 0.3 gpm/sq ft has been shown by FM Global to effectively suppress pool fires with Class III liquids (FM Data Sheets 7-79, "Fire Protection for Gas Turbines and Electric Generators" and 5-23 "Emergency and Standby Generator Systems"). NFPA 13 could allow a density that is lower than in these cases as there could more than one sprinkler density/area combination based on a curve that could be acceptable as an Extra Hazard 1 (EH1) occupancy suppression. However, these density/area combinations may not be sufficient for these types of pool fires.

Public Input No. 3-NFPA 37-2021 [Section No. 11.4.6]

11.4.6 Dry Chemical and Fixed Aerosol Fire Suppression Systems.

Dry chemical and Fixed Aerosol fire suppression systems shall be designed to operate for a minimum of 20 minutes or until it can be demonstrated that the engine has cooled to below the autoignition temperature of combustible material present.

Statement of Problem and Substantiation for Public Input

The use of Fixed Aerosol Fire Extinguishing systems as a "Total Flooding" method of protection for Combustion Turbines has been demonstrated and implemented on a limited basis. This is a precedent for application to Internal Combustion Engine installations as well. Additionally, the use of Fixed Aerosol Fire Extinguishing systems was recognized in NFPA 850 with the 2015 edition; hence, this change aligns NFPA 37 with existing guidance in NFPA 850.

A deep dive into the "Total Flooding" guidance in NFPA 17 and NFPA 2010 reveals it is consistent between the two documents; hence a single entry referencing both methods in NFPA 37 is appropriate.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1-NFPA 37-2021 [Section No. 2.2]	Text update related to the added NFPA reference

Submitter Information Verification

Submitter Full Name: Larry Danner
Organization: GE Power
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 19 09:17:57 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: Fixed aerosol systems are not listed or tested for this type of equipment. This technology cannot be used in occupied areas because it may create a hazardous atmosphere. It could have the potential to be corrosive, and may have oxidizing capability. These aerosols could also ignite a flammable atmosphere.

Public Input No. 22-NFPA 37-2021 [Section No. A.1.3.1]

~~**A.1.3.1**~~ —

~~This standard is not intended to apply to engines used to propel mobile equipment.~~

~~For engines used to drive fire pumps, see also NFPA 20.~~

~~For engines used in essential electrical systems in health care facilities, see also NFPA 99.~~

~~For engines used in emergency power supplies, see also NFPA 110.~~

~~For engines installed on marine vessels for purposes other than propulsion, NFPA 37 should be used as a guide.~~

Statement of Problem and Substantiation for Public Input

This proposal essentially moves the A.1.3.1 annex material into the body of the code. The requirement for this standard not applying to engines used to propel mobile equipment should be in the body of the standard, not the annex.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 21-NFPA 37-2021 [Section No. 1.3.1]	

Submitter Information Verification

Submitter Full Name: Kelly Nicolello
Organization: UL
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 30 11:40:23 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-34-NFPA 37-2022

Statement: Because of the nature of NFPA 20, NFPA 99, and NFPA 110 to reference NFPA 37 as well, leaving the language in the annex is more appropriate. The language would have to be changed to mandatory language to be added to the requirements section, which is not appropriate in these cases.

The last sentence was changed to clarify that NFPA 37, which is a standard, should not be considered as a guide. The first sentence was changed to the last sentence such that it did not make the section look like a charging statement.

Public Input No. 5-NFPA 37-2021 [Section No. A.4.1.2.2.3]

A.4.1.2.2.3

Explosion venting for a fuel explosion should be considered for large engine installations. In some installations where it might not be practical for the normal constantly operating ventilation to prevent the accumulation of flammable vapors or gases from leakage, a hazardous vapor detection system can be installed. The system is often set up to detect the hazardous vapors at two concentration levels (percentage of the lower explosive limit, LEL).

If the first (lower) level is reached, the ventilation volume is increased by use of a purge fan to remove the vapors. If the second (higher) level is reached, the operation is shut down and the enclosure ~~inverted~~ inerted as the ventilation is stopped. The ~~inverting~~ inerting is normally done quickly and maintained until the leak is stopped, after which the entire hazard volume is purged while operations are resumed.

Statement of Problem and Substantiation for Public Input

The text proposes to "invert" an enclosure that has a concentration of hazardous vapors. This is not practical. The enclosure should be "inerted", i.e. remove that hazard by introducing inert materials such as fire-suppression gasses.

The text says: "The inverting is normally done quickly... ." Same reasoning as above.

Submitter Information Verification

Submitter Full Name: Peter Smith

Organization: Emergency Power Systems

Affiliation: self

Street Address:

City:

State:

Zip:

Submittal Date: Fri Mar 05 14:12:55 EST 2021

Committee: INT-AAA

Committee Statement

Resolution: FR-7-NFPA 37-2022

Statement: This change fixes two errors and the term "inerted" should be used instead of "inverted."

Public Input No. 25-NFPA 37-2021 [Section No. A.4.1.3.2.2]

A.4.1.3.2.2

Two means of demonstrating compliance are by means of full-scale fire tests , such as testing specified in UL 2200A (Investigation for Fire Containment Testing of Stationary Engine Generator Enclosures) or by calculation procedures, such as those given in NFPA 555. See A.4.1.4.2.2

Statement of Problem and Substantiation for Public Input

The UL 2200A Outline of Investigation provides fire test data and performance criteria to evaluate stationary engine generator assemblies for installation less than the required spacing by NFPA 37. The fire condition represented by this test simulates a catastrophic engine failure that results in the ignition of lubricating oil and combustible components and assemblies within the generator enclosure. The requirements do not evaluate the contribution of the fuel source (LPG, natural gas, gasoline, diesel) to fire growth. The addition of the reference for UL 2200A in A.4.1.3.2.2 is consistent with a reference in A.4.1.4.2.2

Submitter Information Verification

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Submittal Date: Thu Dec 30 11:55:02 EST 2021
Committee: INT-AAA

Committee Statement

Resolution: FR-3-NFPA 37-2022

Statement: The addition of the reference for UL 2200A in A.4.1.3.2.2 is consistent with the reference in A.4.1.4.2.2.

The UL 2200A Outline of Investigation provides fire test data and performance criteria to evaluate stationary engine generator assemblies for installation less than the required spacing by NFPA 37. The fire condition represented by this test simulates a catastrophic engine failure that results in the ignition of lubricating oil and combustible components and assemblies within the generator enclosure. The requirements do not evaluate the contribution of the fuel source (LPG, natural gas, gasoline, diesel) to fire growth.

Public Input No. 33-NFPA 37-2022 [Section No. A.4.1.4.2.2]

A.4.1.4.2.2

It has been shown that combustible materials exhibit different levels of combustibility, ignitability, and fire performance. Therefore, full-scale fire tests should be conducted in the presence of combustible materials that adequately represent the expected potential fire hazard at the location where the engine is to be placed *(see NFPA 555)*.

~~An example of a test method that provides data for installations less than the required spacing to combustible structures in accordance with 4.1.4.1 is UL 2200A, *UL LLC Outline of Investigation for Fire Containment Testing of Stationary Engine Generator Enclosures* . The fire condition represented by this test simulates the ignition of combustibles and assemblies within the generator enclosure.~~

For liquid-fueled engines that include a fuel tank within the enclosure, the maximum quantity of fuel should be considered as part of the fire test.

The calculation procedures in Chapter 10 of NFPA 555 contain a procedure similar to the “Radiant Ignition of a Near Fuel” algorithm in NIST’s Fire Protection Engineering Tools for Hazard Estimation (FPETool) for calculating ignition from a nearby fire. It is a sound, engineering-based method of predicting radiative ignition of a material not in direct contact with a flame.

The values in 4.1.4 and the reference to the NFPA 555 calculation method are the result of the calculations presented to the technical committee in 1996. The calculations treated an engine fire as a vertical cylinder. The values in 4.1.4 changed somewhat in the 1998 edition of NFPA 37 based on those calculations. They are reasonably consistent with the requirements of the *BOCA National Building Code* , which was in effect at the time. The technical committee wanted to include a performance alternative in NFPA 37. The reference to the NFPA 555 method in this annex provides guidance on how to evaluate proposed alternatives.

Statement of Problem and Substantiation for Public Input

UL2200A is a standard that is based on the thermal performance and spacings from combustible surfaces as it relates to fixed appliances installed indoors. The maximum temperature requirements in UL2200A are restrictive when applied to engines installed outdoors. I am being told that this Outline of Investigation is being considered for a rewrite before being balloted for release as a standard. For these reasons the reference to UL2200A should be removed from the Annex.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 34-NFPA 37-2022 [Section No. C.1.2.10]	
Public Input No. 34-NFPA 37-2022 [Section No. C.1.2.10]	

Submitter Information Verification

Submitter Full Name: Jeff Jonas
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Submittal Date: Wed Jan 05 17:26:22 EST 2022
Committee: INT-AAA

Committee Statement

Resolution: UL 2200A is a fire test outline and is shown as an example, and it is not enforceable. Users can use alternative procedures. There are no known problems with referencing this outline in the annex.

Public Input No. 17-NFPA 37-2021 [Section No. A.5.4.4.1]

A.5.4.4.1

It is permissible, but less desirable, to replace one of the ASSVs that complies with UL 1337 and with one of the following valves if it will automatically shut off the flow of fuel within 2 seconds of the engine stopping:

(1) *Carburetion valve*. The carburetion valve is often referred to as the mixer or air/gas valve. The carburetion valve controls the air–fuel mixture by metering the fuel inlet based on the velocity of the air coming into the valve. If there is no air flow, the carburetion valve shuts off the fuel.

(2) *Zero governor–type regulating valve*. Also referred to as a "zero pressure regulator" or "zero governor." In the case of a venturi mixer, a zero governor–type regulating valve is used. When used as a shutoff valve, it must be adjusted to provide zero fuel flow in the standby condition. Prime mover vacuum draws against a diaphragm, which opens the spring-loaded fuel inlet valve, causing fuel to flow.

(3) *Auxiliary valve*. This category would include any other types of valves that suit the purpose of providing positive fuel shutoff within 2 seconds of the prime mover stopping.

Statement of Problem and Substantiation for Public Input

Since UL 1337 is the standard to which such controls are listed, it would be good to add this reference.

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Committee: INT-AAA

Committee Statement

Resolution: UL 1337 is an outline and is not a standard. Adding this reference without knowing the potential consequences to industry may be detrimental.

Public Input No. 26-NFPA 37-2021 [Section No. C.1.2.10]

C.1.2.10 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 2080, *Fire Resistant Tanks for Flammable and Combustible Liquids*, 2000.

UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2010.

UL 2200, *Standard for Stationary Engine Generator Assemblies,* ~~2012, revised 2015~~ 2020 .

UL 2200A, ~~*UL LLC*~~ *Outline of Investigation for Fire Containment Testing of Stationary Engine Generator Enclosures*, 2019.

Statement of Problem and Substantiation for Public Input

Update UL 2200 edition reference. “Remove Standard for” The term is redundant and unnecessary. All references to UL publications are standards unless noted otherwise. UL LLC is removed from UL 2200A since it is not part of the title.

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Committee: INT-AAA

Committee Statement

Resolution: FR-27-NFPA 37-2022

Statement: The NFPA Manual of Style requires that references are updated to the latest editions.

Public Input No. 34-NFPA 37-2022 [Section No. C.1.2.10]

C.1.2.10 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 2080, *Fire Resistant Tanks for Flammable and Combustible Liquids*, 2000.

UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2010.

UL 2200, *Standard for Stationary Engine Generator Assemblies,* 2012, revised 2015.

~~UL 2200A, *UL LLC Outline of Investigation for Fire Containment Testing of Stationary Engine Generator Enclosures* , 2019.~~

Statement of Problem and Substantiation for Public Input

This PI is related to the PI 33 for A.4.1.4.2.2. If UL2200A is removed from Annex A it should be removed from the list in Annex C.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 33-NFPA 37-2022 [Section No. A.4.1.4.2.2]	

Submitter Information Verification

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Submittal Date: Wed Jan 05 17:57:42 EST 2022
Committee: INT-AAA

Committee Statement

Resolution: FR-27-NFPA 37-2022

Statement: The NFPA Manual of Style requires that references are updated to the latest editions.