

Approval Standard

Storage Buildings and Lockers

Class Number 6049
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Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This Standard states Approval requirements for storage buildings. Storage buildings are used in a variety of commercial and industrial applications. Some of these uses are to store and/or dispense ignitable liquids, to store flammable and non-flammable compressed gases in cylinders and to store other types of combustible and non-combustible goods such as chemicals, fertilizers and other general storage.
- 1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies) and audit of quality assurance procedures.

1.2 Scope

- 1.2.1 This standard sets performance requirements for structures designed to provide a safe, secure storage and/or dispensing area for ignitable liquids, for the storage of flammable and non-flammable compressed gases in cylinders and for the storage of combustible and/or non-combustible commodities.
 - 1.2.1.1 The structures Approved in this standard are generally referred to as storage buildings. This standard also recognizes a subcategory of structures that shall be referred to as storage lockers. When categorized by this standard as a storage locker, the structure's Approval shall be limited to outdoor usage.
 - 1.2.1.2 Storage structures Approved in this standard shall not be permitted to be referred to as storage cabinets by the manufacturer unless they also meet the requirements of Approval Standard 6050, Storage Cabinets.
- 1.2.2 These buildings are generally considered to be portable. When used outdoors, anchoring means may be necessary to prevent movement under high wind conditions.
- 1.2.3 Storage buildings eligible for Approval fall into the categories shown below:
 - a) For the storage of ignitable liquids **with** provisions for damage-limiting construction;
 - b) For the storage of ignitable liquids **without** provisions for damage-limiting construction;
 - c) For the storage of flammable compressed gases in cylinders **with** provisions for damage-limiting construction;
 - d) For the storage of non-flammable compressed gases in cylinders **without** provisions for damage-limiting constructions;
 - e) For general use without provisions for damage-limiting construction.
- 1.2.4 Manufacturers shall provide a label on the structure indicating the category for which the structure has been approved.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing and/or the standards of other national and international organizations. The advice of manufacturers, users and loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of storage buildings for the purpose of obtaining Approval. These requirements are intended primarily as guides and strict conformity is not always mandatory. Buildings having characteristics not anticipated by this standard may be FM Approved if performance equal or superior to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, buildings which do meet all the requirements identified in this standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval is based upon satisfactory evaluation of the building and the manufacturer in the following major areas:

- 1.4.1 Examination and analysis of building construction shall be performed to evaluate:
- the suitability of the building;
 - the proper operation and performance of the building as specified by the manufacturer and required by FM Approvals; and, as far as practical;
 - the durability and reliability of the building.
- 1.4.2 If an assembly submitted for Approval incorporates a component for which a separate Approval Standard exists, then that component shall be examined, at minimum, to the extent required by its own Approval Standard. Components already separately FM Approved which are submitted as part of an assembly to be Approved need only be examined to the extent necessary to assure proper functioning as part of the assembly.
- 1.4.3 An examination of the manufacturing facilities and audit of quality control procedures shall be made to evaluate the manufacturer's ability to produce the building which is examined and tested, and the marking procedures used to identify the building. These examinations are repeated as part of FM Approvals' follow-up program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the building as currently FM Approved;
- the continued use of acceptable quality control procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Master Agreement; and
- re-examination of production buildings for continued conformity to requirements.

1.6 Effective Date

The effective date of an Approval Standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval. The effective date shall apply to the entire Approval standard, or, where so indicated only to specific paragraphs of the standard.

The effective date of this Standard is **October 1, 2014** for full compliance with all requirements.

1.7 System of Units

Units of measurements are U.S. customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. Appendix B lists the selected units for quantities dealt with in testing these products; conversions to SI units are included. Conversion of customary English units is in accordance with ASTM E380.

1.8 Applicable Documents

American Iron and Steel Institute (AISI)

AISI North American *Specifications for the Design of Cold Formed Steel Structural Members* (NASPEC 2001)

American Institute for Steel Construction, Inc. (AISC)

AISC *Steel Construction Manual* 14th edition

American Society of Civil Engineers (ASCE)

ASCE 7- 10, *Minimum Design Loads for Buildings and Other Structures*

American Society for Testing and Materials (ASTM)

ASTM E84- 12c, *Standard Test Method for Surface Burning Characteristics of Building Materials*

ASTM E119- 12a, *Standard Test Methods for Fire Tests of Building Construction and Materials*

ASTM E136- 12, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*

ASTM E 1529-13, *Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural members and Assemblies*

American National Standards Institute (ANSI)

ANSI/UL 555, *Standard for Fire Dampers*

FM Global Data Sheets

FM Global Property Loss Prevention Data Sheet 1-28, *Wind Design*, January 2012

FM Global Property Loss Prevention Data Sheet 1-44, *Damage-Limiting Construction*, April 2012

FM Global Property Loss Prevention Data Sheet 7-29, *Ignitable Liquid Storage in Portable Containers*, April 2012

FM Global Property Loss Prevention Data Sheet 7-32, *Ignitable Liquid Operations*, April 2012

FM Global Property Loss Prevention Data Sheet 7-50, *Compressed Gases in Cylinders*, January 2012

FM Global Property Loss Prevention Data Sheet 7-83, *Drainage and Containment Systems for Ignitable Liquids*, April 2012

National Fire Protection Association (NFPA)

NFPA 13-2013, *Standard for the Installation of Sprinkler Systems*

NFPA 30-2012, *Flammable and Combustible Liquids Code*

NFPA 55-2013, *Compressed Gases and Cryogenic Fluids Code*

NFPA 68-2013, *Standard on Explosion Protection by Deflagration Venting*

NFPA 70-2014, *National Electrical Code*

1.9 Definitions

Compressed Gas

A material, or a mixture of materials, that 1) is a gas at 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.3 kPa) and 2) has a boiling point of 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.3 kPa) and that is liquefied, non-liquefied or in solution, except that those gases that have no health or physical hazard properties are not considered to be compressed gases until the pressure in the packaging exceeds an absolute pressure of 40.6 psi (280 kPa) at 68°F (20°C).

Cylinder

A pressure vessel designed for absolute pressures higher than one atmosphere and having a circular section.

Damage-Limiting Construction

A combination of pressure-relieving (venting) and pressure-resisting exterior construction which is intended to mitigate over-pressure damage to the building in case of a vapor-air deflagration. The design of relieving and resisting features must be engineered to account for fuel, surface area of the enclosure, vent area and structural loads imposed by the deflagration.

Flammable Gas

A material that is a gas at 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.3 kPa) when in a mixture of 13% or less by volume with air, and that has a flammable range at an absolute pressure of 14.7 psi (101.3 kPa) with air of at least 12%, regardless of the lower limit.

Ignitable Liquid

For purposes of this standard, the term ignitable liquid is used to represent any liquid that burns.

Indoor Usage

An arrangement when the Approved storage building is physically located inside of another building and acts as a cut-off room.

Non-Combustible Materials

Materials that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion or release flammable vapors when subjected to fire or heat. Such materials meet the criteria of ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*.

Non-Flammable Gas

A gas that does not meet the definition of a flammable gas.

Storage Building

A prefabricated structure designed to provide a safe and secure storage area.

Storage Locker

Similar to a storage building but generally smaller in size. Lockers do not allow personnel to enter the structure and are designed such that containers for which it is designed to store cannot be placed within ½ the height of the container from the door opening. The Approval of storage lockers shall be limited to outdoor usage.

2 GENERAL INFORMATION

2.1 Non-Combustible Construction

2.1.1 Building walls, roofs and doors shall be of steel construction or utilize other non-combustible materials.

2.1.2 The basic test that building officials consider when determining non-combustibility of most building materials is ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*. This test method exposes the material being tested to a stream of air heated to 750°C (1382°F). To qualify as non-combustible, four specimens must be tested, and three must pass the following criteria:

- The surface or interior temperature must not exceed the furnace temperature by more than 30°C (54°F);
- After 30 seconds into the test, no flaming of the specimen is allowed; and
- If the sample loses more than 50 percent of its weight during the test, its temperature cannot exceed 750°C (1382°F) and it cannot flame.

2.1.3 The International Building Code allows layered building materials to be considered noncombustible if:

- The core of the material passes the test procedure set forth in ASTM E136;
- The material surfacing is not more than 1/8 inch (3.2 mm) thick, and;
- The composite material has a flame-spread rating not greater than 50 when tested in accordance with ASTM E84, "Standard Test Method for Surfacing Burning Characteristics of Building Materials."

2.1.3.1 The Uniform Building Code references a UBC standard, UBC 2-1, in lieu of E136; however, UBC 2-1 reflects essentially the same criteria as E136. The UBC contains the same alternate definition criteria for non-combustibility as described above for the IBC.

2.2 Fire Rated Construction

2.2.1 Walls are generally of steel stud construction covered in turn by gypsum board and light gauge sheet metal. Roofs are constructed of non-combustible materials and insulating material supported by steel joists and lined with light gauge sheet metal. Doors are generally of light gauge sheet metal – and are provided with a label indicating that they are fire rated by an independent certification agency. Other methods of construction are not excluded by the preceding statements. All methods shall be considered on an individual basis.

2.2.2 Buildings are not required to be fire rated. When buildings are fire rated, the components (exterior walls, exterior sump walls, roof, doors, dampers or opening protectives) shall be rated as evidenced by a fire test or a published listing shown in a listing agency publication that is acceptable to FM Approvals.

2.3 Damage-Limiting Construction

Buildings shall be permitted to be designed for damage-limiting construction. When so designed, it shall be done in accordance with Paragraph 3.2 and Appendix C.

2.4 Building Design and Usage

2.4.1 Building shall be designed for and limited to outdoor use unless specifically designed for indoor use in accordance with Paragraph 3.5.