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# **American National Standard for Evaluating Fire Performance of Intermediate Bulk Containers (IBCs)**

**ANSI/FM Approvals 6020-2015**

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# Foreword

**NOTE:** This foreword is introductory only and is not part of American National Standard FM 6020.

This standard is intended to verify that the product as described will meet minimum specific stated conditions of performance, safety and quality, useful in determining the potential suitability for end-use conditions of these products. It describes minimum performance requirements for products that are intended for use as intermediate bulk containers by evaluating the compatibility of the materials with various fluids and the performance of the materials in a fire exposure situation.

This American National Standard has been developed according to the essential requirements of due process for standards development of the American National Standards Institute (ANSI). FM Approvals is an ANSI-accredited standards developer (ASD).

Approval of an American National Standard requires verification by ANSI that the principles of openness and due process have been followed and that a consensus of those directly and materially affected by the standard has been achieved. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached.

The American National Standards Institute does not develop standards nor will it in any circumstances give an interpretation of any American National Standard. Requests for interpretations of this test standard should be addressed to FM Approvals.

ANSI regulations require that this American National Standard shall be revised, reaffirmed or withdrawn within five years of the date of publication.

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## 1 INTRODUCTION

### 1.1 Purpose

This standard states test requirements for composite Intermediate Bulk Containers (IBCs) with a capacity of 275 gal (1000 liters) or 330 gal (1250 liters) used for the storage of liquids with closed cup flash points greater than 200°F (93°C).

### 1.2 Scope

This standard sets the fire performance requirements for composite IBCs constructed with combustible and non-combustible components.

### 1.3 Basis for Requirements

The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.

### 1.4 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with IEEE/ASTM SI 10, "American National Standard for Metric Practice".

## 2 APPLICABLE DOCUMENTS AND GLOSSARY

### 2.1 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

ASTM Standard D56, "Standard Test Method for Flash Point by Tag Closed Cup Tester," ASTM International, West Conshohocken, PA

Title 49, Code of Federal Regulations, Part 178, "Specifications for Packaging", United States Department of Transportation (DOT)

ISO 2719:2002, *Determination of Flash Point – Pensky-Martens Closed Cup Method*

NFPA 30, "Flammable and Combustible Liquids Code", National Fire Protection Association (NFPA)

IEEE/ASTM SI 10, "American National Standard for Metric Practice," ASTM International, West Conshohocken, PA

United Nations Designation 31H1, 31H2, or 31HZ1

## 2.2 Glossary

For purposes of this standard, the following terms apply:

*Closed Cup Flash Point*: a liquids flash point measured in accordance with ASTM D56 Standard Test Method for Flash Point by Tag Closed Cup Tester and ISO 2719:2002 - Determination of Flash Point – Pensky-Martens Closed Cup Method.

*Dog House*: outlet valve housing.

*Flash Point*: the lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air.

*Intermediate Bulk Container (IBC)*: any closed vessel having a liquid capacity not exceeding 793 gal (3000 liters) and intended for storing and transporting liquids, as defined in Title 49, Code of Federal Regulations, Parts 100 through 199 or in Part 6 of the United Nations Recommendations on the Transport of Dangerous Goods, Ninth Edition, Chapter 16. For the purposes of this standard scope is limited to IBCs with a capacity of 275 gal (1000 liters) or 330 gal (1250 liters).

## 3 GENERAL INFORMATION

### 3.1 Physical or Structural Features

Composite IBCs may be fabricated with both combustible and non-combustible components including metal, plastic and composite materials with a capacity of 275 gal (1000 liters) or 330 gal (1250 liters).

### 3.2 Markings

Marking on the product shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- model number, size, rating, capacity, etc.

All markings shall be legible and durable.

### 3.3 Manufacturer's Installation and Operation Instructions

The manufacturer shall provide the user with:

- instructions for the installation, maintenance, and operation of the product;
- facilities for repair of the product and supply replacement parts; and
- services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

## 4 PERFORMANCE REQUIREMENT

Each IBC shall satisfy the following test requirement as described in paragraph 4.1 below. In addition, prior to testing the manufacturer shall present evidence that the IBC meets the requirements of the Department of Transportation (DOT) as an approved shipping container manufactured and marked in accordance with Title 49, Code of Federal Regulations, Part 178 and/or United Nations Designation 31H1, 31H2, or 31HZ1.

### 4.1 Combustibility

#### 4.1.1 Requirement

The candidate IBC shall possess adequate physical properties to resist a specified minimum fire exposure without breach of, or leakage from the IBC during the test. IBCs shall be evaluated to be used for the storage of liquids with closed cup flash points greater than 200°F (93°C).

#### 4.1.2 Test Apparatus

- 4.1.2.1 The test apparatus consists of eight (8) IBCs arranged in a 2x2x2 palletized array positioned within a 14 ft x 14 ft (4.3 m x 4.3 m) pan and the entire assembly positioned within a second metal pan 25 ft x 25 ft x 1 ft (7.62 m x 7.62 m x 0.30 m) high and centered below the movable ceiling, shown in Figure 1. The four IBCs on the bottom of the array shall be placed on supports such that the bottom of the IBCs are 1 in. (25 mm) above the liquid fire exposure at the start of the test. Drainage shall be provided to maintain the level of the fire exposure within 1 in. (25 mm) so the bottom of the IBCs are never submerged in the liquid from the fire exposure or sprinkler discharge. Note that the IBCs are arranged such that the dog houses are turned 90° away from the ignition location, thus exposing the wide side of the IBC to the developing fire. The transverse and longitudinal flues are 152 mm (6 in). Each IBC will be filled with Mineral Seal Oil (CAS No. 8042-47-5) to its rated capacity.
- 4.1.2.2 The test apparatus is centered among four (4) sprinklers with the movable ceiling set to a height of 30 ft. (9.1 m). Protection is provided via Viking Corporation, standard response, K11.2 sprinklers with a temperature rating of 165°F (74°C) on a 10 ft x 10 ft (3.05 m x 3.05 m) spacing. The water pressure is set to 29 psi (2.0 bar) resulting in a discharge density of 0.6 gpm/ft<sup>2</sup> (24 mm/min).

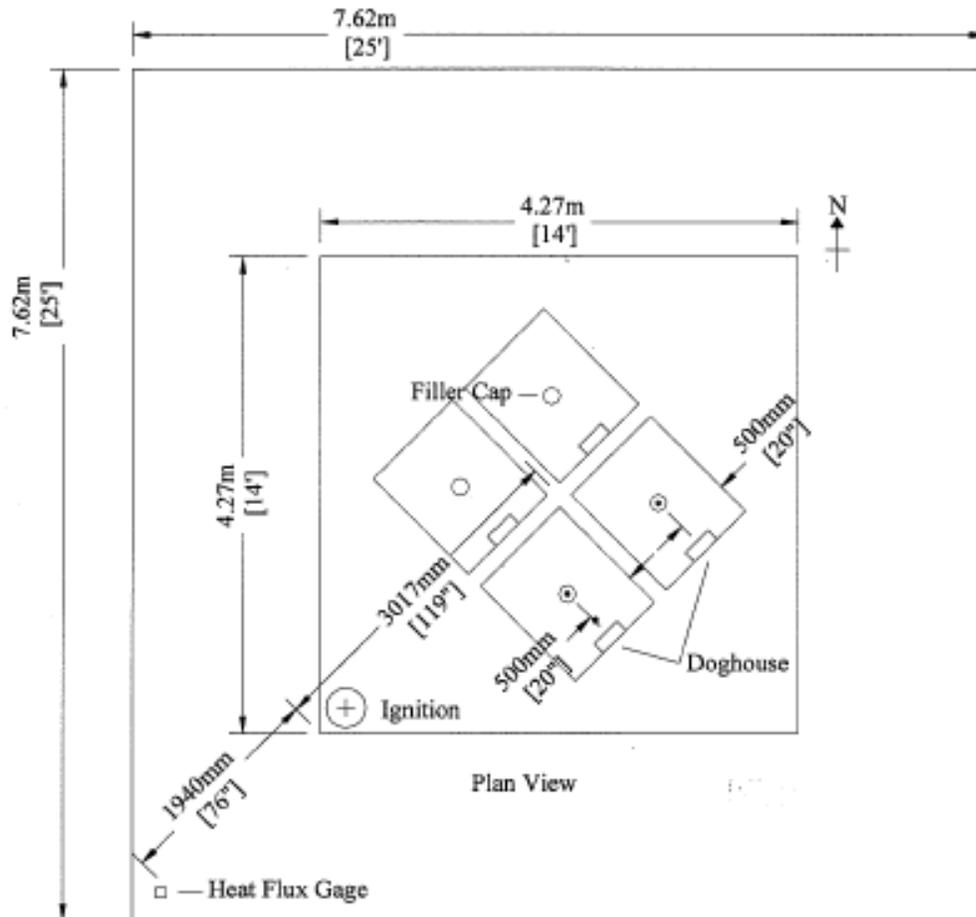


Figure 1 Large Scale Test Configuration

#### 4.1.3 Test Preparation

4.1.3.1 Fill each IBC with Mineral Seal Oil (CAS No. 8042-47-5) to its rated capacity.

4.1.3.2 Arrange the IBC's in the Test Apparatus as described above in 4.1.2.1 and 4.1.2.2 while following the test parameters as outlined in 4.1.3.4 below.

4.1.3.3 The fire exposure to the IBCs is a 1 in (25.4 mm) depth of mineral seal oil floated on approximately 6 in (152 mm) of water within the 14 ft x 14 ft (4.3 m x 4.3 m) pan. The oil will be ignited in the south-west corner of the pan with a propane torch applied to 1 pint (0.5 liter) of heptane floated on the oil.

## 4.1.3.4 Test Parameters:

Test Sample	Mineral Seal Oil Filled IBCs
Storage Arrangement	2x2x2 Palletized
Array Nominal Size L x W x H (in. x in. x in. [m x m x m])	100 x 84 x 92 (2.5 x 2.1 x 2.3)
Stack Height (ft-in [ m])	7-8 (2.3)
Nominal Pallet Load Height (ft-in [ m])	7-8 (2.3)
No. of Storage Levels	2
Ceiling Height (ft [m])	30 (9.1)
Clearance to Ceiling (ft-in [m])	22-4 (6.8)
Aisle Width (ft [m])	No Aisle
Ignition Centered Below (No. of Ceiling Sprinklers)	4
Ceiling Sprinkler k-factor (gpm/psi <sup>1/2</sup> [lpm/bar <sup>1/2</sup> ])	11.2 (160)
Ceiling Sprinkler Temperature Rating (°F [°C])	165 (74)
Ceiling Sprinkler Spacing (ft x ft [m x m])	10 x 10 (3.0 x 3.0)
Ceiling Sprinkler Discharge Pressure (psi [bar])	29 (2.0)
Ceiling Sprinkler Discharge Density (gpm/ft <sup>2</sup> [mm/min])	0.6 (24)

## 4.1.4 Test Procedure

- 4.1.4.1 Prior to starting the tests, the operator shall verify that all equipment is operational and the customer (if present) is satisfied with the test set-up.
- 4.1.4.2 Prior to starting the tests, the operator shall verify that all safety precautions are in place.
- 4.1.4.3 Ignite the oil in the corner of the pan (as shown in Figure 1) with a propane torch applied to 1 pint (0.5 liter) of heptane floated on the oil.
- 4.1.4.4 The test shall be run for a maximum duration of twenty (20) minutes or until breach of, or leakage from, an IBC is confirmed.
- 4.1.4.5 Record all data and observations.
- 4.1.4.6 Once the test duration has elapsed or IBC failure has occurred, the test will be terminated.

## 4.1.5 Performance Requirements

There can be no breach of, or leakage from, the IBC during the 20 minute exposure or for 24 hours after the conclusion of the test. Hole formation above the liquid level in the IBC is acceptable as long as the net area does not exceed 2 in<sup>2</sup> (13 cm<sup>2</sup>).

**APPENDIX A: UNITS OF MEASUREMENT**

LENGTH:	in. - "inches"; (mm - "millimeters") mm = in. x 25.4
	ft - "feet"; (m - "meters") m = ft x 0.3048
AREA:	in <sup>2</sup> - "square inches"; (mm <sup>2</sup> - "square millimeters") mm <sup>2</sup> = in <sup>2</sup> x 6.4516 x 10 <sup>2</sup>
	ft <sup>2</sup> - "square feet"; (m <sup>2</sup> - "square meters") m <sup>2</sup> = ft <sup>2</sup> x 0.0929
MASS:	lb - "pounds"; (kg - "kilograms") kg = lb x 0.454
PRESSURE:	psi - "pounds per square inch"; (bar - "bar") kPa = psi x 6.895
	bar - "bar"; (kPa - "kilopascals") bar = kPa x 0.01 bar = psi x 0.06895
HEAT:	Btu - "British thermal units"; (J - "joules") J = Btu x 1.0551 x 10 <sup>3</sup>
HEAT RELEASE RATE:	Btu/min - "British thermal units per minute"; (kW - "kilowatts") kW = Btu/min x 0.0176
TEMPERATURE:	°F - "degrees Fahrenheit"; (°C - "degrees Celsius") °C = (°F - 32) x 0.556
LIQUID VOLUME:	gal - "gallons"; (L - "liter") L = gal x 3.785
	L - "liter"; (dm <sup>3</sup> - "cubic decimeters") L = dm <sup>3</sup>
FLOW RATE:	gal/min - "gallon per minute"; (L/min - "liters per minute") L/min = gal/min x 3.785