Approval Standard for Composite Intermediate Bulk Containers (IBCs)

Class Number 6020

September 2016

Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet 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.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose

1.1.1 This standard states Approval 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 200ºF (93ºC).

1.1.2 Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.1.3 For all IBCs, the Approval is limited to the storage of sealed containers only that are used in storage applications.

1.1.3.1 For all IBCs, the Approval is void once the valve cap seal has been broken.

1.1.3.2 For IBCs that use a barrier to protect the primary container from fire exposure, the Approval is void once the barrier has been removed.

1.1.3.3 For all IBCs, the Approval is valid for single-use only. The Approval is void once the IBC is recycled or reused.

1.1.4 The IBC manufacturer shall communicate with the end user to ensure that the fluid and the composite IBC materials are compatible.

1.2 Scope

1.2.1 This standard sets the fire performance requirements for composite IBCs constructed with combustible and non-combustible components including metal, plastic and corrugated board materials with a capacity of 275 gal (1000 liters) or 330 gal (1250 liters).

1.2.2 This standard is intended to verify that the systems as described will meet the stated conditions of the performance, and quality useful to determine the suitability for end-use conditions of these products.

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 organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of composite IBCs for the purpose of obtaining Approval. Composite IBCs 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, composite IBCs which meet all of 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 product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate

- the suitability of the product for its intended end use;
- the performance of the product as required by FM Approvals; and, as far as practical,
- the durability and reliability of the product when used as an FM Approved Intermediate Bulk Container.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures are made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. These examinations are conducted at a minimum frequency of annually as part of FM Approvals' Surveillance Audit Program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as currently FM Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval Report and Master Agreement;
- re-examination of production samples for continued conformity to requirements; and
- satisfactory audits conducted at least annually as part of FM Approvals' Surveillance Audit Program.

Also, as a condition of retaining Approval, manufacturers may not change a product or service without prior authorization by FM Approvals.

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 of this standard is upon publication for compliance with all requirements.

1.7 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".

1.8 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

FM Global Property Loss Prevention Data Sheet 7-29, *Ignitable Liquid Storage in Portable Containers, FM Global Engineering Standards, Norwood, MA*

FM Global Property Loss Prevention Data Sheet 7-88, *Ignitable Liquid Storage Tanks, FM Global Engineering Standards, Norwood, MA*

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

ISO 2719, "Determination of Flash Point – Pensky-Martens Closed Cup Method," International Organization for Standardization, Geneva, Switzerland

ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," International Organization for Standardization, Geneva, Switzerland

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

Test Procedure Class Number 6020, *Large Scale Testing for Fire Performance of Intermediate Bulk Containers*, FM Approvals, LLC, Norwood, MA

Test Procedure Class Number 6020, *Small Scale Testing for Material Compatibility of Intermediate Bulk Containers*, FM Approvals, LLC, Norwood, MA

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

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

1.9 Definitions

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 - Determination of Flash Point – Pensky-Martens Closed Cup Method.

Composite IBC - An IBC which consists of a rigid outer packaging enclosing a plastic inner receptacle together with any service or other structural equipment. The outer packaging of a composite IBC is designed to bear the entire stacking load. The inner receptacle and outer packaging form an integral packaging and are filled, stored, transported, and emptied as a unit.

Dog House – bottom outlet valve housing.

Flash Point – is 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 less than 119 gallons (450 liters) and 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 Approval will be limited to IBCs with a capacity of 275 gal (1000 liters) or 330 gal (1250 liters).

Primary Container – container in direct contact with liquid.

2 GENERAL INFORMATION

2.1 Product Information

The requirements of this standard shall be used to measure and describe the performance of composite IBCs in response to exposure from fire under controlled laboratory conditions. The results of these controlled exposures shall not be used to describe or appraise actual exposure conditions, since such conditions may vary widely. The Approval examination includes fire tests as noted. Inspection of the product manufacturing facility shall be conducted to assure conformance with the required tests and specifications.

2.2 Approval Application Requirements

To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to:

Manager of Building Materials
FM Approvals
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062
U.S.A.

The manufacturer shall provide the following preliminary information with any request for Approval consideration:

- A complete list of all models, types, sizes, and options for the products being submitted for Approval consideration;
- General assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, nameplate format, brochures, sales literature, specification sheets, installation, operation and maintenance procedures;
- The number and location of manufacturing facilities.
- All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.
- The formulation and specifications for the IBCs shall be submitted to FM Approvals for review and be kept on file at FM Approvals on confidential basis.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of an Approval examination, the manufacturer may be required to submit samples for examination and testing based on the Approvals requested. Sample requirements will be determined by FM Approvals following review of the preliminary information.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the sole discretion of FM Approvals.

2.3.4 Approval will be limited to the actual size of the composite IBC tested.

2.3.5 It is the manufacturer's responsibility to provide any necessary test fixtures or special tools, such as those which may be required to evaluate the products for Approval.

3 GENERAL REQUIREMENTS

3.1 Markings

3.1.1 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., and
- the FM Approval mark.

When hazard warnings are needed, the markings shall be universally recognizable and permanent.

3.1.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the product as FM Approved. The manufacturer shall not place this model or type identification on any other product unless covered by a separate agreement.

3.1.3 The Approval Mark shall be displayed visibly and permanently on the product as noted below. The manufacturer shall not use this Mark on any other product unless such product is covered by a separate report.

3.1.3.1 The Approval Mark shall be applied on the outlet valve within the dog house of the IBC.

3.1.3.2 For IBCs that use a barrier to protect the primary container from fire exposure, the Approval Mark shall instead be applied to the barrier plate outside the dog house.

3.1.4 All markings shall be legible, durable and located near the top of the IBC so they are readily visible.

3.2 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.

3.3 Calibration

All examinations and tests performed in evaluation to this Standard shall use calibrated measuring instruments traceable and certified to acceptable national standards in accordance with ISO/IEC 17025.

3.4 Observation of Test Sample Production

A representative of FM Approvals shall witness production of, and place an identification mark on, each composite IBC to be evaluated. At the discretion of FM Approvals, additional components may require a witness of production if the component is considered critical and may affect the results of the performance testing.

4 PERFORMANCE REQUIREMENTS

In order to qualify for Approval, each composite IBC shall satisfy the following test requirements as described in paragraphs 4.1 and 4.2 below. In addition, prior to testing the manufacturer shall present evidence that the candidate 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 Compatibility – Small Scale Material Compatibility Testing

4.1.1 Requirement

The material in contact with the stored fluid shall be compatible with the fluid. The tests shall be conducted in accordance with the FM Approvals Test Procedure Class Number 6020, *Small Scale Testing for Material Compatibility of Intermediate Bulk Containers*.

4.1.2 Test/Verification

The small scale testing consists of 1) Variable Temperature Exposure used to examine the permeability of the fluids into the primary container material of construction and 2) Material Compatibility Test used to determine the interaction between the primary container material of construction and various fluids during a fire exposure.

Note: These tests are conducted for identification purposes. FM Approvals places no limits on the values obtained.

4.1.3 At the discretion of FM Approvals small scale testing can be waived if the IBC material is not conducive to this form of testing.

4.2 Combustibility – Large Scale Fire Testing

4.2.1 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). The test shall be conducted in accordance with the FM Approvals Test Procedure Class Number 6020, *Large Scale Testing for Fire Performance of Intermediate Bulk Containers*.

4.2.2 Test/Verification

The large scale fire exposure test consisting of a 2 x 2 x 2 palletized array of eight (8) IBCs filled with mineral seal oil and exposed to a mineral seal oil pool fire for a duration of 20 minutes. The test array is centered under four sprinklers spaced on a 10 by 10 ft. (3.0 by 3.0 m) grid. 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^2 (13 cm^2).

5 OPERATIONS REQUIREMENTS

A quality assurance program is required to ensure that subsequent composite IBCs produced by the manufacturer shall present the same quality and reliability as the specific composite IBCs examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and is documented in the Approval Report
- Continued conformance of the FM Approved product is verified by the Surveillance Audit Program
- Quality of performance is determined by field performance and by periodic re-examination and testing

5.1 Demonstrated Quality Control Program

5.1.1 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.2 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.3 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.4 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the Approval Report, must be reported to, and authorized by, FM Approvals prior to implementation for production.
- The manufacturer shall assign an appropriate person or group to be responsible for, and require that, proposed changes to FM Approved products be reported to FM Approvals before implementation. The manufacturer shall notify FM Approvals of changes in the product or of persons responsible for keeping FM Approvals advised by means of FM Approved Products/Specification tested Revision Request Form, FM Approved Product /Specification-Tested Revision Report or Address/Main Contact Change Report.
- Records of all revisions to all FM Approved products shall be maintained.

5.2 Surveillance Audit

5.2.1 An audit of the manufacturing facility is part of the Approval investigation to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to insure a uniform product consistent with that which was tested and FM Approved.

5.2.2 These audits shall be conducted periodically but at least annually by FM Approvals or its representatives.

5.2.3 FM Approved products or services shall be produced or provided at or from the location(s) audited by FM Approvals and as specified in the Approval Report. Manufacture of products bearing the Approval Mark is not permitted at any other location without prior written authorization by FM Approvals.

5.3 Manufacturer's Responsibilities

The manufacturer shall notify FM Approvals of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

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^2 - "square inches"; (mm^2 - "square millimeters") $mm^2 = in^2 \times 6.4516 \times 10^2$
	ft^2 - "square feet"; (m^2 - "square meters") $m^2 = ft^2 \times 0.0929$
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") $J = Btu \times 1.0551 \times 10^3$
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^3 - "cubic decimeters") $L = dm^3$
FLOW RATE:	gal/min - "gallon per minute"; (L/min - "liters per minute") L/min = gal/min x 3.785