



Member of the FM Global Group

Examination Standard for Plastic Plugs for Steel Drums

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Foreword

This standard 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 this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states testing and certification requirements for plastic plugs used with steel drums containing ignitable liquids.
- 1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

- 1.2.1 This standard applies to any plastic plug intended to protect a steel drum of ignitable liquid during a fire exposure and to provide adequate venting capacity.

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 plastic plugs, gaskets connecting metal flanges, and cap seals for the purpose of obtaining certification. Plastic plugs having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 Basis for Certification

Certification 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;
 - the performance of the product as specified by the manufacturer and required for certification;
 - the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted 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. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance

1.5 Basis for Continued Certification

The basis for continual certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;

- satisfactory field experience;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard 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. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

1.8 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ANSI/IEEE/ASTM SI 10, *American National Standard for Metric Practice*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads*

USDOT Transportation, *Code of Federal Regulations (CFR) Title 49*

1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

Cap Seal

A thin circular cap that is secured over the plug/metal flange connections.

Gasket

A ring of material placed on the plug to make the mating connection leak proof.

Metal Flange

A formed steel insert with mating threads to accept the plug. The insert is rolled into the head of the steel drum.

Plug

A plastic insert threaded into the metal flange that prevents any liquid contents from being discharged from the connection.

Torque Adapters

A mechanical tool that fits into the manufacturer's supplied plug. The torque adapter is attached to a torque wrench allowing the operator to apply the correct amount of torque to the plug according to the manufacturer's recommended value.

2 GENERAL INFORMATION

2.1 Product Information

- 2.1.1 Plastic plugs are devices installed in a steel drum to make the storage of ignitable liquids less hazardous. Plugs are designed to thread in to the ¾ inch and 2 inch diameter openings at the top of the drum communicating with the vapor space in the drum.
- 2.1.2 Should the drum be exposed to fire, the plastic plug is designed to prevent bursting of the drum through emergency venting capability. Venting relieves internal drum pressure and allows ignitable vapors to burn outside the drum. Venting occurs when the plastic plug disengages itself from the drum or the top wall section of the plastic plug melts allowing vapors to vent to atmosphere.
- 2.1.3 An examination of applicable drawings and specifications shall be made to verify that the plugs are in conformance with the manufacturer's published information and drawings with respect to applicable standards, materials, dimensions, markings, workmanship, and comply with the requirements for certification.
- 2.1.4 The plastic plugs shall be designed to fit either the ¾ inch or 2 inch plug opening in steel drums manufactured in conformance to DOT and UN requirements, as cited in 49 CFR Parts 100-199.
- 2.1.5 The submitted manufacturer's plastic plugs must be tested with gaskets, in conjunction with the manufacturer's metal plug insert flanges and cap seals used on the drum head.
- 2.1.6 Third party documentation shall be provided to verify that a drum incorporating the plugs, flanges, and cap seals submitted for certification meets all performance tests specified in the DOT and UN requirements.

2.2 Certification Application Requirements

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

- complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- complete set of manufacturing drawings, materials list, anticipated marking format, nameplate format, brochures, sales literature, spec. sheets, installation and operation 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.

2.3 Material Samples Requirements for Examination

- 2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:
 - Sample requirements to be determined by the certification agency
- 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 discretion of the certification agency.
- 2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the plastic plugs.
- 2.3.5 The plastic plug manufacturer must supply the torque adapters and any special tooling to connect the cap seal to the metal drum.

3 GENERAL REQUIREMENTS

3.1 Review of Documentation

- 3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The certification examination results may further define the limits of the final certification.

3.2 Physical or Structural Features

3.2.1 Materials

The plug shall be constructed of suitable non-corrosive materials, free of defects that would impair safety and serviceability over a temperature range of 0°F (-18°C) to 140°F (60°C).

3.2.2 Threads

The plastic plugs with gaskets shall be either a 3/4 inch or 2 inch external pipe threads for connection to standard 3/4 inch or 2 inch metal drum connections. Pipe threads shall be in accordance with ISO 228-1. Other thread arrangements may be acceptable if they meet requirements in the country of use.

3.2.3 Resin Manufacturer

Materials shall be appropriate for the service(s) specified. Resin manufacturers' compatibility specifications shall be submitted by the plug manufacturer to justify their use with specific fluids. The plugs shall only be certified for use with compatible fluids.

3.2.4 UV degradation

Materials chosen must be resistant to UV degradation. Resin manufacturer's data must be submitted by the closure manufacturer to verify compliance with this requirement. This requirement will be waived if the manufacturer system includes a cap seal.

3.2.5 Cap Seal

The cap seal shall be supplied with the plastic plug, if applicable.

3.3 Markings

- 3.3.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying 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., as appropriate.
 - The connecting flange must be marked with the certification mark on the underside of the flange. The seal cap must be marked with the certification mark on the top side of the cap.

When hazard warnings are needed, the markings should be universally recognizable.

- 3.3.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.
- 3.3.3 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.
- 3.3.4 All markings shall be legible and durable.

3.4 Manufacturer's Installation and Operation Instructions

- 3.4.1 Installation instructions shall be provided by the manufacturer.
- 3.4.2 The installation instructions shall list the liquid service intended, such as hydrocarbons, ketones, esters or alcohols.

3.5 Calibration

- 3.5.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.
- 3.5.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

4 PERFORMANCE REQUIREMENTS

4.1 Torque Test

4.1.1 Requirement

The plastic plug with its associated gasket shall be assembled, installed, and removed, in conformance with the manufacturer's instructions to verify their practical usability. Each thread size plug shall show no evidence of stripping or fracture.

4.1.2 Test/Verification

Each thread size plug with its associated gasket shall be subjected to an installation torque 1.5 times greater than the manufacturer's recommended value, while at 68°F ±10 (20°C ±6).

4.2 Venting Pressure Relief Test

4.2.1 Requirement

Each sample plug with its associated gasket shall be subjected to a one minute leak test at 5 psi (35 kPa) or its rated pressure (if greater) while at the maximum and minimum temperatures. Each sample shall maintain the test pressure during a one minute period and the tested sample shall show no signs of leakage. The plugs shall be removed at the conclusion of each test and while still at the test temperature. Plugs shall exhibit no damage as a result of installation, pressure testing, and removal, in these tests.

4.2.2 Test/Verification

Plug samples and the test fixture shall be conditioned at the specified maximum and minimum rated temperatures for 2 hours. Minimum temperature shall be no greater than 0°F (-18°C) and maximum temperature shall be no less than 140°F (60°C) for this test. The plugs shall be pressure tested while still at the test temperature.

4.3 Fire Exposure Test

4.3.1 Requirement

Each sample plug size shall be subjected to a fire exposure test, while assembled into a 55 gallon (208 L) steel drum. If a cap seal is supplied with the plug, it will be included in the test. Each plug shall relieve the resulting built-up pressure within the drum at or below 20 psi (140 kPa). See Appendix A for the fire exposure test arrangement.

4.3.2 Test/Verification

- 1) One plug (either ¾ inch or 2 inch with its gasket shall be attached to a standard metal 55 gallon (208L) drum (DOT/UN 1A1/X1.8/300) along with its associated cap seal. The plug shall be installed in accordance with manufacturer's torque recommendations and the seal cap installed in accordance with the manufacturer's recommendations.
- 2) When testing the 2-inch closure, the plug shall be covered with a 6 × 8 × 1 in. thick (152 × 203 × 25 mm) thick piece of wooden board. One wood screw shall be placed in each of the four corners of the board. The screws shall be adjusted allowing the bottom of the board to rest against the chime of the drum.
- 3) When testing the ¾ inch closure, the plug shall be tested exposed.

- 4) The drum shall be filled with 99 percent isopropyl alcohol (IPA) leaving a 2 inch (50.8 mm) air space.
- 5) A pressure relief/pressure sensing line shall be attached to the unused plug opening. The pressure relief line shall connect directly to a normally open safety shut off valve. The valve shall be energized (closed) before the start of the test. The pressure relief line shall also be attached to a pressure measuring device upstream of the safety shut off valve.
- 6) The drum shall be placed on 7 ½ inch (190 mm) high concrete blocks in a 4 × 4 × 1 ft (1.2 × 1.2 × 0.3 m) pan. The drum shall be located in the center of the pan.
- 7) The pan shall be filled with 7½ inch (190 mm) of water and ¾ inch (19 mm) of heptane. The water level shall be even with the bottom of the drum.
- 8) The heptane pool shall be ignited. Pressure measurements shall be recorded every 10 seconds until the plug vents or the internal pressure in the drum reaches 20 psi (140 kPa).
- 9) If the internal pressure exceeds 20 psi (140kPa), the tested system will automatically vent, terminating the test and constituting a product failure.

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

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

- Design quality is determined during the examination and tests and may be documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 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.

5.1.3 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.

5.1.4 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.

5.1.5 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 certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit

- 5.2.1 An audit of the manufacturing facility may be part of the certification agency's surveillance requirements 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 ensure a uniform product consistent with that which was tested and certified.
- 5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 Manufacturer's Responsibilities

- 5.3.1 The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

6 BIBLIOGRAPHY

ISO/IEC 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*.

APPENDIX A: Fire Exposure Test Arrangement

