Approval Standard for Panels Used in Data Processing Center Hot and Cold Aisle Containment Systems

Class Number 4884

April 2020

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.

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1 INTRODUCTION

1.1 Purpose

1.1.1 This standard states Approval requirements for Panels Used in Data Processing Center Hot and Cold Aisle Containment Systems.

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 surveillance audit program.

1.2 Scope

1.2.1 This standard applies to panels for use in data processing center hot and cold aisle containment systems.

1.2.2 Panels evaluated by this standard are considered FM Approved with an unlimited height rating and may function as both wall and ceiling panels used in data processing center hot and cold aisle containment systems.

1.2.3 Framing and accessories installed with FM Approved panels used in data processing center hot and cold aisle containment systems must be non-combustible.

1.2.4 This standard evaluates panels used in data processing center hot and cold aisle containment systems only. For Class 1 Building Panels or Interior Finish Materials and Class 1 Building Panels or Interior Finish Materials for Smoke Sensitive Occupancies FM Approvals requires successful examination in accordance with the following applicable standards:

- FM Approvals Standard 4880, Class 1 Fire Rating of Building Panels or Interior Finish Materials,
- FM Approvals Standard 4882, Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies

1.2.5 This standard is intended to evaluate only those hazards investigated and is not intended to determine suitability for the end use of a product.

1.2.6 This standard shall not qualify chlorinated materials such as Polyvinyl Chloride (PVC) or Chlorinated Polyvinyl Chloride (C-PVC).

1.2.7 This standard is limited to the evaluation of materials for use as panels in data processing center hot and cold aisle containment systems. Materials requiring FM Approval as a drop out ceiling panel are tested in accordance with FM 4651.

1.2.8 This standard does not evaluate the corrosivity of the products of combustion of these materials.

1.3 Basis for Requirements

1.3.1 The requirements of this standard are based on experience, research and testing, Approval Standard for Class 1 Fire Rating of Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies, Class Number 4882, Test Standard for FM Approvals Cleanroom Materials Flammability Test Protocol, Class Number 4910 and American National Standard for Clean Room Materials Flammability Test Protocol ANSI/FM Approvals 4910. The advice of manufacturers, users, trade associations and loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of panels used in data processing center hot and cold aisle containment systems for the purpose of obtaining Approval. Panels used in data processing center hot and cold aisle containment systems 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, panels used in data processing center hot and cold aisle containment systems which 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.

1.3.3 Meeting the requirements of this standard qualifies panels as FM Approved panels used in data processing center hot and cold aisle containment systems. Requirements prohibit component substitutes without prior authorization by FM Approvals.

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 use as an FM Approved panel used in data processing center hot and cold aisle containment systems;
- The performance of the product as specified by the manufacturer and required by FM Approvals, and as far as practical;
- The durability and reliability of the product when used as an FM Approved panel used in data processing center hot and cold aisle containment systems

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures is 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 may be repeated 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;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Surveillance Audits conducted as part of FM Approvals' product follow-up 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.

The effective date of this standard for compliance with all requirements is the publication date.

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 the American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing Materials (ASTM) SI 10, "American National Standard for Metric Practice."

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. For undated references, the latest edition of the referenced document (including any amendments) applies:

1.8.1 FM Approvals Test Procedures:

FM Approvals 8 ft. (2.4 m) Parallel Panel Test

1.8.2 American National Standards Institute, 1899 L Street, NW, Washington, DC 20036

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

ANSI FM 4910, *American National Standard for Clean Room Materials Flammability Test Protocol*

1.8.3 FM Approvals, 1151 Boston-Providence Turnpike, Norwood, Massachusetts 02062

FM 4880, *Approval Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials*

FM 4882, *Approval Standard for Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies*

FM 4910, *Cleanroom Materials Flammability Test Protocol*

1.8.4 ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428

ASTM C167, *Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations*

ASTM C303, *Standard Test Method for Dimensions and Density of Preformed Block or Broad-Type Thermal Insulation*

ASTM D792, *Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement*

ASTM D1505, *Test Method for Density of Plastics by the Density-Gradient Technique*

ASTM D1622, *Standard Test Method for Apparent Density of Rigid Cellular Plastics.*

ASTM D1746, *Standard Test Method for Transparency Rating of Plastic Sheeting*

ASTM E1252, *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis*

ASTM E 1642, *Standard Practice for General Techniques of Gas Chromatography Infrared (GC/IR) Analysis*

1.9 Terms and Definitions

Data processing center – A room or an entire building dedicated to the collection, processing and storage of computer and networking equipment.

Hot and cold aisle – A design method focusing on air transfer in data processing centers where server racks or other technological equipment are arranged such that the flow of hot and cold air is regulated in order to conserve energy.

Opaque – Not capable of allowing light to pass through.

Translucent – Allowing light to pass through such that objects behind cannot be distinctly seen.

Transparent – Allowing light to pass through such that objects behind can be distinctly seen.

2 GENERAL INFORMATION

2.1 Product Information

Panels used in data processing center hot and cold aisle containment systems are used to separate hot and cold air flow around electronic server equipment. Containment panels, as they may be referred to, are also used to fill in gaps between equipment or cabinets. They are not intended as fire barriers. Panels are usually supplied in sheet form or in the form of factory fabricated panels which are connected to one another with various types of framings and accessories. Panels are generally translucent although they may be transparent or opaque. They may consist of a homogeneous plastic with single or multiple thin layers, a metal single skin, a reinforced plastic material or an insulating core material faced with plastic (reinforced or unreinforced), aluminum or steel. They are tested at the maximum thickness for which Approval is sought.

2.2 Approval Application Requirements

To apply for an Approval examination the manufacturer, or its authorized representative, should submit a request to information@fmapprovals.com.

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 or services being submitted for Approval consideration;
- General assembly drawings, manufacturing drawings, raw material supplier list, anticipated marking format, formulations, brochures, sales literature, spec. sheets, installation instructions; and 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.
- A list of all manufacturing locations.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of an Approval examination, the project engineer will inform the manufacturer of the number and type of samples that shall be submitted for examination and testing.

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

2.3.3 A representative of FM Approvals shall inspect the manufacturing facility for, witness the production of, and place their mark on, each sample panel used in data processing center hot and cold aisle containment systems.

2.3.4 If a panel used in data processing center hot and cold aisle containment systems has one or more plastic components, production of the plastic component(s), including the blending of foam or resin systems, shall be witnessed by a representative of FM Approvals

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

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 Approval investigation shall define the limits of the Approval.

3.2 Markings

3.2.1 Marking on the product or on its packaging shall include the following information:

- Name and address of the manufacturer or marking traceable to the manufacturer, and
- Date of manufacture or code traceable to date of manufacture or lot identification, and
- Model number, trade name or product identification, and
- The FM Approval Mark as detailed below.

3.2.2 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.

3.2.3 The manufacturer shall supply a separate certificate with the panel shipment stating the lot or batch number of the panels. The Approval Mark shall be displayed visibly and permanently on the certificate. Other means of identification may be used if reviewed and accepted by FM Approvals. The manufacturer shall not use this Mark on any other product unless such product is covered by a separate report.

3.2.4 All markings shall be legible and durable.

3.3 Manufacturer's Installation and Operation Instructions

3.3.1 The manufacturer shall provide the user with:

- Instructions for the installation and maintenance 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.

3.3.2 Panels used in data processing center hot and cold aisle containment systems shall be installed with framing and accessories manufactured from non-combustible material. Panels installed with framing and accessories manufactured from combustible material are not considered FM Approved in accordance with this standard.

3.4 Calibration

3.4.1 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 for FM Approvals records. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified as traceable to the National Institute of Standards and Technology (NIST) or traceable to other acceptable reference

standards 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 is required for FM Approvals' records.

3.4.2 The calibration of new equipment is also required. Documentation indicating either the date of purchase or date of shipment, equipment description, model and serial number is required for identification. The new test equipment shall be clearly identified by label or sticker showing the date of initial calibration and the next due date.

3.4.3 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 thus equipment.

3.5 Approved Product Changes

3.5.1 All changes to an FM Approved panel used in data processing center hot and cold aisle containment systems shall be reviewed by FM Approvals prior to implementing a change via the submission of a FM Approved Products/Specification Tested Revision Request Form. All requests for changes to the product shall be submitted with sufficient information for review. Product changes include, but are not limited to:

- formulation changes
- configuration changes (e.g. shape, density, etc.)
- manufacturing location or procedure changes

3.5.2 Formulation changes include, but are not limited to;

- ingredient change(s),
- changing a raw material supplier of an ingredient, and/or
- changing manufacturing tolerances of ingredients of an existing Approved formulation.

3.5.3 Panels used in data processing center hot and cold aisle containment systems shall be Approved with a density range of +/-5% of the density determined in accordance with this Standard. If a material is requested to be examined in accordance with this Standard including a density range larger than +/-5%, then the maximum and minimum densities of the material shall be tested and Approval shall be granted to the density range that met the requirements of the Standard.

4 PERFORMANCE REQUIREMENTS

4.1 FM Approvals 8 ft (2.4 m) Parallel Panel Test

4.1.1 Requirement:

Panels used in data processing center hot and cold aisle containment systems shall be evaluated in the 8 ft. (2.4 m) Parallel Panel test. Visual observations for fire propagation and flame height, chemical heat release rate, and heat flux data are used to assess propagating versus non-propagating behavior. The acceptance criteria for the Parallel Panel test are that:

1. visual flame height does not exceed 6 ft (1.8 m),
2. heat flux measured at 4 ft (1.2 m) above the sand burner does not exceed 40 kW/m^2
3. heat release rate 2 minutes after the burner is shut off falls to or below 25% of that maximum heat release rate observed 10 seconds before the burner is shut down,
4. smoke generation rate is less than, or equal to, 0.23 g/s (0.0005 lb/s),
5. smoke generation at 12 min. is less than, or equal to, 0.07 g/s (0.0002 lb/s) and
6. total smoke is less than, or equal to, 60 g (0.13 lb).

4.1.2 Tests/Verification:

This test is performed in accordance with the FM Approvals 8 ft. (2.4 m) Parallel Panel Test Procedure.

4.2 Transparency Level

4.2.1 Requirement:

The transparency level of panels used in data processing center hot and cold aisle containment systems shall be determined and reported in terms of a percentage, where 0% is opaque and 100% is transparent.

Note: This test is for identification purposes only. FM Approvals places no limits on the values obtained.

4.2.2 Test/Verification:

ASTM D1746, Standard Test Method for Transparency Rating of Plastic Sheeting

4.3 Density of Plastic Panels

4.3.1 Requirement:

The density or area density of the plastic panel or plastic panel facings shall be determined and reported.

Note: This test is for identification purposes only. FM Approvals places no limits on the values obtained.

4.3.2 Test/Verification:

ASTM D792, Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement or ASTM D1505, Test Method for Density of Plastics by the Density-Gradient Technique.

4.4 Density of Insulating Cores

4.4.1 Requirement:

If a panel with an insulating core is being examined in accordance with this standard, the density of the insulating core (with no adhesives or facers) shall be determined and reported.

Note: This test is for identification purposes only. FM Approvals places no limits on the values obtained.

4.4.2 Test/Verification:

ASTM C167, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations, ASTM C303, Standard Test Method for Dimensions and Density of Preformed Block or Broad-Type Thermal Insulation or ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

4.5 Infrared Spectra for Quantitative Analysis

4.5.1 Requirement:

For plastic panels and other components as applicable, FTIR Spectra shall be determined and reported at the sole discretion of FM Approvals.

Note: This test is for identification purposes only. FM Approvals places no limits on the values obtained.

4.5.2 Test/Verification:

ASTM E1252, Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis

4.6 Thermal Desorption Gas Chromatography Mass Spectrometry (TD/GC/MS)

4.6.1 Requirement:

For foam plastic and other components as applicable, TD/GC/MS Spectrograms shall be determined and reported at the sole discretion of FM Approvals

Note: This test is for identification purposes only. FM Approvals places no limits on the values obtained.

4.6.2 Test/Verification:

ASTM E 1642, Standard Practice for General Techniques of Gas Chromatography Infrared (GC/IR) Analysis

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent specimens of panels used in data processing center hot and cold aisle containment systems produced by the manufacturer shall present the same quality and reliability as the specific panels 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 to this standard is verified by the Surveillance Audit.
- 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 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 Approvals' Form 797, 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 and/or Audit Manual. Manufacture of products bearing the Approval Mark is not permitted at any other location without prior written authorization by FM Approvals.

5.3 Installation Inspections

Field inspections may be conducted to review an installation. The inspections are conducted to assess ease of application, and conformance to written specifications. When more than one application technique is used, one or all may be inspected at the sole discretion of FM Approvals.

5.4 Manufacturer's Responsibilities

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