



Member of the FM Global Group

Examination Standard for Fire Protective Coatings and Wraps for Grouped Cables

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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 certification 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.

TABLE OF CONTENTS

1 INTRODUCTION	1
1.1 Purpose.....	1
1.2 Scope.....	1
1.3 Basis for Requirements	1
1.4 Basis for Certification	1
1.5 Basis for Continued Certification	2
1.6 Effective Date.....	2
1.7 System of Units	2
1.8 Normative References.....	2
1.9 Terms and Definitions.....	3
2 GENERAL INFORMATION	4
2.1 Product Information.....	4
2.2 Certification Application Requirements.....	4
2.3 Requirements for Samples for Examination.....	4
3 GENERAL REQUIREMENTS	5
3.1 Review of Documentation.....	5
3.2 Markings	5
3.3 Manufacturer’s Installation and Operation Instructions.....	5
3.4 Calibration.....	5
4 PERFORMANCE REQUIREMENTS	7
4.1 Flammability	7
4.2 Aging.....	7
4.3 8 ft (2.4 m) Parallel Panel Test	7
4.4 Identification Tests - Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis, ASTM E1252	8
4.5 Identification Test – Thermal Desorption Gas Chromatography Mass Spectrometry (TD/GC/MS)	8
4.6 Additional Tests.....	9
5 OPERATIONS REQUIREMENTS	10
5.1 Demonstrated Quality Control Program.....	10
5.2 Surveillance Audit	11
5.3 Installation Inspections.....	11
5.4 Manufacturer's Responsibilities.....	11

1 INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states certification requirements for fire protective coatings and wraps for grouped cables.
- 1.1.2 Testing and certification 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 program.

1.2 Scope

- 1.2.1 This standard applies to fire protective coatings and wraps intended to be applied over grouped cables for the purposes of reducing ignition of the grouped cables from external fire sources and limiting spread of flame along the grouped cables. It is intended to evaluate coatings and wraps in direct contact with cable and does not apply to wraps covering partially filled cable trays.
- 1.2.2 This standard is intended to evaluate only those hazards investigated, and is not intended to determine suitability for the end use of a product.
- 1.2.3 The results of tests conducted under the controlled conditions required by this standard shall not be used to describe or appraise performance under actual fire conditions. Actual fire conditions vary widely.
 - i. Coatings or wraps are not to adversely affect the cable insulation or jacketing.
 - ii. The standard is not intended to, nor does it evaluate the derating of cables due to coating or wrapping.

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 fire protective coatings and wraps for the purpose of obtaining certification. Fire protective coatings and wraps 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; and as far as practical,
 - the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be 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. 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, but is not limited to, 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 in the certification report;
- 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 certification 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*.

ASTM International (American Society for Testing and Materials)

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

ASTM E1642, *Standard Practice for General Techniques of Gas Chromatography Infrared (GC/IR) Analysis*.

ASTM E2058, *Standard Test Methods for Measurement of Material Flammability Using a Fire Propagation Apparatus (FPA)*

1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

Cable – A conductor with or without insulation and other coverings (single conductor cable) or a combination of conductors insulated from one another (multi-conductor cable)

Cable Coating – A compound usually applied by spray, brush or trowel to cables or cable lying in a cable tray

Cable Wrap – A blanket or sheet applied around cables or cables lying in a cable tray

Chemical Heat Release – The heat release during the fire propagation process and determined from the generation rates of carbon monoxide and carbon dioxide

Critical Heat Flux – The minimum heat flux at or below which there is no ignition

Fire Propagation Index – A measure of the fire propagation tendency of the cable and is the ratio of the heat flux provided by the flame and the thermal response parameter of the cable

Heat Flux – The rate of heat flow measured across a given surface

Self-sustained Flame Propagation – A cable flame propagation assisted by the flame heat flux from the burning sample only and not by other heat sources

Thermal Response Parameter – A property of material describing its reaction to heat in terms of ignition temperature, thermal conductivity, density and specific heat

2 GENERAL INFORMATION

2.1 Product Information

Cable coatings are supplied as a liquid and are spray, brush, or roller applied to grouped cables which may be in or out of a cable tray. Cable wraps are supplied as sheets and are applied around cable trays or around grouped cables.

2.2 Certification Application Requirements

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

- A complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- General installation instructions, a complete set of manufacturing drawings, materials list, anticipated marking format, brochures, sales literature, specification sheets, and maintenance procedures, etc.
- 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 Requirements for Samples 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. The certification agency, at their discretion, shall reserve the right to witness production of test samples and/or any components or raw materials that are deemed to be critical to the performance of the product. 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, substrates, or installation tools such as those which may be required to evaluate the coatings or wrap when applied over cables.

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 Markings

3.2.1 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.

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

3.2.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.2.3 The certification mark 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.

3.2.4 All markings shall be legible and durable.

3.3 Manufacturer's Installation and Operation Instructions

3.3.1 The manufacturer shall:

- prepare instructions for the installation, maintenance, and use of the product;
- provide facilities for repair of the product and supply replacement parts, if applicable; and
- provide 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.

3.4 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. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified as 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.

- 3.4.2 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 Flammability

4.1.1 Requirement

A coated or wrapped cable shall have a Fire Propagation Index (FPI) less than $10 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$ when applied over a cable with a known FPI value greater than $20 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$.

4.1.2 Test/Verification

The FPI evaluation shall be in accordance with ASTM E2058 by testing the coated or wrapped cable using ASTM E2058 ignition test and fire propagation test procedures. The subject coating or wrap shall be applied over a cable with a known FPI value greater than $20 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$.

Note: The averaged peak chemical heat release rate from three fire propagation tests is used in the determination of TRP.

4.2 Aging

4.2.1 Requirement

Simulated aging by temperature extremes shall not result in an increase in peak chemical heat release rate of the coated or wrapped cable of more than 20% when tested per the ASTM E2058 fire propagation test.

4.2.2 Tests/Verification

The subject coating or wrap shall be applied over a cable with a known FPI value greater than $20 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$. Samples of coated or wrapped cable shall then be subjected to alternating temperatures of 160°F (71°C) and -40°F (-40°C) for 24 hour periods over a two week duration. The sample is then tested per the ASTM E2058 fire propagation test to determine the peak chemical heat release rate. The averaged peak chemical heat release rates from three fire propagation tests, both before and after aging, are used.

4.3 8 ft (2.4 m) Parallel Panel Test

4.3.1 Requirement

As an alternative, coated or wrapped cable samples with an FPI greater than $10 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$ when tested in accordance with section 4.1, or those which cannot be properly evaluated in accordance with section 4.1, may 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.

4.3.2 Tests/Verification

The test is performed in the 8 ft. (2.4 m) parallel panel test apparatus. The subject coating or wrap shall be applied over cables with a known FPI value greater than $20 \text{ (m/s}^{1/2}\text{)/(kW/m)}^{2/3}$. Samples of the coating or wrap are applied over a single layer of cables on two vertical parallel panels, each 8 ft (2.4 m) long by 2 ft (0.61 m) wide, and placed 1 ft (0.3 m) apart. The ignition source is a propane gas sand

burner with a heat output of 57 BTU/second (60 kW). The sample is subjected to the ignition source for the first 10 minutes of the test with data acquisition, followed by 2 minutes of data acquisition with the burner shut off. The below criteria must be met during the 12 minute test.

Observation/measurement	Criteria
Average flame height, ft (m)	Max 6 (1.8)
Heat flux at 4 ft (1220 mm), Btu/ft ² /min. (kW/m ²)	Max 211 (40)
Chemical heat release rate decay	Decay of at least half after 1 minute and of at least a factor of 4 after 2 minutes, from the max rate

4.4 Identification Tests - Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis, ASTM E1252

4.4.1 Requirement

For coatings and wraps as applicable, FTIR spectra shall be determined and reported at the discretion of the certification agency¹.

4.4.2 Tests/Verification

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

Note 1: These tests are conducted for identification purposes. The certification agency shall place no limits on the values obtained.

4.5 Identification Test – Thermal Desorption Gas Chromatography Mass Spectrometry (TD/GC/MS)

4.5.1 Requirement

As an alternative identification test to that described in section 4.4, for coatings and wraps as applicable, TD/GC/MS Spectrograms shall be determined and reported at the discretion of the certification agency¹.

4.5.2 Tests/Verification

Standard Practice for General Techniques of Gas Chromatography Infrared (GC/IR) Analysis, ASTM E1642

Note 1: These tests are conducted for identification purposes. The certification agency shall place no limits on the values obtained.

4.6 Additional Tests

- 4.6.1 Additional tests may be required, at the discretion of the certification agency, depending on design features and results of any foregoing tests.
- 4.6.2 Any test following a failure shall be acceptable only at the discretion of the certification agency and with a technical justification of the conditions or reasons for failure.

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent coatings or wraps produced by the manufacturer shall present the same quality and reliability as the specific coatings or wraps 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 reexamination 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;
- inprocess 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 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 discretion of the certification agency.

5.4 Manufacturer's Responsibilities

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*.