



# UL 2431

## STANDARD FOR SAFETY

### Durability of Fire Resistive Coatings and Materials



UL Standard for Safety for Durability of Fire Resistive Coatings and Materials, UL 2431

Second Edition, Dated October 15, 2014

### **Summary of Topics**

***This revision of ANSI/UL 2431 dated January 30, 2025 includes changes in requirements for Irradiance Levels for Lamps in [Table 5.3](#).***

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

These revised requirements are substantially in accordance with Proposal(s) on this subject dated November 1, 2024.

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## **UL 2431**

### **Standard for Safety for Durability of Fire Resistive Coatings and Materials**

The first edition was titled "Standard for Safety for Durability of Spray-Applied Fire Resistive Coatings

First Edition –August, 2007

### **Second Edition**

**October 15, 2014**

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through January 30, 2025.

The most recent designation of ANSI/UL 2431 as an American National Standard (ANSI) occurred on January 30, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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## INTRODUCTION

### 1 Scope

1.1 This standard is intended to provide a means to measure the ability of fire resistive materials to retain their fire resistive properties after being subjected to various conditioning environments. The fire resistive performance is determined by measuring temperatures of steel tubes, wide flange sections and plates protected by the materials.

1.2 Various types of conditioning environments are described. The conditioning environments include air erosion, a combination of wet, freeze and dry cycling, humidity, impact resistance, industrial atmosphere, salt spray, temperature stability, ultraviolet light, and vibration.

1.3 Two fire exposures are defined, a normal temperature rise fire and a rapid temperature rise fire. The normal temperature rise fire is intended to represent a fully developed interior building fire. The rapid temperature rise fire is intended to represent a hydrocarbon pool fire.

1.4 The conditioning environments and fire exposure tests are not intended to be representative of all exposure and fire conditions. With respect to fire exposure, conditions vary with changes in the amount, nature, and distribution of fire loading; ventilation; compartment size and configuration; and heat conducting and dissipating characteristics of the compartment in which the fire resistive material is installed.

### 2 General

#### 2.1 Units of measurement

2.1.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

#### 2.2 Undated references

2.2.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

### 3 Glossary

3.1 For the purpose of this Standard the following definitions apply.

3.2 **CONDITIONING ENVIRONMENT** – Exposures intended to simulate conditions potentially experienced by protective coating systems after application to steel surfaces.

3.3 **CONDITIONED INTERIOR SPACE** – Interior locations where the relative humidity and the temperature are controlled according to the manufacturer's recommendations. The maximum recommended relative humidity is not to be more than 75 percent during the application and curing of the fire resistive material.

3.4 **CONDITIONING SAMPLE(S)** – A maximum of two test samples that is to be or has been subjected to the conditioning environment as specified in Conditioning Environments, Section [5](#).

3.5 **CONTROL SAMPLE** – A prepared sample intended to provide a performance comparison benchmark with a test sample; unlike a test sample, a control sample is not subjected to any identified conditioning environment, such as temperature stability, humidity, air erosion or the like.

**3.6 FIRE RESISTIVE MATERIAL** – Any material intended to extend the fire resistance rating of bare structural steel. These materials include, but are not limited to, spray-applied fire resistive materials (SFRM's) and paint type coatings such as mastic and intumescent coatings.

**3.7 PROTECTIVE COATING SYSTEM** – All materials added to the steel section such as a primer, insulating coating, reinforcement mesh and surface sealer required for fire resistive performance.

**3.8 LIMITING TEMPERATURE TIME** – The time period in minutes determined by the first occurrence steel sample(s) reaching 1000°F (538°C) as measured by the four thermocouples on the tube, wide flange or steel plate sample, or the time when one thermocouple reaches a temperature of 1200°F (649°C). The average thickness of fire resistive material on each steel sample used to determine the reference period is to be within 10 percent of the standard deviation as determined from the population consisting of the average fire resistive material thickness calculated for each sample used in the investigation.

**3.9 SAMPLE SET** – The minimum number of samples required for evaluation of a specific conditioning exposure.

Note: For example, a sample set for a II-A-3 condition (Indoor, Exposed Non-Controlled Temperature and Humidity Environment) will consist of  $\geq 2$  control samples,  $\geq 2$  temperature stability samples,  $\geq 2$  UV samples,  $\geq 2$  High Humidity samples,  $\geq 2$  Air Erosion samples,  $\geq 2$  Impact samples and  $\geq 2$  Vibration samples.

**3.10 STRUCTURAL STEEL SECTION** – A steel member used for the application of the protective coating material under investigation. These sections may consist of steel tubes (hollow structural steel), wide flange or plate configurations.

**3.11 TARGET DENSITY** – The density of the SFRM or other protective coating system selected for evaluation on application to the steel section.

**3.12 TARGET THICKNESS** – A thickness of the protective coating system selected for evaluation on application to the steel section. The thickness of protective coating system shall be sufficient such that the average temperature of the control sample reaches 1000°F (538°C) in not less than 60 minutes as measured by the four thermocouples within the steel sample. The maximum temperature at the time when the average temperature is 1000°F (538°C) shall not be greater than 1200°F (649°C).

**3.13 UNCONDITIONED INTERIOR SPACE** – Interior locations where conditions do not meet requirements for conditioned interior space.

## **PERFORMANCE**

### **4 General**

#### **4.1 General**

**4.1.1** The steel section used for the conditioning sample(s) and the control sample(s) for a specific conditioning environment shall be the same size.

#### **4.2 Steel tube sections**

**4.2.1** Each steel tube section shall be a 6 x 6 x 3/16 inches hollow structural section as described in the Manual of Steel Construction, published by AISC. The tube sample shall consist of a 24 inches (610 mm) long steel section with a 0.25 inch (6.4 mm) thick steel plate at each end. Each steel tube section and both steel plates shall be coated with the protective coating system under investigation. The area of the steel

plates shall be sufficient to provide resistance to the expansion of the protective coating system applied on the steel section. The ends of the specimen, including the means for restraint, are to be given sufficient thermal insulation to prevent appreciable direct heat transfer through the ends of the column.

#### 4.2.2 Wide flange sections

4.2.2.1 Wide flange steel sections shall consist of a 24 inches (610 mm) long steel section with a 0.25 inch (6.4 mm) thick steel plate at each end. Each wide flange section and both steel plates shall be prepared with the protective coating system under investigation. The area of the steel plates shall be sufficient to provide resistance to the expansion of the protective coating system applied on the steel section. The ends of the specimen, including the means for restraint, are to be given sufficient thermal insulation to prevent appreciable direct heat transfer through the ends of the column.

#### 4.2.3 Steel Plates

4.2.3.1 Steel plates of minimum size 8-inch x 8-inch (200 mm x 200 mm) with a nominal thickness of 3/16-inch (5 mm) shall be used while conducting the combined Temperature stability, UV & High humidity environmental exposure specified in Classification Categories I-A and I-B in [Table 5.2](#), and the UV environmental exposure as specified in Classification Category II-A-3 in [Table 5.3](#). A maximum of 0.5-inches (12.7 mm) of the steel plate edges shall be treated with an anti-corrosion material. Where necessary, reinforcement shall be used to ensure bond of the material to the steel plate.

#### 4.2.4 Thermocouples

4.2.4.1 Each steel tube and wide flange section shall include a set of four thermocouples of the same gauge and response time. Such thermocouples shall be a maximum 14 gauge and minimum 18 gauge of Type K and fusion welded at the end to be in contact with the test specimen.

4.2.4.2 Each steel plate section shall include a set of four thermocouples of the same gauge and response time. A thermocouple assembly may be used in lieu of the thermocouple specified in [4.2.4.1](#). Each thermocouple assembly shall consist of thermocouple wires having a diameter of not more than 0.03 inch with each thermocouple wire brazed to the center of the face of a copper disk 0.5 inch in diameter and 0.01 inch thick. Each thermocouple or thermocouple assembly for steel plates shall be located under a minimum 2 x 2 inch pad as specified in Appendix [A](#) and secured to the surface of the specimen at the required position. The thermocouples for all steel samples shall be located as shown in [Figure 4.1](#) – [Figure 4.3](#).

4.2.4.3 *Deleted*

4.2.4.4 *Deleted*