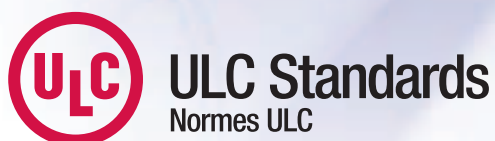


**NATIONAL STANDARD
OF CANADA**

CAN/ULC-S139:2017

**STANDARD FOR FIRE TEST FOR CIRCUIT INTEGRITY OF
FIRE-RESISTIVE POWER, INSTRUMENTATION, CONTROL,
AND DATA CABLES**

Prepared and Published by:



Approved by:



Standards Council of Canada
Conseil canadien des normes



ANSI/UL 2136-2017



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Prepared by:



**ULC Standards
CAN/ULC-S139
Third Edition**



**Underwriters Laboratories Inc.
ANSI/UL 2196
Second Edition**

**Standard for Fire Test for Circuit Integrity of Fire-Resistive Power,
Instrumentation, Control, and Data Cables**

August 29, 2017

Approved by:



ANSI/UL 2196-2017



**Standards Council of Canada
Conseil canadien des normes**



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This ANSI/UL Standard for Safety consists of the Second Edition including revisions through August 29, 2017.

The most recent designation of ANSI/UL 2196 as an American National Standard (ANSI) occurred on August 29, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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ULC Preamble

International Classification for Standards (ICS): 13.220.50, 29.060.20

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Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patents rights. ULC Standards shall not be held responsible for identifying any or all such patents rights.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

This Standard is intended to be used for conformity assessment.

The Third Edition of this ULC Standard was based on, and superseded, the Second Edition.

The review and action to revise or reaffirm this Standard will not exceed 5 years from the date of publication, unless the Standard is identified as fitting within a stabilized category, whereby the review will commence within the appropriate time frame set out by ULC Standards.

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Preface

This is the common UL and ULC Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables. It is the Third edition of CAN/ULC-S139, and the Second edition of ANSI/UL 2196.

This common Standard was prepared by Underwriters Laboratories Inc., ULC Standards, and the Joint UL/ ULC Task Group. The efforts and support of the Joint Task Group are gratefully acknowledged.

This Standard was formally approved by the ULC Standards Committee on Fire Tests and UL Standard Technical Panel on Fire Resistive Cables.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This standard has been approved as a National Standard of Canada by the Standards Council of Canada.

This standard has been approved by the American National Standards Institute as an American National Standard.

Annexes A, B and C are identified as normative, forms mandatory parts of this Standard.

Annex D is identified as informative, is for informational purposes only.

Note: *Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.*

Level of Harmonization

This Standard is published as an identical standard between UL and ULC Standards. An identical standard is a standard that is the same in technical content except for conflicts in Codes and Governmental Regulations. Presentation shall be word for word except for editorial changes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

UL Effective Date

A UL effective date is established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

1 SCOPE

1.1 The intent of this Standard is to evaluate the integrity of power, control, instrumentation, and data cables for their ability to maintain circuit integrity when subjected to standard fire test exposure and associated hose stream test.

1.2 The power, control, instrumentation, and data cables covered by this Standard are intended to comply with the following requirements :

In Canada:

Canadian Electrical Code and the National Building Code of Canada;

In the United States:

National Electrical Code, and/or the National Fire Alarm and Signaling Code, and/or the Standard for Fixed Guideway Transit and Passenger Rail Systems, and/or the Standard for Road Tunnels, Bridges, and Other Limited Access Highways.

1.3 Power, control, and instrumentation cables are subjected to the fire exposure in accordance with CAN/ULC-S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials, and ANSI/UL 263, Standard for Fire Tests of Building Construction and Materials. During the fire test, cables are continuously energized at their maximum rated voltage or maximum utilization voltage (power cables); or at their maximum utilization voltage (control and instrumentation cables) and evaluated for circuit integrity. Insulation resistance measurements are also taken to quantify leakage current. Following the fire test, the assembly shall be subjected to a hose stream test.

1.4 Data cables are subjected to the fire exposure in accordance with CAN/ULC-S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials, and ANSI/UL 263, Standard for Fire Tests of Building Construction and Materials. During the fire tests, the data cables are evaluated for their ability to maintain error free data transfer and retrieval at the specified protocol and data rates. Following the fire test, the assembly shall be subjected to a hose stream test.

1.5 The fire exposure and hose stream tests are not intended to be representative of all fire conditions and impact conditions, respectively. It is likely that conditions will vary with changes in the amount, nature, distribution of fire loading, ventilation, compartment size and configuration, and heat conducting and dissipating characteristics of the compartment in which the cables are installed. These requirements provide a relative measure of fire performance of comparable assemblies under these specified fire exposure conditions. It is possible that any variation from the construction or operating condition tested, such as size, method of assembly and materials, will substantially change the performance characteristics of the cables.

1.6 The standardized fire and hose stream exposures for comparing the performance of cables represents one factor in determining the acceptability of cables for use in specific applications.

1.7 The construction and operation of the furnace and the general test conditions are intended to be in accordance with the requirements in CAN/ULC S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials, and ANSI/UL 263, Standard for Fire Tests of Building Construction and Materials.

2 UNITS OF MEASUREMENT

2.1 The metric unit shall be designated as the official unit for purposes of this standard. Where values of measurement are specified in both SI and English units, either unit is used. In cases of dispute, the metric unit shall be used.

3 REFERENCE PUBLICATIONS

3.1 See Annex A for a list of publications referenced in this standard. 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. When the latest edition of a standard is not applicable, the appropriate edition is indicated accordingly in Annex A.

4 GLOSSARY

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

4.1 **CABLE CONSTRUCTION** – A distinct design type as evidenced by number and size of conductors, conductor type, insulation type, shield type, and any individual insulation or overall jacket type, armor type, etc.

4.2 **CABLE CONSTRUCTION FAMILY** – A distinct group of cable construction types that have similar design features for a range of sizes and/or number of conductors all having the same circuit integrity rating.

4.3 **CABLE TRAY** – A unit or assembly of units or sections and associated fittings forming a structural system used to securely fasten or support cables and raceways.

4.4 **CIRCUIT INTEGRITY** – The ability of a power, instrumentation, or control cable to maintain voltage and current to the load or the ability of a data cable to maintain error free data transfer and retrieval.

4.5 **CIRCUIT INTEGRITY RATING** – The time period during which the cable or cable system continues to operate in its designated manner under specified fire conditions and after the hose stream test for fire-resistive cable or free air installation circuit integrity cable.

4.6 **FIRESTOP SYSTEM** – A specific construction of materials intended to prevent the spread of fire through an opening made in a fire-resistive structure for passage of penetrating items such as cables.

4.7 **FIRE-RESISTIVE CABLE** – Power, control, instrumentation, or data cable in a system and evaluated in accordance with this Standard.

4.8 **FREE AIR INSTALLATION CIRCUIT INTEGRITY CABLE** – Power, instrumentation, control or data cable in free air (not installed within a raceway) and evaluated in accordance with Annex C.

4.9 **LOAD VOLTAGE** (E_{applied}) – The voltage applied between phase and ground to the cable that determine circuit integrity and insulation resistance.

4.10 RACEWAY – An enclosed channel of metallic or nonmetallic materials designed expressly for support and routing wires or cables.

4.11 TEST ASSEMBLY – The cable and its means of securement, firestop system and any structure used to support the cable during the fire and hose stream tests.

4.12 UTILIZATION VOLTAGE – The maximum voltage anticipated during intended usage of a power, instrumentation, control or data cable.

NOTE: Typical utilization voltages are 600 V, 480 V, 208 V, 120 V, or less.

4.13 VERTICAL WALL ASSEMBLY – The vertical structure that supports the test samples and cable systems.

5 TESTS

5.1 FIRE TESTS

5.1.1 Test Samples

5.1.1.1 General

5.1.1.1.1 Representative samples of each power, instrumentation, control, and data cable construction family shall be tested. Each cable construction tested shall include a minimum of five separate samples.

NOTE 1: Examples of different cable designs are multi-conductor, single conductor, twisted, parallel, shielded, nonshielded, stranded and solid conductor(s) cables. Cables with bare or insulated bonding conductor or grounding conductor are other examples of cable design.

NOTE 2: Examples of different optical fibre designs are simplex, distribution, and breakout. Optical fibre cables refer to the complete assembly of fibres, strength members and insulating jackets.

NOTE 3: Fibre material and doping, cladding, thickness, buffering, coloring, water blocking, armor, ripcords, etc. may all affect fibre function during a fire. Electrical data cables may have similar critical characteristics as described in Note 1 but may also include center filler, pair lay length, cable lay length, type of shield material, application of shield, lap, barrier tapes, etc.

5.1.1.1.2 The results of the fire test are restricted to the cable construction family tested.

5.1.1.1.3 Cables representative of the cable construction family for which a circuit integrity rating is desired shall be tested. The construction details of the cable samples or cable and cable system samples shall be identified and recorded. As a minimum, the following features shall be recorded, as applicable:

ELECTRICAL POWER, CONTROL, AND DATA CABLES

A) Conductor

i) Material

ii) Size

iii) Type, stranded or solid

a) If stranded, number of strands and lay length

- iv) Plating material and thickness
- v) Number of conductors
 - a) If more than one conductor, parallel or cabled
 - 1) If cabled, the length of lay
- vi) Separator tape over the conductor (such as Mica/glass or others)

B) Insulation

- i) Material
- ii) Thickness and/or distance between conductors
- iii) Manufacturing process
- iv) Jacket over insulated conductor
 - a) Material
 - b) Thickness
 - c) Manufacturing process (e.g., coextrusion)

C) Shielded, unshielded, or barrier tape

- i) If taped,
 - a) Number of layers
 - b) Material
 - c) Thickness
 - d) Type (tape wrap or longitudinally applied)
 - e) Overlap
 - f) Drain wire for control or data cable
 - 1) Material
 - 2) Size
 - 3) Plating

D) Layup

- i) Number of conductors
 - a) If more than one conductor, parallel or cabled

- 1) If cabled, length of lay
- ii) Ground wires
 - a) Bare or insulated (same information on conductor and insulation)
- iii) Filler
 - a) Material
 - b) Thickness
 - c) Overlap
 - d) Helical or parallel
- E) Armor
 - i) Material
 - ii) Type (interlocked, corrugated and welded, smooth)
 - iii) Thickness
 - iv) Number of convolutions per unit length
- F) Inner or Overall Jacket
 - i) Material(s)
 - ii) Thickness(es)
 - iii) Manufacturing process

OPTICAL FIBRE CONTROL AND DATA CABLE

- A) Configuration
 - i) Simplex
 - ii) Distribution
 - iii) Breakout
- B) Single mode or multimode
 - i) Optical characteristics
- C) Fibre material
 - i) Doping
 - ii) Cladding

iii) Thickness of layers

D) Buffering

i) Material

ii) Thickness

E) Coloring

i) Material

ii) Thickness

F) Water blocking

i) Material

G) Assembly

i) Type or lay

H) Strength members

i) Material

ii) Thickness

I) Jackets

i) Material

ii) Thickness

iii) Ripcords

INSTALLATION

A) Cable within raceway or without raceway

i) If cable without raceway,

a) Cable support/grip or Cable tray system

1) Type

I) Hook

II) Ladder

III) Solid bottom

IV) Trough

V) Channel

VI) Wire Mesh

VII) Single rail