FCIA Webinar Series

Critical Electrical and Communications Circuit Protection

Rich Walke, CTI

FCIA
Firestop Contractors International Association

April 28, 2021

FCIA – Firestop Contractors International Association

- **Fire Exits??**
- **Housekeeping….Phones, Hands off Keyboard!**
- **Thanks to FCIA Members**
  - Firestop Contractors
  - Manufacturers, Consultants
  - Firestop Distributors, Reps, Friends
- **FREE PDF MOP/ Word Doc Spec** - Specifiers @ AE, Independents, AHJ's with Jurisdictions, More

FCIA – Firestop Contractors International Association

- **FREE Life Safety Digest**

- **UL/ULC, FM 4991 Contractor Programs, IAS AC 291 Inspection Agency Accreditation Program**, Individual Knowledge
- **ASTM Inspection Standards**
- **Tools** @ **FCIA.org** for Specifiers, AHJ's, Building Owners, Firestop Contractors & Inspection Agencies
- **Watch FCIA.org for Webinar Announcements!**

“TOTAL FIRE PROTECTION”

- **Effective Compartmentation**
  - Fire Barriers, Fire Walls/Floors, Smoke Barriers
  - Firestopping, Fire Dampers, Swinging and Rolling Fire Doors, Fire Rated Glazing
- **Detection & Alarm Systems**
- **Sprinkler Suppression Systems**
- **Education for Safety**
  - Building Owners & Managers, Building Occupants and Firefighters

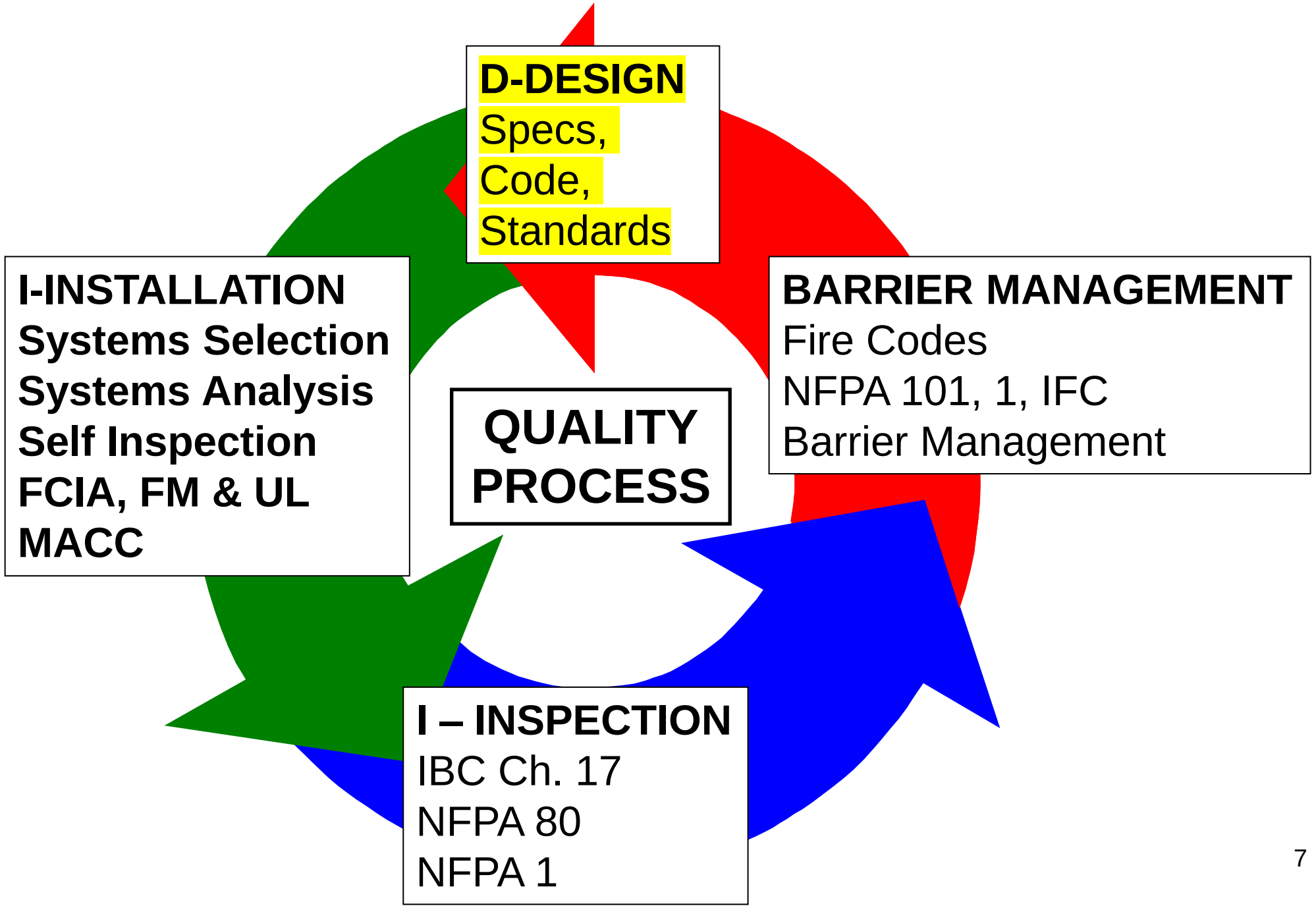
“DIIM” – Design, Install, Inspect, Maintain

- Fire Resistance & Smoke Resistant Firestopping
  - **Properly *Designed*** Building Codes
    - FCIA - 07-84-00 – Specification – ***CCS, RSW***
    - ***Tested and Listed Systems*** – ASTM E814, UL1479, ASTM E1966, UL 2079, ASTM E2307, E2837, E2874, E3037
    - **Movement (M), Smoke (L), Water (W)**
  - Professional ***Installation*** –
    - FCIA Member, UL/ULC Qualified Contractors, FM 4991 Approved Contractors
  - Properly ***Inspected*** –
    - ASTM E2174 / E2393, by IAS-AC291 Agency, UL/ULC, IFC, FM Exam
  - ***Protection Maintained*** – Annually – by FCIA Members

FCIA Actions - 2021

Firestop Contractors International Association

- Conferences - HYBRID
  - FCIA ECA @ KC – May 9-12 – Tues.-Thurs. PATTERN
  - FCIA FIC @ San Diego – Nov. 2-5
- Webinars & Symposiums
- Code Development & Standards Discussions
- Committee Action
- International Discussions
- ***NEW Education for Careers in Firestopping!!***
  - ***FCIA's FCAEP – Check it out!***


D-DESIGN
Specs,
Code,
Standards
I-INSTALLATION
Systems Selection
Systems Analysis
Self Inspection
FCIA, FM & UL
MACC
QUALITY
PROCESS
BARRIER MANAGEMENT
Fire Codes
NFPA 101, 1, IFC
Barrier Management
I – INSPECTION
IBC Ch. 17
NFPA 80
NFPA 1

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Critical Electrical and Communications Circuit Protection

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Introduction

- Original Webinar – December 16, 2020
  - ASTM E119 / UL 263 – Baseline for other fire resistive standards
  - *Overview* of complimentary standards and ratings developed on each unique method for protecting breaches in or through hourly rated assemblies
- 2021 Series of Webinars
  - Multiple webinars which will address the *details* of the standards and ratings developed on each unique method for protecting breaches in or through hourly rated assemblies
- Todays Webinar – Critical Electrical and Communications Circuit Protection

What are Critical Electrical & Communications Circuit Systems?

- These systems are intended to protect critical electrical circuits such that they remain functional during a fire event
  - Original concept was developed for the nuclear power industry to protect critical electrical circuits needed for safe shut down of the nuclear reactor in the event of a fire

What are Critical Electrical & Communications Circuit Systems?

- Currently, the primary use of these systems is related to commercial construction. Examples of their use include
  - Cabling for fire pumps
  - Fire alarm cables
  - Cabling for smoke control systems
  - Cabling for emergency and standby power systems
  - Cabling for fire service access elevators
  - Cabling for emergency evacuation elevators

Terminology

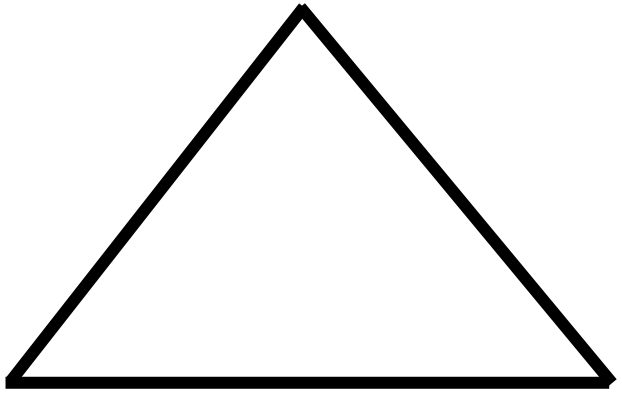
- The International Building Code (IBC) and the National Electrical Code (NEC) refer to the systems as “Electrical Circuit Protective Systems”
- UL recently changed their description of these systems from “Electrical Circuit Protective Systems” to “Electrical Circuit Integrity Systems”

Electrical Circuit Protective Systems and Balanced Fire Protection

- Balanced Fire Protection – An integrated system of fire and smoke protection elements in the construction environment composed of detection, suppression and containment features designed to provide an acceptable level of protection for people and property

Fire Protection Triad

Detection



Containment

Suppression

What is the Function of a Balanced Fire Protection Design?

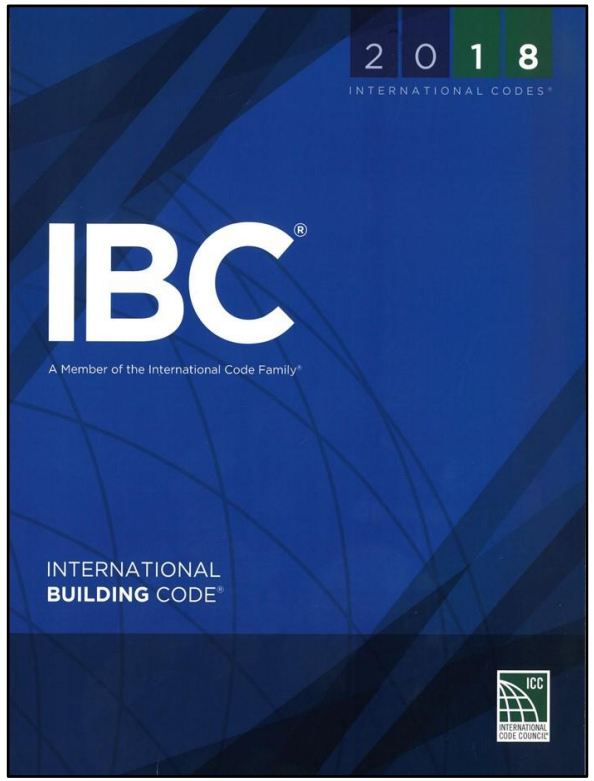
- Detection is used to activate fire alarms and notify building occupants and emergency responders
- Sprinklers are designed to control small and medium fires and to prevent fire spread beyond the typical water supply design area of about 1,500 ft^2
- Compartmentation mitigates the spread of more severe but less frequent fires by limiting building areas, subdividing building with fire-resistance-rated construction, based on hourly ratings

Protection of Electrical & Communications Circuits

- The protection of electrical and communications circuits compliments all three components of the Fire Protection Triad
  - Detection – Keeps the alarm system functional during a fire event, allowing continued notification and voice commands
  - Suppression – Keeps the fire pumps feeding the fire suppression system functional
  - Containment – Keeps the fire service access and occupant evacuation elevators functional allowing egress from building

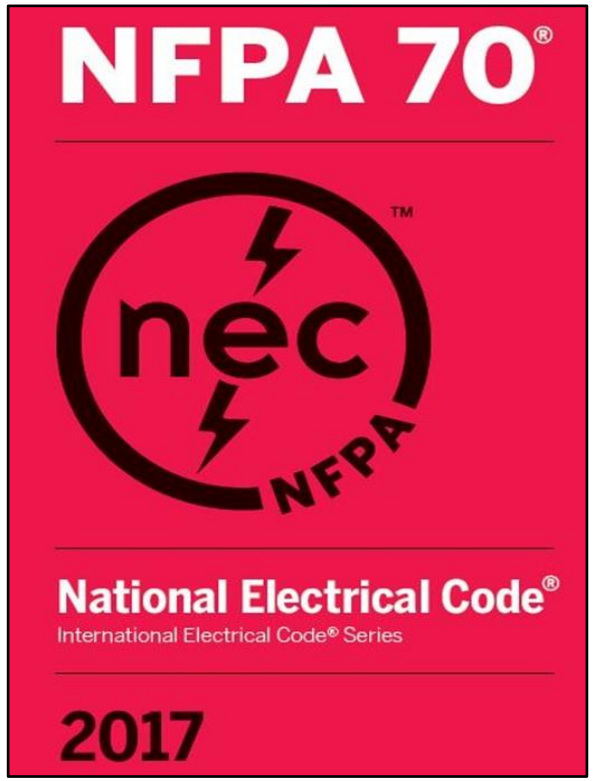
International Building Code Requirements for Circuit Protection Systems

2018 IBC Section	System
412.2.4.1	Airport Traffic Control Towers
909.20.6.1	Smoke Control Systems
913.2.2	Fire Pumps
2702.3	Emergency and Standby Power Systems
3007.8.1	Fire Service Access Elevators
3008.8.2	Occupant Evacuation Elevators



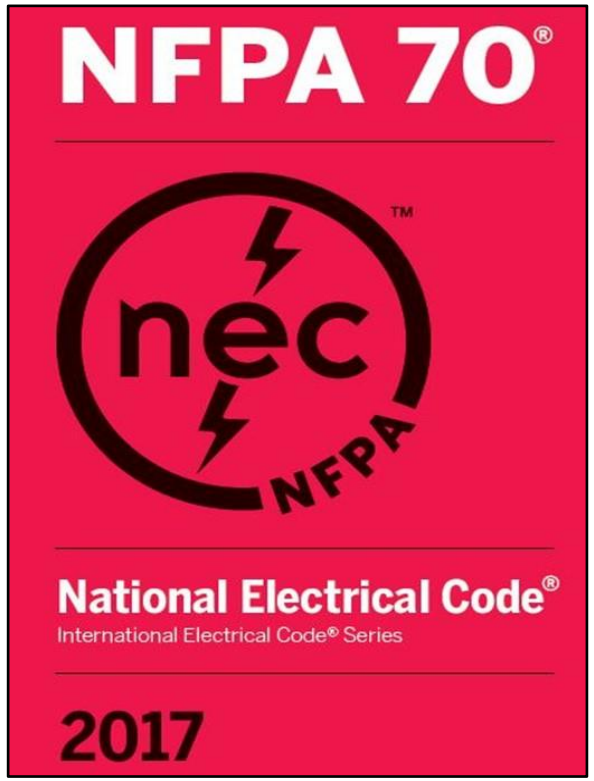
National Electrical Code Requirements for Circuit Protection Systems

2017 NEC Article	System
695.6(A)(2)	Special Equipment / Fire Pumps / Power Wiring / Supply Conductors / Feeders
695.6(H)	Special Equipment / Fire Pumps / Power Wiring / Supply Conductors / Controller Wiring
695.14	Special Equipment / Fire Pumps / Control Wiring / Generators Control Wiring
700.10(D)(1)	Special Conditions / Emergency Systems / Wiring, Emergency Systems / Fire Protection / Feeder Circuit Wiring
708.10(C)(2)	Special Conditions / Critical Operations Power Systems (COPS) / Feeder and Branch Circuit Wiring / COPS Feeder Wiring Requirements / Fire Protection for Feeders



National Electrical Code Requirements for Circuit Protection Systems

2017 NEC Article	System
760.176(F)	Special Conditions / Fire Alarm Systems / Listing and Marking of NPLFA Cables / Fire Alarm Circuit Integrity Cable or Electrical Circuit Protective System
760.179(G)	Special Conditions / Fire Alarm Systems / Listing and Marking of PLFA Cables / Fire Alarm Circuit Integrity Cable or Electrical Circuit Protective System
770.179(E)	Special Conditions / Fire Alarm Systems / Optical Fiber Cables / Circuit Integrity Cable or Electrical Circuit Protective System
800.179(G)	Communication Systems / Communications Circuits / Communication Wires and Cables / Circuit Integrity Cable or Electrical Circuit Protective System



Type of Protection Required by Code

- Depending on the Code Section specified, protection achieved using one of the following methods
  - Circuit Integrity (CI) cable tested to UL 2196 having a rating of 1 or 2 hrs
  - Electrical Circuit Protective System tested to UL 2196 having a rating of 1 or 2 hrs
  - Electrical Circuit Protective System tested to UL 1724 or ASTM E1725 having a rating of 1 or 2 hrs
  - Using construction having a fire-resistance rating of 1 or 2 hrs
  - Encased in a min of 2 in. of concrete

Type of Protection Available

- Circuit Integrity (CI) Cable
  - Tested for circuit integrity to UL 2196
  - Cable by itself meets the hourly rating – no conduit, wrap, etc. necessary
  - Cable marked “CI”

Type of Protection Available Cont.

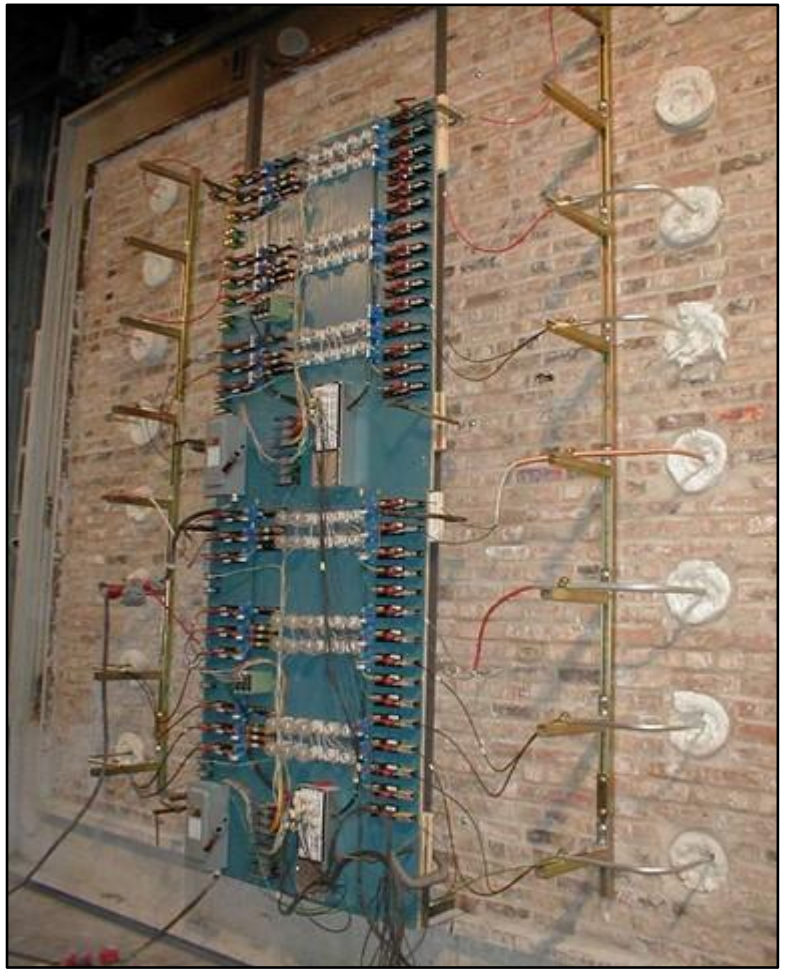
- Fire-resistive Cables in Conduit, MI Cables, MC Cables
  - Tested for circuit integrity to UL 2196
  - Results published in the form of a “system”
    - The IBC and the NEC refer to the systems as “Electrical Circuit Protective Systems”
    - UL refers to the systems as “Electrical Circuit Integrity Systems”

Type of Protection Available Cont.

- Cables in Protective Enclosure
  - Tested based on temperature rise to UL 1724 or ASTM E1725
  - Results published in the form of a “system”
    - The IBC and the NEC refer to the systems as “Electrical Circuit Protective Systems”
    - UL refers to the systems as “Electrical Circuit Integrity Systems”

CI Cables, Fire-resistive Cables in Conduit, MI Cables, MC Cables

Establishing
the Rating Based on
UL 2196



Testing Parameters

- UL 2196 – Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
  - Cables run from the unexposed side through a protected penetration, then either horizontally or vertically along the exposed side wall, and then back through another protected penetration to the unexposed side
  - Cables supported in accordance with the NEC or the manufacturer’s installation instructions

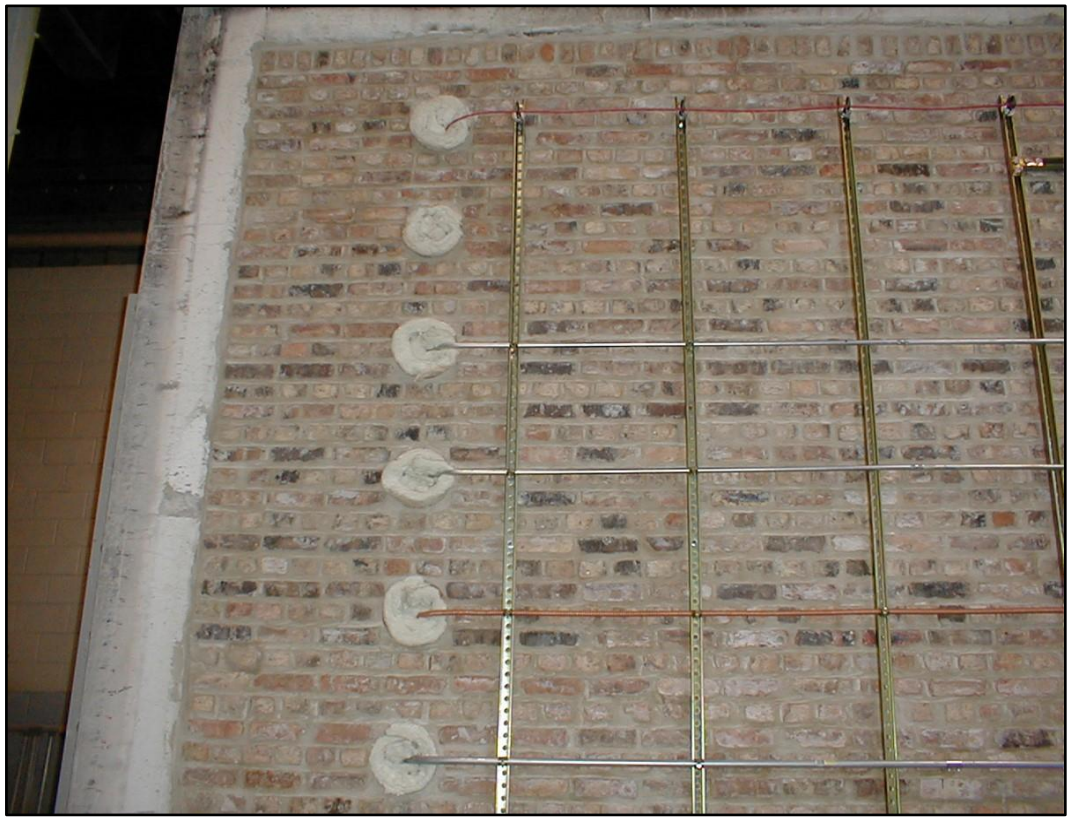
Testing Parameters Cont.

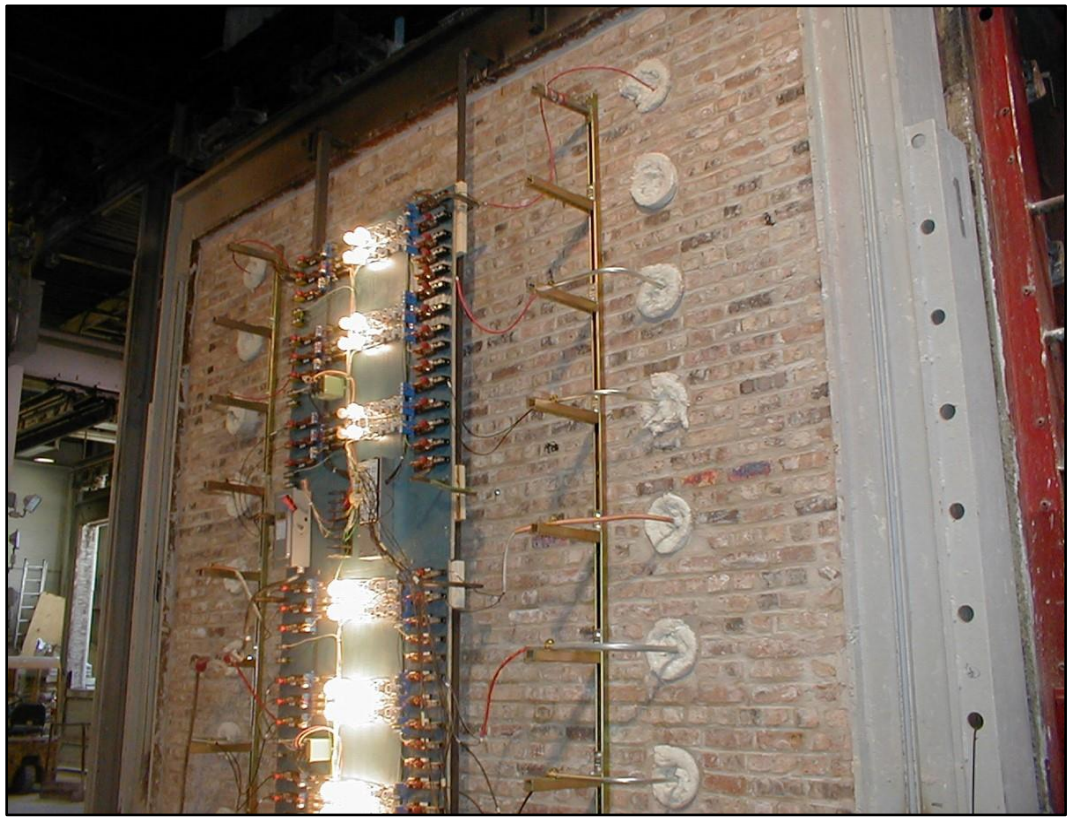
- Power cables connected to a rated voltage or max utilization voltage, and control or instrumentation cables to their max utilization voltage, at low amperage during the fire exposure test
- Data cables evaluated for their ability to maintain error free data transmission during the fire exposure test
- Visual indicator (light bulb) installed on power, control and instrumentation cable to provide visual indicator of functionality

Testing Parameters Cont.

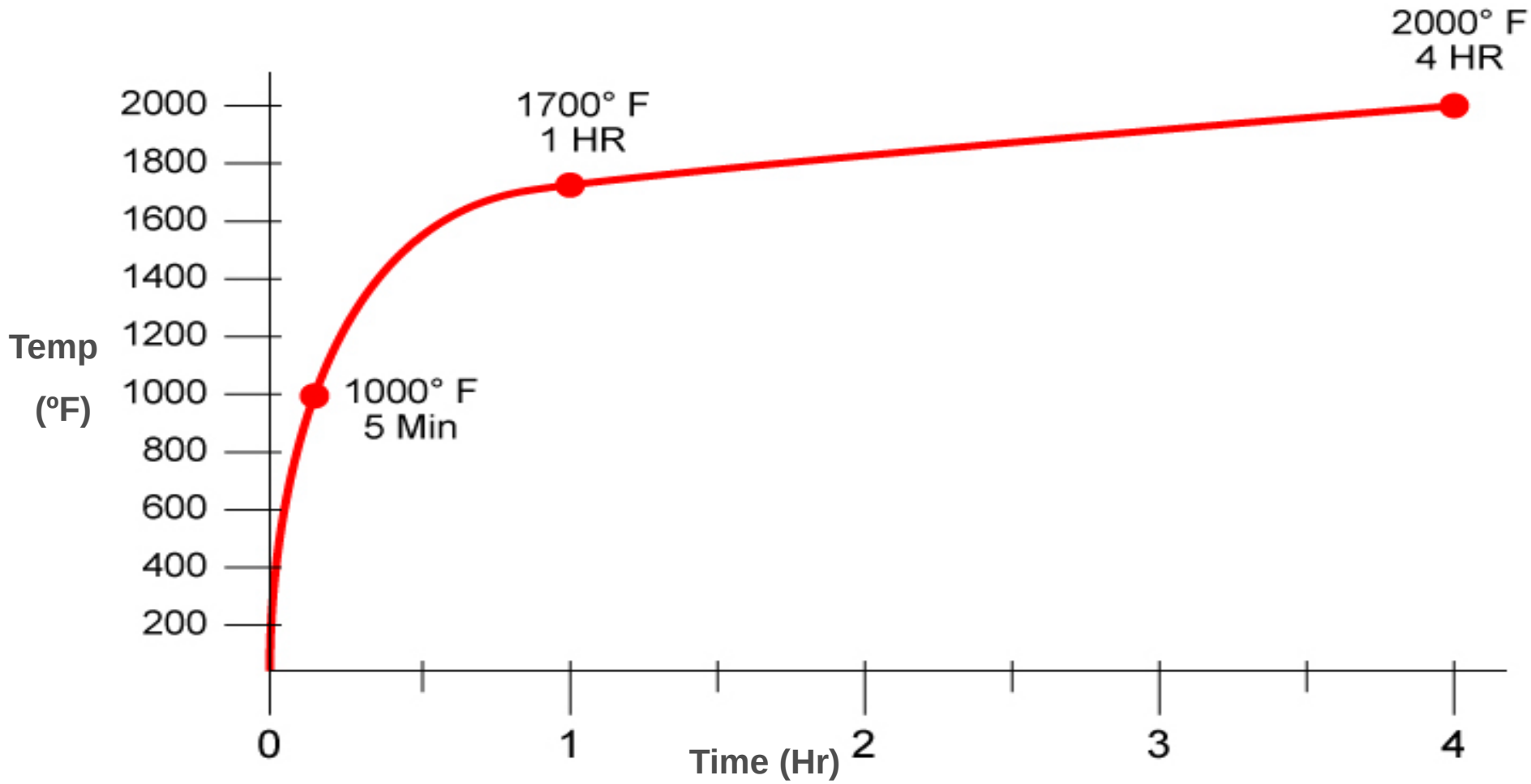
- Load applied to vertical cable runs to replicate the longest vertical run intended in the field
- Insulation resistance test conducted prior to fire exposure test
- Fire exposure test conducted using same time-temperature curve as used for the basic barrier or firestop systems

Pre Fire Exposure Test





Time-Temperature Curve

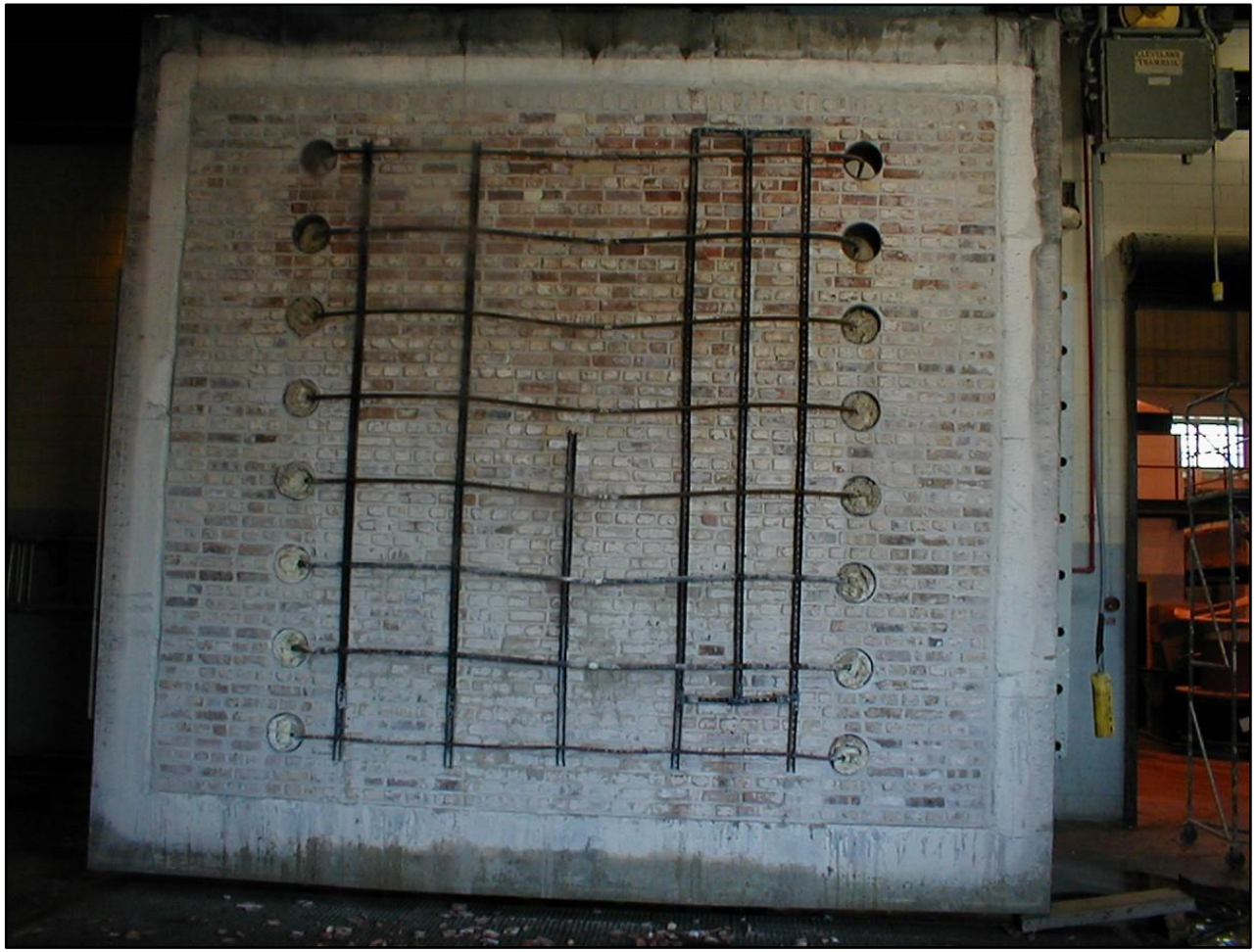


Testing Parameters Cont.

- After fire exposure, power or data signal deenergized for the conduct of the hose stream test
- Insulation resistance test conducted again after the fire exposure test
- Hose stream tested conducted in a similar manner as for the basic barrier or for firestop systems
- Cables reenergized after hose stream test and circuit integrity reevaluated

Hose Stream Test

Post Hose Stream Test



Conditions of Acceptance – UL 2196

- For power, instrumentation and control cables, the conductors shall maintain continuity, and supply voltage and current to the load during and after the fire exposure and after the hose steam tests
- The visual indication shall remain functional during and after the fire exposure and after the hose steam tests
- For data cables, the cables shall maintain error free transmission during and after the fire exposure and after the hose steam tests

Publication of UL Listings

- Circuit Integrity cables tested in “free air” are marked CI on the cable to indicate compliance with UL 2196
- Four product categories which reference “CI” marked cables
  - Communications Cable (DUZX)
  - Nonpower-limited Fire Alarm Cables (HNHT)
  - Power-Limited Fire Alarm Cable (HNIR)
  - Power-limited Circuit Cables (QPTZ)

Publication of UL Listings

- Hourly rating of Fire-resistive Cables tested in raceways (i.e. conduit), MI cable, and MC cable are published by UL as an “Electrical Circuit Integrity System” (FHIT)
- System includes the details on the raceway, raceway orientation and support, splices, cable type and construction, and hourly fire rating achieved
- Details of fire-resistive cables used in “Electrical Circuit Integrity Systems” are listed by UL under the product category “Fire-resistive Cables” (FHJR)

Cables in Protective Enclosures

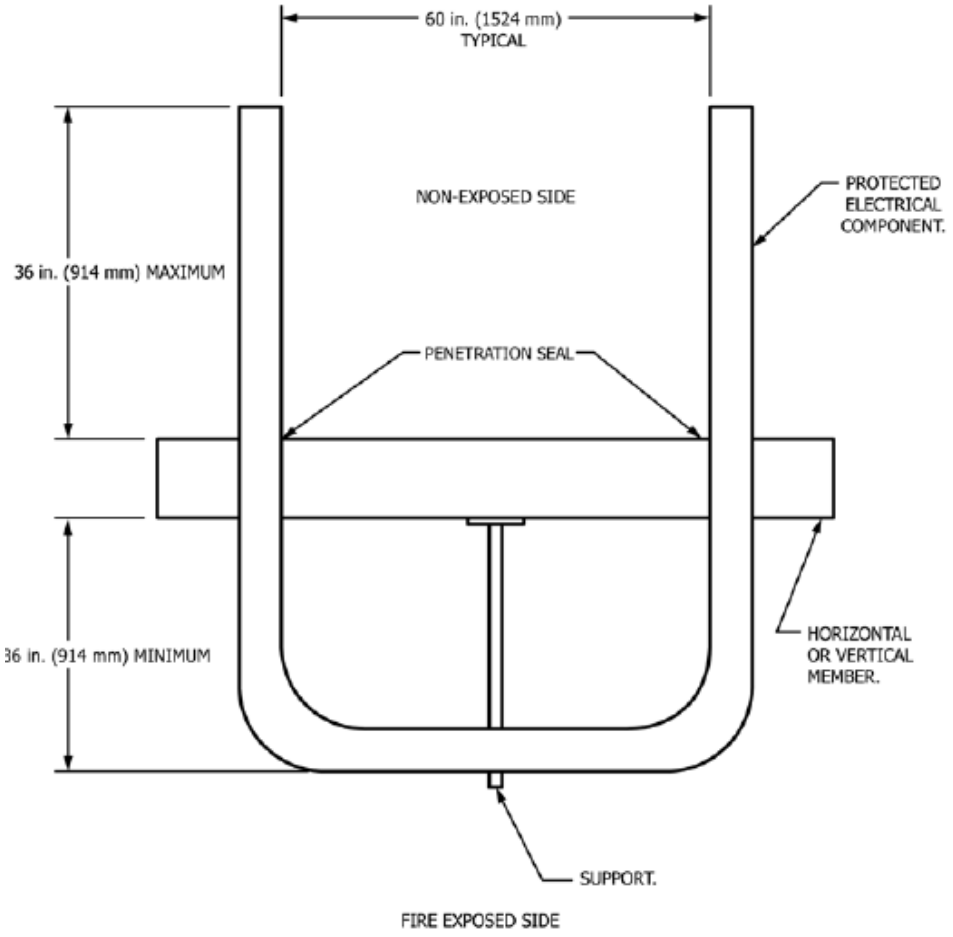
Establishing the Rating Based on UL 1724 or ASTM E1725

Testing Parameters

- UL 1724 – Outline of Investigation for Fire Tests of Electrical Circuit Protective Systems, or
- ASTM E1725 – Standard Test Methods for Fire Tests of Fire Resistive Barriers for Electrical System Components
  - Raceway (cable tray or conduit) run adjacent to either a vertical or a horizontal barrier

Testing Parameters Cont.

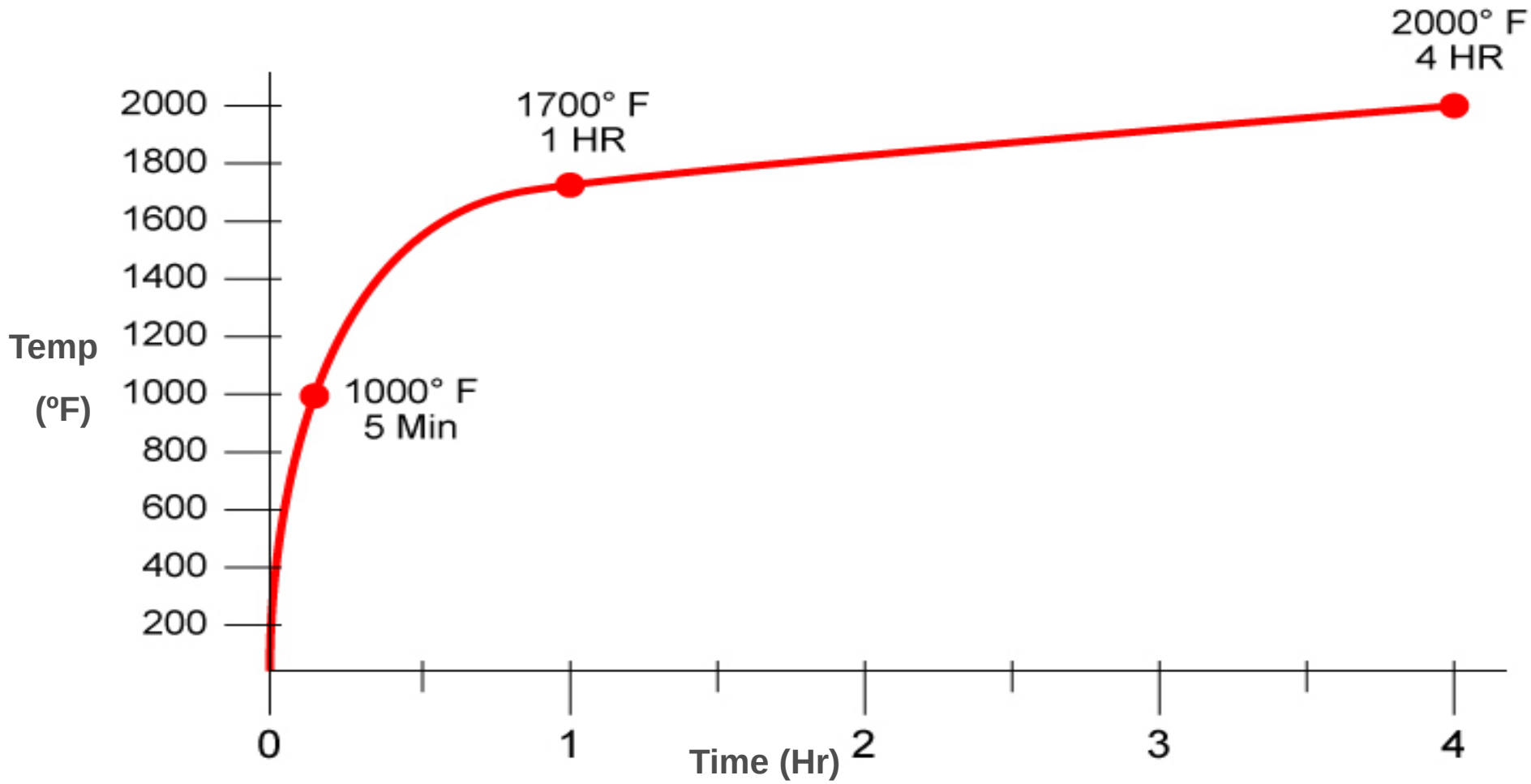
- Raceway run from the unexposed side through a protected penetration in the vertical or horizontal barrier, then horizontally min 60 in. along the exposed side of the barrier, and then back through another protected penetration to the unexposed side



Testing Parameters Cont.

- No 8 bare copper conductor attached to cable tray
- Cable tray, conduit and No. 8 bare copper conductor thermocoupled prior to installation of protective barrier
- Raceway protected with enclosure system per manufacturer’s installation instructions
- Fire exposure test conducted using same time-temperature curve as used for the basic barrier or firestop systems

Time-Temperature Curve



Testing Parameters Cont.

- Hose stream tested conducted in a similar manner as for the basic barrier or for firestop systems

Hose Stream Test

Testing Parameters Cont.

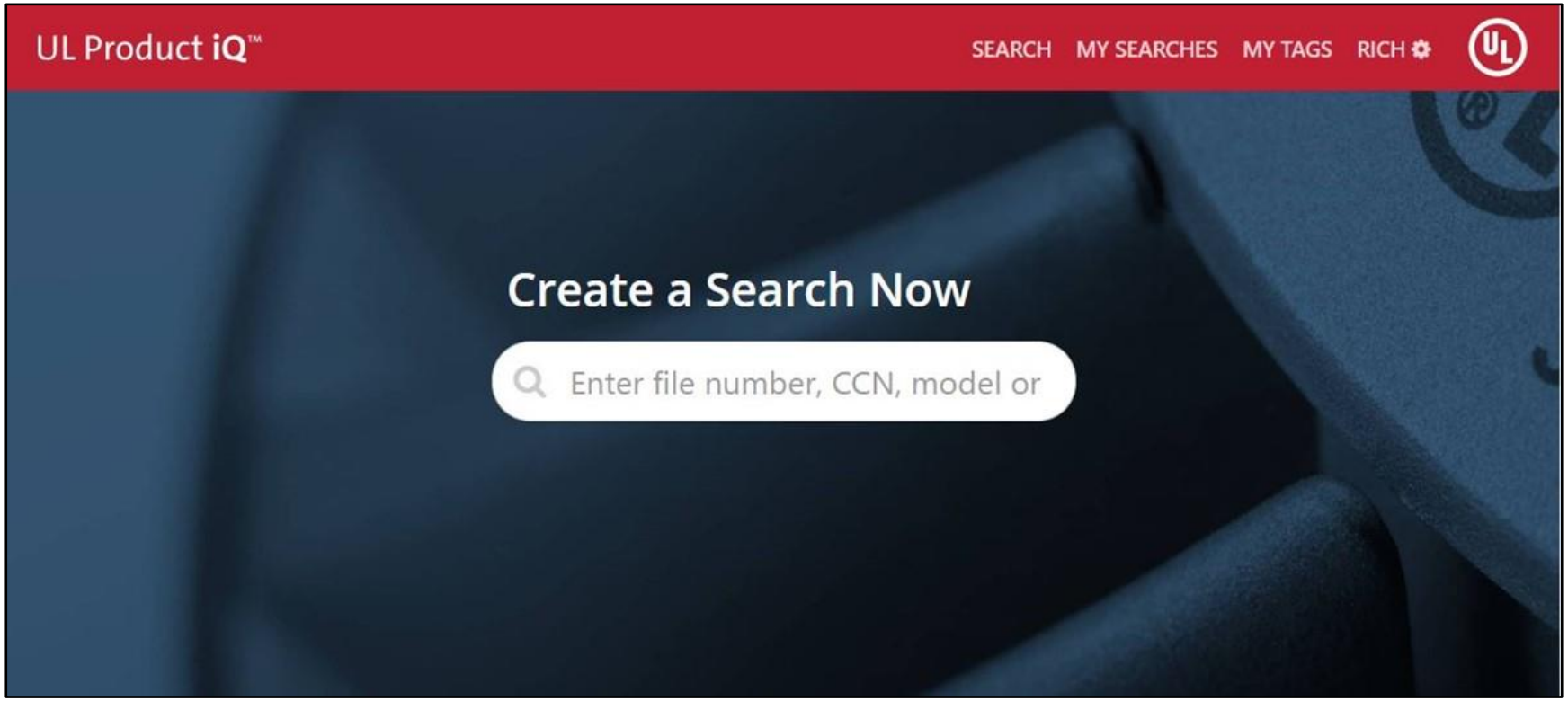
- Rating established base on time of occurrence of either of the following Conditions of Acceptance:
  - The average temperature of any set of thermocouples for the electrical system component is raised more than 250°F (139°C) above the initial temperature, or
  - The temperature of any one thermocouple of the set for each electrical system component is raised more than 325°F (181°C) above the initial temperature

Publication of UL Listings

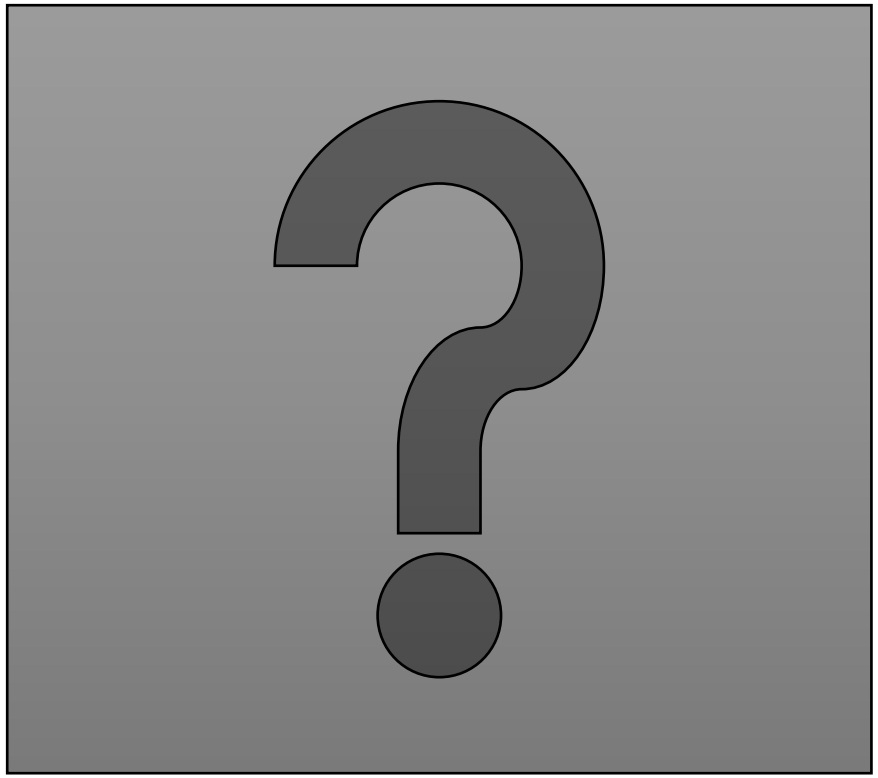
- Cable trays and conduit tested within an enclosure are published by UL as an “Electrical Circuit Integrity System” (FHIT)
- Unless proprietary cables are evaluated within enclosure, the system is intended for use with any cables within the tested raceway
- System includes the details on the raceway, raceway orientation and support, construction of the enclosure system, and hourly fire rating achieved

Where Can I Find The Most Current Listings?

UL Product iQ on www.ul.com



Questions??



Thanks for Attending!!!

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