

Fire Alarm Pathway Survivability – The Healthcare Perspective

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Jensen Hughes

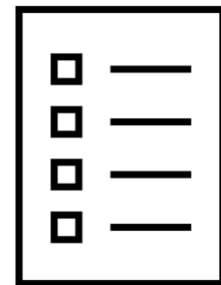
40th Annual FPC Seminar + Expo

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Pathway Survivability – A Healthcare Perspective

Agenda

- + What is the Code history and current requirements of pathway survivability?
- + What fire alarm circuits must be survivable and how can this be accomplished?
- + What effect does product listing have on survivable cable?
- + How can a designer provide and an AHJ approve a survivable cable installation in a healthcare occupancy?



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What is Pathway Survivability?

The ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information **to remain operational during fire conditions.**



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Code Requirements for Pathway Survivability

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PERSPECTIVE

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CODE HISTORY

NFPA 72F-1985



Early Beginnings...

- ❖ “Attack by fire in a paging zone...shall not result in loss of communications to any other paging zone.”
- ❖ Constant Changes to NFPA 72:
 1. 1993 – Combined requirements; same principle
 2. 1996 – First allowance of 2-hour rated cable
 3. 1999 – Section rewrite
 4. 2002 – Tone, Voice, and Visual circuits must comply
 5. 2007 – Dependent / Remote FACU Equipment
 6. 2010 – Wholesale Changes; New Chapter 12 & 24
 7. 2016 – Exceptions based on rated construction
 8. 2019 – Minor changes
 9. **2022 – New Level 4; Significant changes to exceptions**

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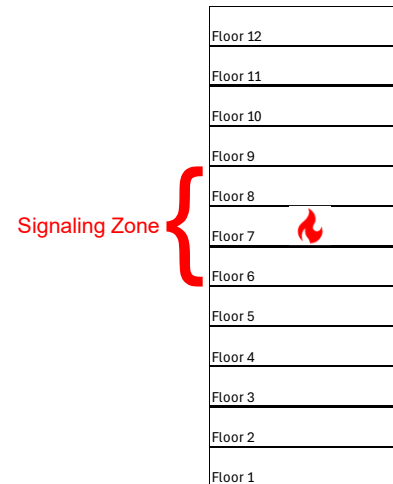
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CODE TERMINOLOGY

Important Definitions:

Notification Zone: A discrete area of a building [bounded by building outer walls, fire or smoke compartment boundaries, floor separations, or other fire safety subdivisions - 2016 Edition] in which people are intended to receive common notification. (NFPA 72-2019)

Signaling Zone: An area consisting of one or more notification zones where identical signals are activated simultaneously. (NFPA 72-2019)



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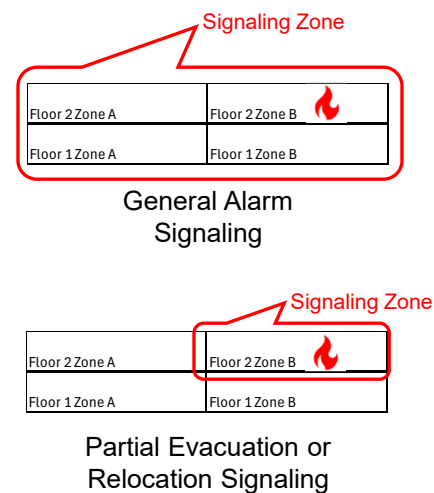
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Chapter 12: Circuits and Pathways

❖ Defined Pathway Survivability Levels:

Required Performance Criteria	Pathway Survivability			
	Level 0 (12.4.1)	Level 1 (12.4.2)	Level 2 (12.4.3)	Level 3 (12.4.4)
Per NFPA 72 sections 12.2.3.3 and 12.4, all pathways to comply with NFPA 70 applicable requirements	YES	YES	YES	YES
Wiring methods permitted are installed in accordance with manufacturer's published instructions (12.2.3.3)	YES	YES	YES	YES
Building is fully protected by an automatic sprinkler system in accordance with NFPA 13		YES		YES
Any interconnecting conductors, cables, or other physical pathways protected by metal raceways or metal armored cables		YES		
One or more of the following: (1) 2-hour fire-rated circuit integrity (CI) or fire-resistive cable (2) 2-hour fire-rated cable system [electrical circuit protective system(s)] (3) 2-hour fire-rated enclosure or protected area (4) Performance alternative approved by the AHJ			YES	YES



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CODE HISTORY

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Chapter 23: Protected Premises Systems

❖ Using Non-Voice **Tone-Based** Systems:

- ❖ Requires: *"Fire alarm systems used for partial evacuation and relocation shall be designed and installed such that attack by fire within a notification zone shall not impair control and operation of the notification appliances outside that notification zone."*
- ❖ No specific pathway survivability level required.
- ❖ Requires "performance features" to "ensure survivability" to be submitted to the AHJ.
- ❖ Annex A suggested "acceptable" options:
 - ❖ Fully sprinklered building
 - ❖ Routing notification appliance circuits separately
 - ❖ Using short-circuit fault-tolerant SLCs for control circuits

Relocation or Partial
Evacuation
Tone System

Survivability
"performance
features"
(NFPA 72-2019 23.10)

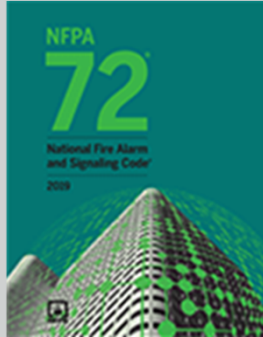
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Chapter 24: Emergency Communications Systems:

- ❖ General Alarm EVACS: Level 0, 1, 2, or 3
- ❖ Relocation or Partial Evacuation EVACS: Level 2 or 3 (with important Exceptions noted on the next slide!)
- ❖ In-Building MNS: Level 0 or greater per Risk Analysis
- ❖ Wide Area MNS: Level 0 or greater per Risk Analysis
- ❖ Two-way In-Building Wired ECS: Level 2 or 3
- ❖ Two-way Radio Communications Enhancement: **NO** Requirements in NFPA 72. All Requirements in NFPA 1221.
- ❖ Area of Refuge (Area of Rescue Assistance) Emergency Communications: Level 2 or 3, except off-premises communications
- ❖ Elevator Emergency Communications: Level 0, 1, 2, or 3
- ❖ Other ECS: Determined by Risk Analysis

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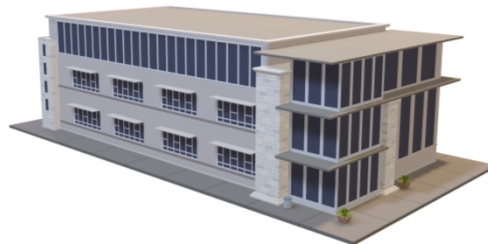
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Chapter 24: Emergency Communications Systems

- ❖ Relocation or Partial Evacuation EVACS: Level 2 or 3
 - ❖ Level 1 allowed where notification zones are separated by less than 2-hour fire-rated construction.
 - ❖ Level 1 allowed where Class X or N pathways are separated by at least one-third the maximum diagonal of the notification zone



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Class X or N Separation

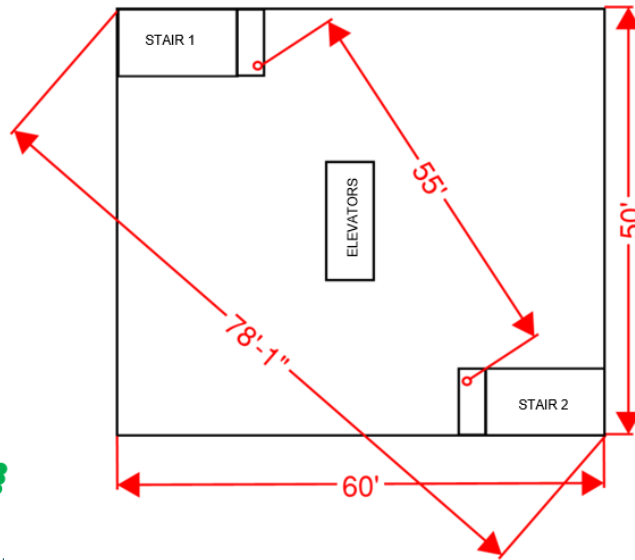
What does it really mean?

Level 1, 2, or 3
Pathway Survivability
for Class X or N Wiring
with 1/3 Diagonal
Separation
(NFPA 72-2019
24.3.14.4.1.2)

1/3 Diagonal:

78 ft. x 0.33 = 25.7 ft.

Separation = 55 ft.



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Class X or N Separation

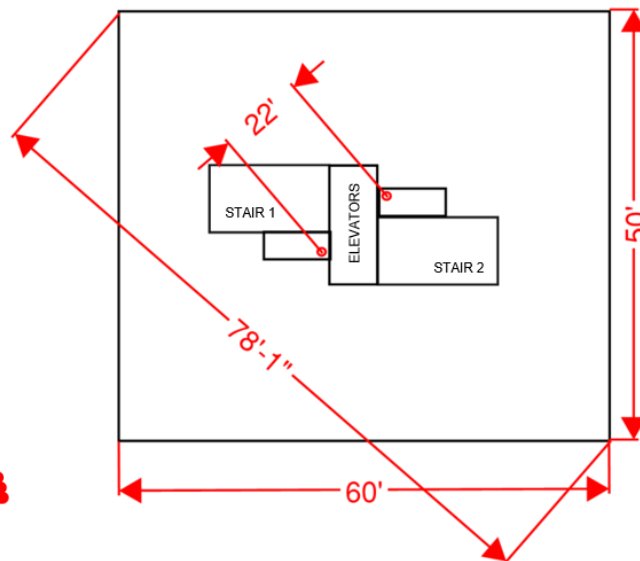
What does it really mean?

Level 1, 2, or 3
Pathway Survivability
for Class X or N Wiring
with 1/3 Diagonal
Separation
(NFPA 72-2019
24.3.14.4.1.2)

1/3 Diagonal:

78 ft. x 0.33 = 25.7 ft.

Separation = 22 ft.



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Chapter 24: Emergency Communications Systems:

- ❖ Relocation or Partial Evacuation – *What Circuits?*:
 - ❖ Audible (tone and voice) and visual notification appliance circuits
 - ❖ Loudspeakers and Strobes
 - ❖ All circuits necessary for the operation of the notification appliances
- ❖ Circuits between dependent control equipment
- ❖ Where control equipment is separated and where circuits are run through junction boxes, terminal cabinets or control equipment, and where cable integrity is not maintained, these components must be protected in 2-hour fire rated enclosure, room, or equivalent.

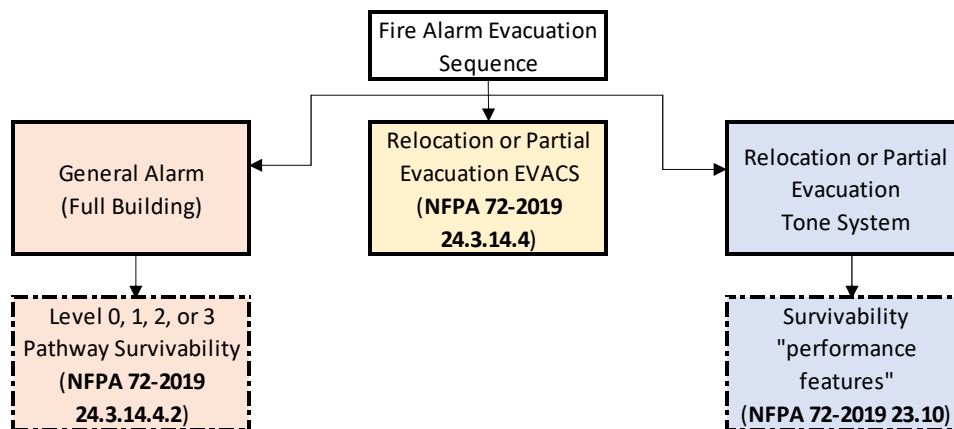


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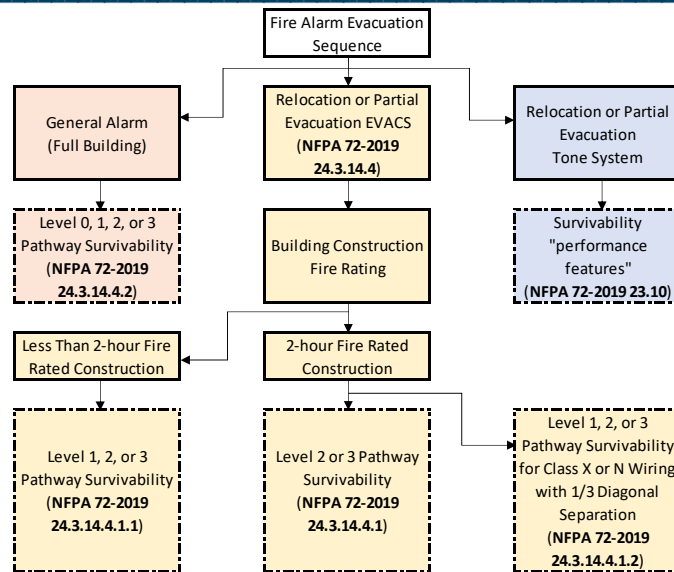


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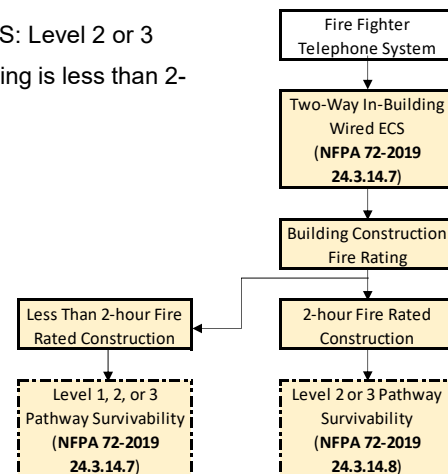
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Chapter 24: Emergency Communications Systems

- ❖ Two-way In-Building Wired ECS: Level 2 or 3
- ❖ Level 1 allowed where building is less than 2-hour fire rated construction.



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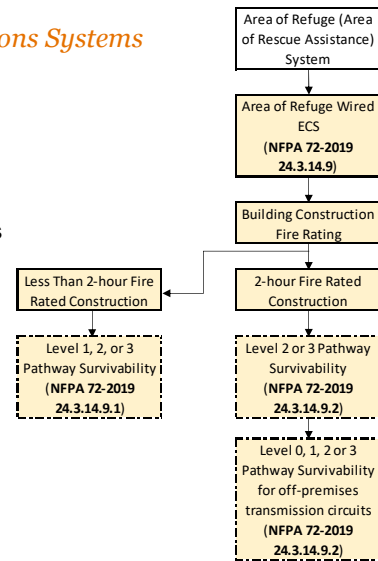
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Chapter 24: Emergency Communications Systems

- ❖ Area of Refuge (Area of Rescue Assistance) Emergency Communications: Level 2 or 3, except off-premises communications
- ❖ Level 1 allowed where building is less than 2-hour fire rated construction.



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Product Listings of Survivable Cable

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PRODUCT LISTINGS

UL 2196

❖ Circuit Integrity (CI) Cable is listed to **ANSI/UL 2196 Standard for Tests for Fire Resistive Cables**

❖ Standard was issued on May 11, 2001 with Revisions issued:

- ❖ March 25, 2004
- ❖ December 7, 2006
- ❖ March 30, 2012

❖ Referenced Standards:

- ❖ UL 1424 Standard for Cables for Power-Limited Fire-Alarm Circuits
- ❖ UL 1425 Standard for Cables for Non-Power-Limited Fire-Alarm Circuits
- ❖ UL 1724 Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems



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PRODUCT LISTINGS

UL 2196

Products fall into two categories:

- ❖ Fire-Resistive Cable (FHJR)
- ❖ Electric Circuit Integrity Systems (FHIT)

Cable and System must survive a fire test of approximately 1,800°F (982°C) for 2 hours and a hose stream test, and still remain intact and the circuit operational.

Depending on Listing, cable may be installed in "free air" or "in conduit".



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PRODUCT LISTINGS

The Situation Now...

- ❖ Several products are listed for fire alarm CI use
- ❖ At least two different manufacturers
- ❖ Both Conduit and Free Air models are available
- ❖ Cables are Listed with system components like conduit, enclosures, supports, pulling lubricant, etc.

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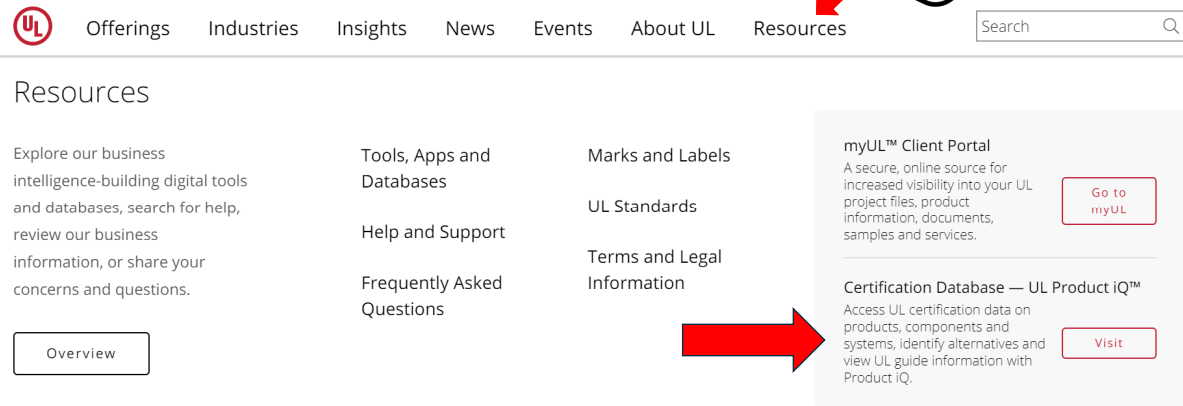
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PRODUCT LISTINGS

How to Find a Product's Listing Information from UL:

Go to UL.com and click on the "Resources" tab at the top.
Look for the UL Product iQ™ link.



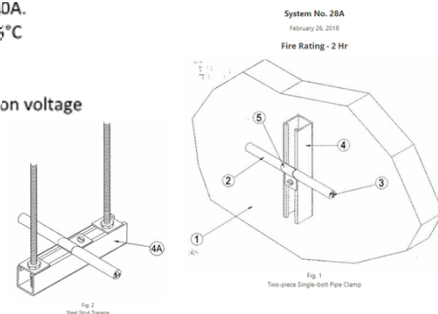
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PRODUCT LISTINGS

The Listing now results in a "system" that must be installed to exacting standards!

Compliance:

- NEC type FPLR-CI-LS, CMR-CI-LS & PLTC-CI-LS for use in Electrical Circuit Integrity System FHIT 40A
- C(UL) listed CMR-LS
- CEC and CSA listed FAS 90 to C22.2 No. 208-14
- UL Certified to ANSI/UL 2196 2-Hour fire rating for use in FHIT system 40A. **(See UL Fire Resistance Directory (R27557))**
- CAN/ULC-S139 Certified with Hose Stream Test for use in FHITC system 40A.
- UL 1424 Listed FPLR-CI-LS for Power-Limited Fire Alarm Cables; 300V / 105°C
- UL 13 Listed PLTC-CI-LS for Power-Limited Circuit Cables; 300V / 105°C
- UL 444 Listed CMR-CI-LS for Communication Cable; 300V / 105°C
- Fire certified for power-limited system use at 72V phase-to-phase utilization voltage
- Sunlight Resistant
- For use in Wet Locations
- NYC Electrical Advisory Board approval #54502, April 2017
- California State Fire Marshal Approved



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*Pathway Survivability in
Healthcare Environments*PATHWAY SURVIVABILITY – A HEALTHCARE
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HEALTHCARE ENVIRONMENTS

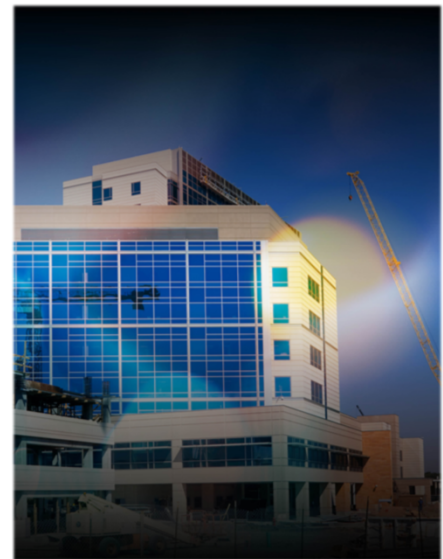
Emergency Communications is Critical in Healthcare

❖ Larger Facilities are Better Defined

- ❖ Coordinated Smoke/Fire Zones
- ❖ Defined Emergency Response Plans
- ❖ Use of Building Construction



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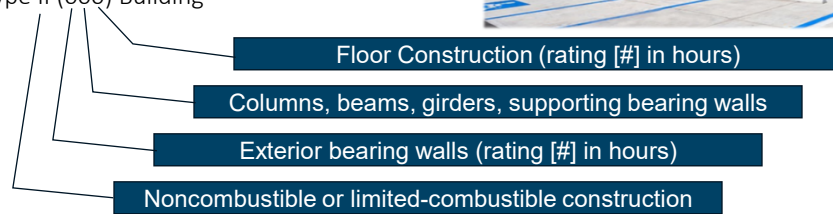
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HEALTHCARE ENVIRONMENTS

Smaller Facilities Can Be Challenging

❖ Free-Standing Emergency Departments / Surgery Centers

- ❖ Two Smoke Compartments
- ❖ Type II (000) Building



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HEALTHCARE ENVIRONMENTS

Smaller Facilities Can Be Challenging

❖ Use of Fire Alarm EVACS

- ❖ Comply with NFPA 72® Chapter 24

❖ Partial Evacuation = Pathway Survivability

- ❖ § 24.3.14.4.1 – Level 2 or 3, unless:
- ❖ § 24.3.14.4.1.1 – Notification zones separated by less than 2-hour fire-rated construction = Level 1 allowed.

❖ All fire alarm notification circuits in metal raceway and fully sprinklered building



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HEALTHCARE ENVIRONMENTS

Smaller Facilities Can Be Challenging

- ❖ What about the FACU itself?
- ❖ Does § 24.4.8.6.6 apply?
 - ❖ 2-hour fire-rated enclosure or room?
 - ❖ Only applies where EVACS equipment is separated and dependent
- ❖ Can the AHJ require Level 2 Survivability and a 2-hour fire-rated room?



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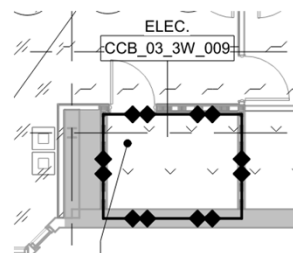
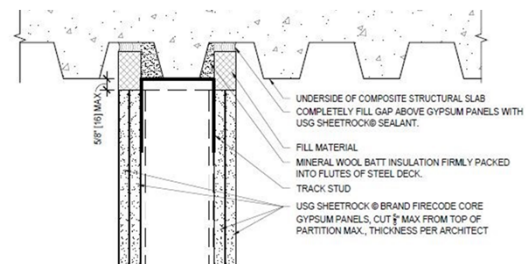
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HEALTHCARE ENVIRONMENTS

Smaller Facilities Can Be Challenging

- ❖ 2-Hour fire-rated room?
- ❖ How is this created in a Type II(000) building?
- ❖ Is a 2-hour fire-rated room enough?
- ❖ Need to protect the FACU from other building equipment?



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CODE – FUTURE REQUIREMENTS

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Chapter 12 Changes

❖ NEW: Level 4 Pathway Survivability

Required Performance Criteria	Pathway Survivability				
	Level 0 (12.4.1)	Level 1 (12.4.2)	Level 2 (12.4.3)	Level 3 (12.4.4)	Level 4 (12.4.5)
Per NFPA 72 sections 12.2.3.3 and 12.4, all pathways to comply with NFPA 70 applicable requirements	YES	YES	YES	YES	YES
Wiring methods permitted are installed in accordance with manufacturer's published instructions (12.2.3.3)	YES	YES	YES	YES	YES
Building is fully protected by an automatic sprinkler system in accordance with NFPA 13		YES		YES	
Any interconnecting conductors, cables, or other physical pathways protected by metal raceways or metal armored cables		YES			
One or more of the following: (1) 1-hour fire-rated fire-resistive cable (2) 1-hour fire-rated cable system [electrical circuit protective system(s)] (3) 1-hour fire-rated enclosure or protected area (4) Performance alternative approved by the AHJ					YES
One or more of the following: (1) 2-hour fire-rated circuit integrity (CI) or fire-resistive cable (2) 2-hour fire-rated cable system [electrical circuit protective system(s)] (3) 2-hour fire-rated enclosure or protected area (4) Performance alternative approved by the AHJ			YES	YES	

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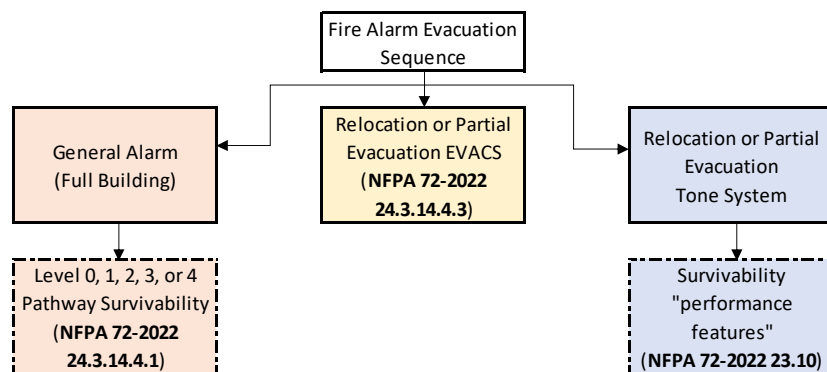
CODE – FUTURE REQUIREMENTS

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Chapter 24 Requirements:

❖ Based on Evacuation Strategy:



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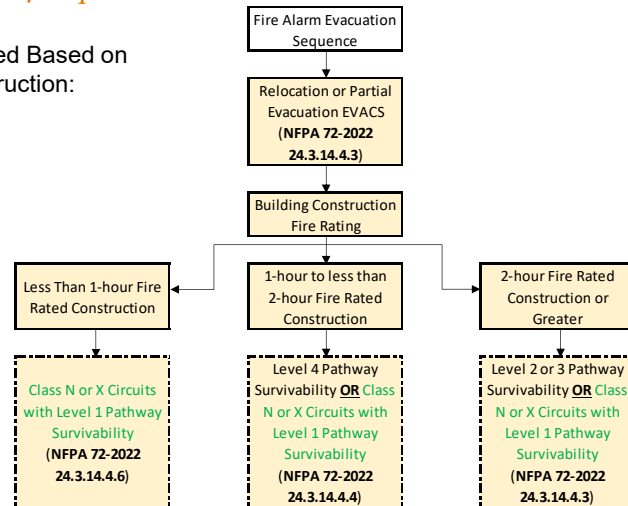
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Chapter 24 Requirements:

❖ Revised Based on Construction:



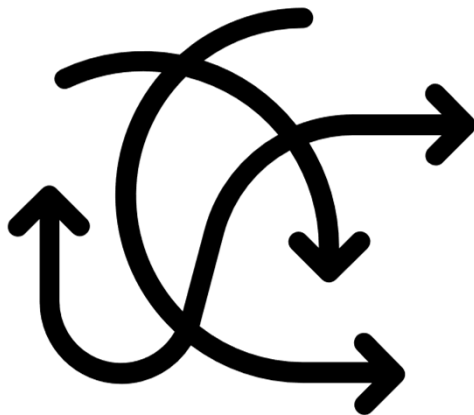
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PATHWAY SURVIVABILITY

What to do?



- + Know the Code
- + Understand Your System
- + Understand the Options Available
- + Explain Thoroughly the Design
- + Inspect the Installation
- + Help the AHJ to Understand


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