Not your Father's Glazing: Understanding the Fire-Rated Glazing of Today

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June 14, 2017

Agenda

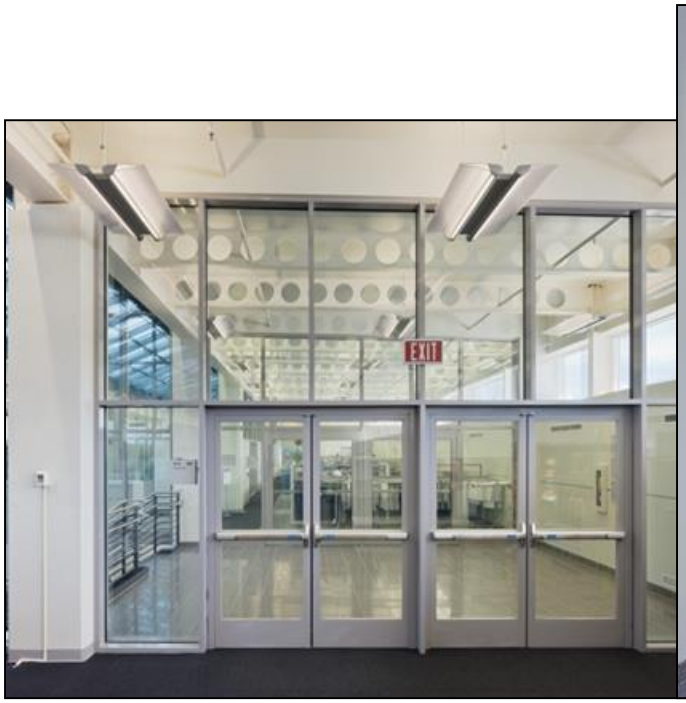
- Introductory Comments on Fire-rated Glazing
- Types of Fire-rated Glazing
- Fire Testing of Glazing Materials
- Code Requirements for Fire-rated Glazing
- Marking Requirements for Glazing
- Installation Standards

Agenda Cont.

- Where are Listings Found?
- UL's Online Resources
- Summary and Closing

Key Purposes of Fire-rated Glazing

- Allows visibility into a space
- Prevents spread of fire (compartmentation)



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Uses of Fire-rated Glazing

- As a fire-resistance-rated wall assembly
- Vision panels in fire rated door assemblies
- Transom and sidelight panels used adjacent to fire doors
- Fire window assemblies

What Type of Glazing is Required?

- The type of glazing required for each of these applications is based on the following:
  - Type of barrier
  - Rating of barrier
  - Size of glazing panel
- The type of glazing required is found in the International Building Code and the Life Safety Code

Types of Fire-rated Glazing

- Fire-rated glazing
  - Fire-resistance-rated glazing
    - Fire-resistance-rated glazing used in walls
    - Fire-resistance-rated glazing used in walls and fire door applications
  - Fire-protection-rated glazing
    - Fire-protection-rated glazing w/o hose stream
    - Fire-protection-rated meeting hose stream requirements
    - Fire-protection-rated meeting hose steam and temperature requirement

Key Attributes for Fire and Human Impact Safety

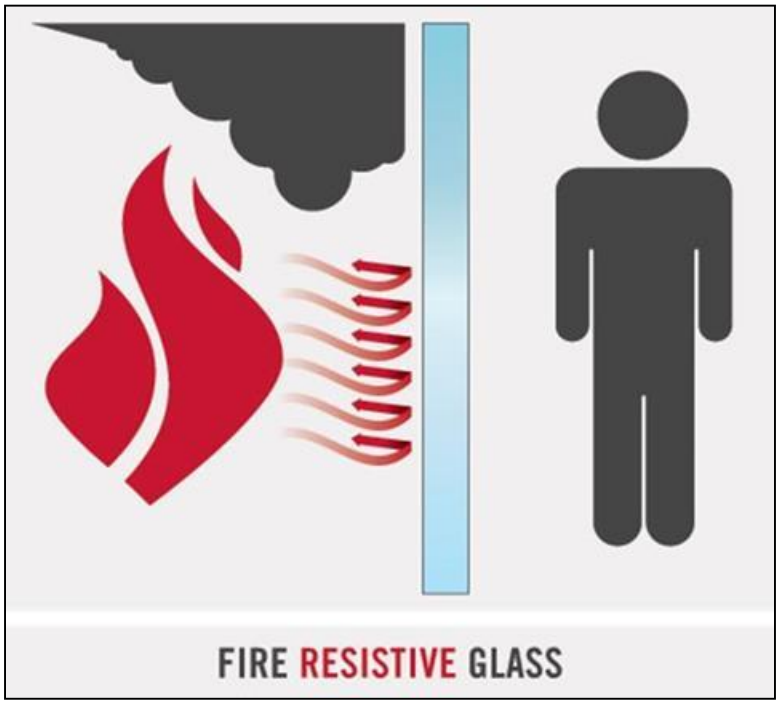
- **Fire Test** - Measures the amount of time, in minutes or hours, that fire-rated glazing and framing can withstand fire exposure in a furnace
- **Hose Stream Test** - Heated glass and frames are subjected to water from a hose stream. The cooling, impact and erosion created by the hose stream evaluates the structural integrity of the glazing and frame

Key Attributes for Fire and Human Impact Safety Cont.

- **Impact Safety Test** - Measures the ability of glass to withstand impact. Ratings are given in levels based on the amount of force the glass can resist. Typically defined by CPSC Category 1 or 2 rating.

Fire-resistance-rated Glazing

- “Thick” glazing
- Stops fire **AND** radiant heat
- Classified as a “wall” rather than an opening (window)
- Meets same requirements as a gypsum or CMU wall
- When use in walls, both glass and frame must block passage of heat



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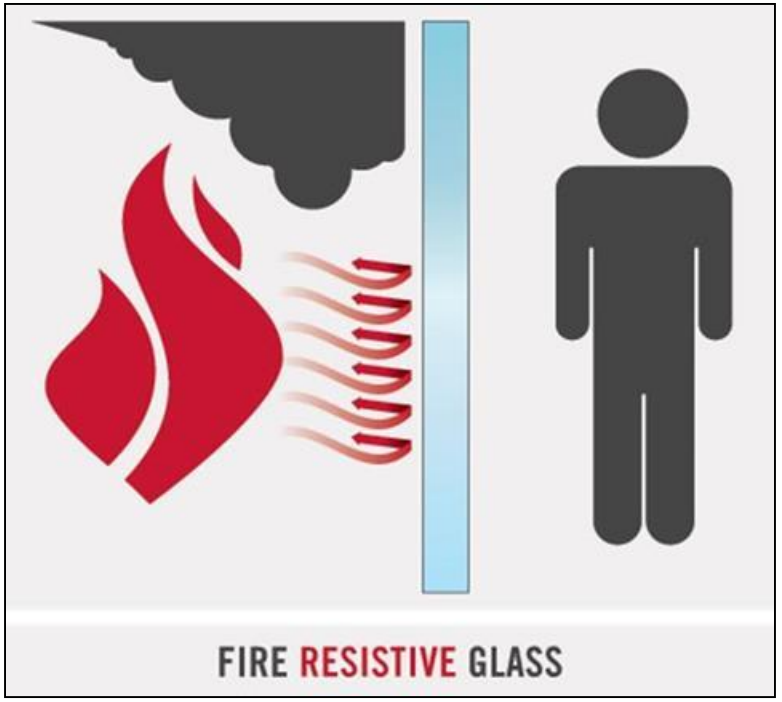
Fire-resistance-rated Glazing Cont.

- May be used in multi story spans or floor to ceiling sizes, but may not exceed manufacturers tested size
- When used in doors, must also meet requirements of hose stream after full fire exposure



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Standards
Fire-resistance-rated Glazing

- When used as a wall
  - UL 263 / ASTM E119
- When used as vision panel in doors
  - UL 263 / ASTM E119,
  - UL 10B / UL 10C / NFPA 257, and
  - In 2012 and later codes, glazing in excess of 100 sq in. in doors in interior exit stairways, ramps and exit passageways is required to be fire-resistance-rated and shall have a max temperature rise of 450ºF for 30 minutes

Conditions of Acceptance
UL 263 / ASTM E119

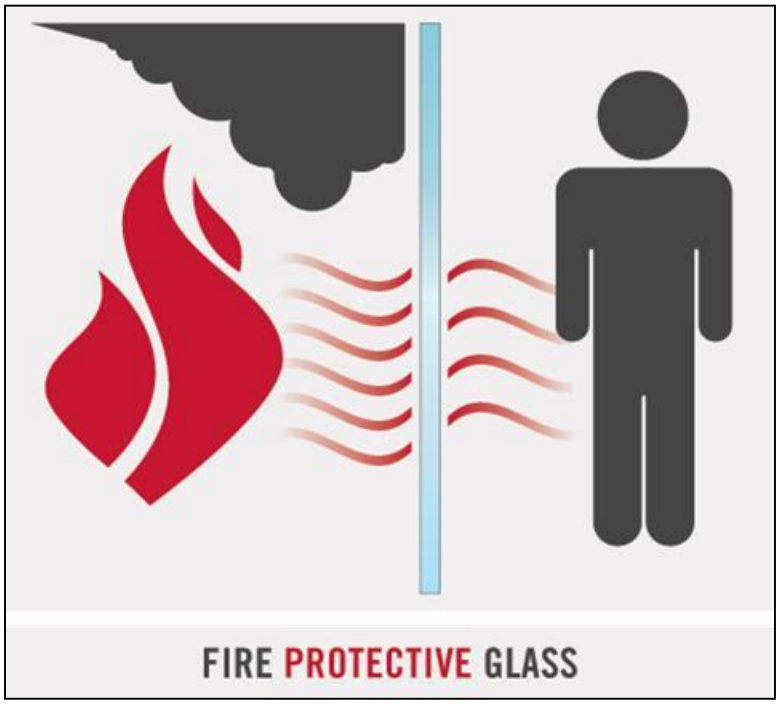
- Flame Passage
- 250ºF / 325ºF Temperature Rise
- Hose Stream on Duplicate Test Sample Exposed to Fire for Reduced Time Frame

Conditions of Acceptance
UL 10B / UL 10C / NFPA 257

- Flame Passage
- Hose Stream after Full Duration Fire Exposure
  - Limited Openings (Max 5% Fall-Out) Permitted

Fire-protection-rated Glazing

- Fire-rated, thin glazing
- Traditional fire-rated material (wired glass, proprietary glass, etc.)
  - Traditional wired glass does not meet safety glazing requirements
- Allows significant radiant heat from unexposed side
- May or may not meet hose stream and temperature requirements



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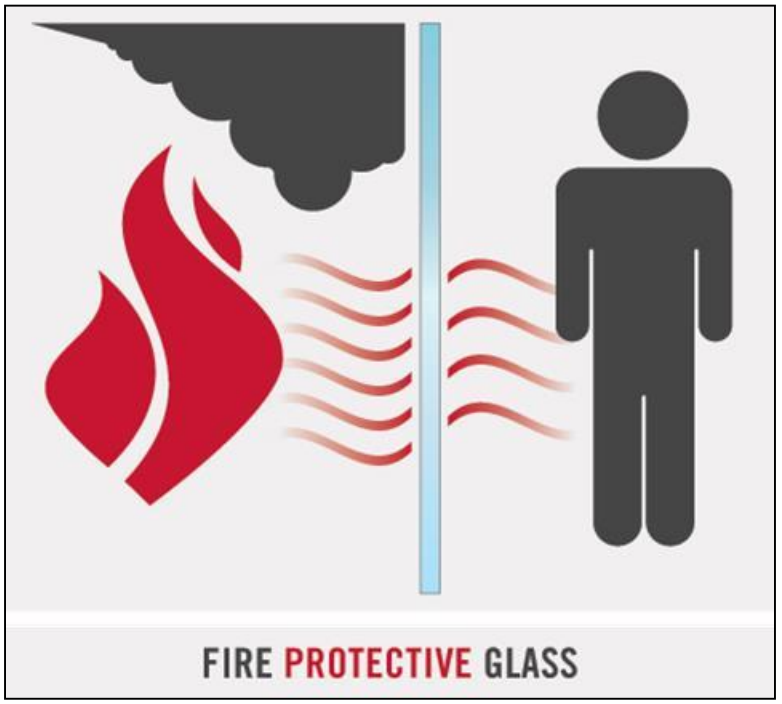
Fire-protection-rated Glazing Cont.

- Used as Opening Protectives
  - Fire Windows: 20 to 90 minutes
  - Fire Doors: 20 minutes to 3 hrs
  - May not exceed 25% of the area of a fire-resistance-rated wall
- Size shall comply with IBC and NFPA 80, and may not exceed manufacturers tested sizes



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Standards
Fire-protection-rated Glazing

- Glazing used in fire door assemblies
  - UL 10C / NFPA 252 (side hinged or swinging fire door assemblies)
  - UL 10B / NFPA 252 (all other types of fire door assemblies)
  - In 2009 and earlier codes, fire-protection-rated glazing in excess of 100 sq in. in doors in exit enclosures and exit passageways was required to have a max temperature rise of 450ºF for 30 minutes

Standards
Fire-protection-rated Glazing Cont.

- In 2012 and later codes, fire-protection-rated glazing in excess of 100 sq in. in doors in exit enclosures and exit passageways is not permitted
- Glazing used in fire window assemblies
  - UL 9 / NFPA 257

Conditions of Acceptance
UL 10C / UL 10B / NFPA 252

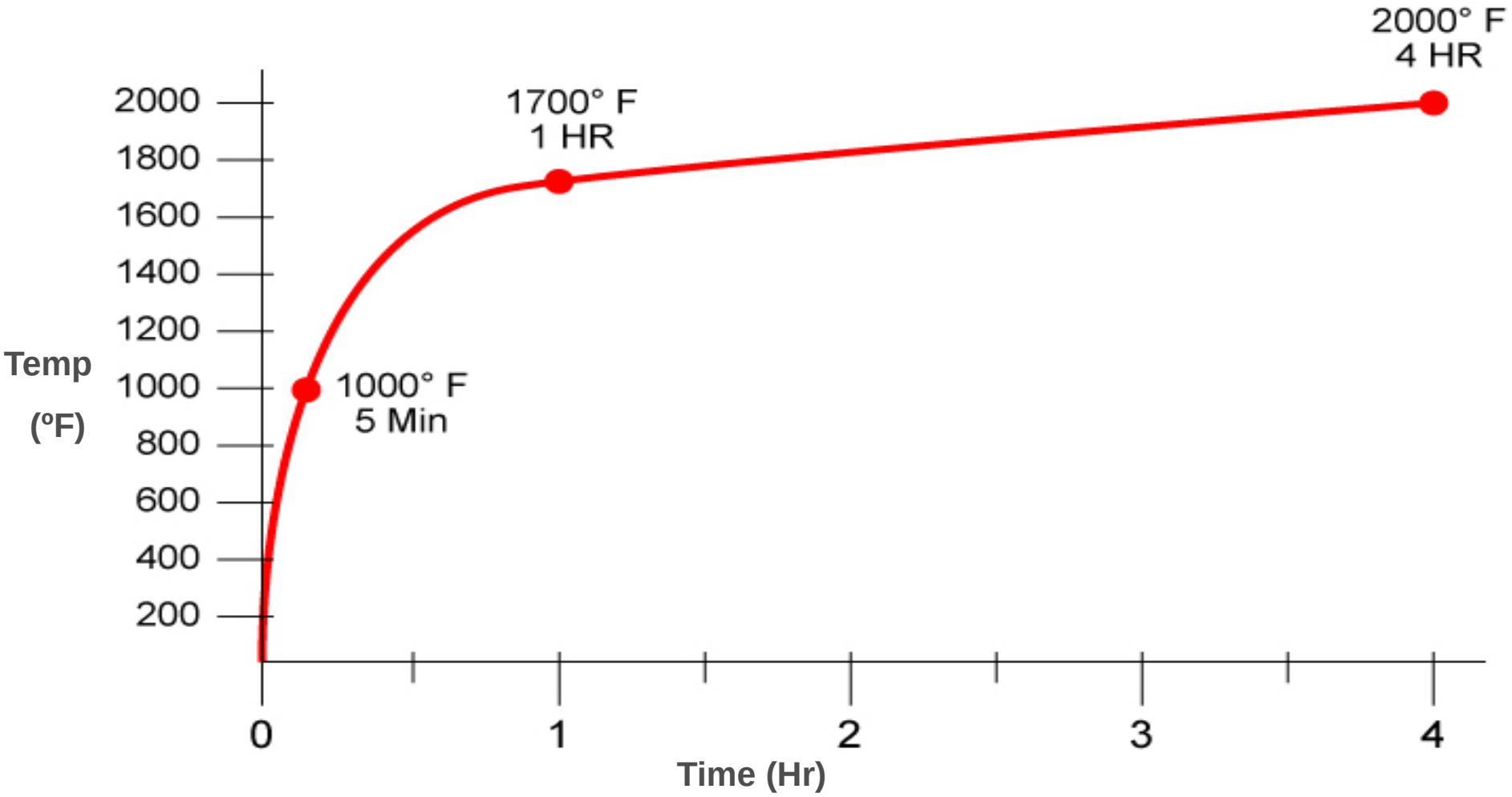
- Flame Passage
- Hose Stream after Full Duration Fire Exposure
  - Limited Openings (Max 5% Fall-Out) Permitted
  - When used in some 20 min fire door applications, the code waives the requirement for the hose stream test

Conditions of Acceptance
UL 9 / NFPA 257

- Flame Passage
- Hose Stream after Full Duration Fire Exposure
  - Limited Openings (Max 5% Fall-Out) Permitted

Fire Testing of Glazing Materials
Fire Door Assembly Ready for Testing

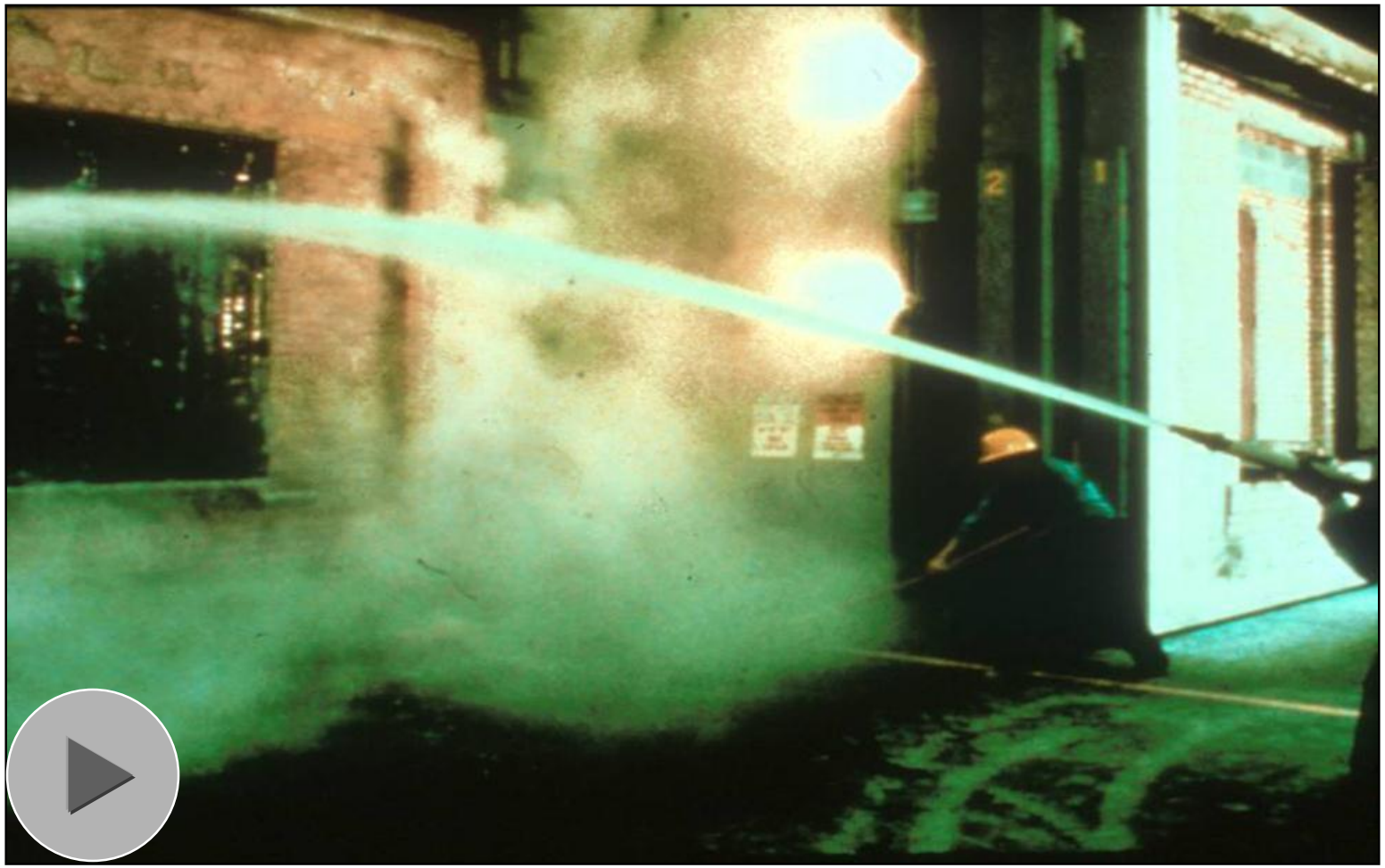
Time - Temperature Curve



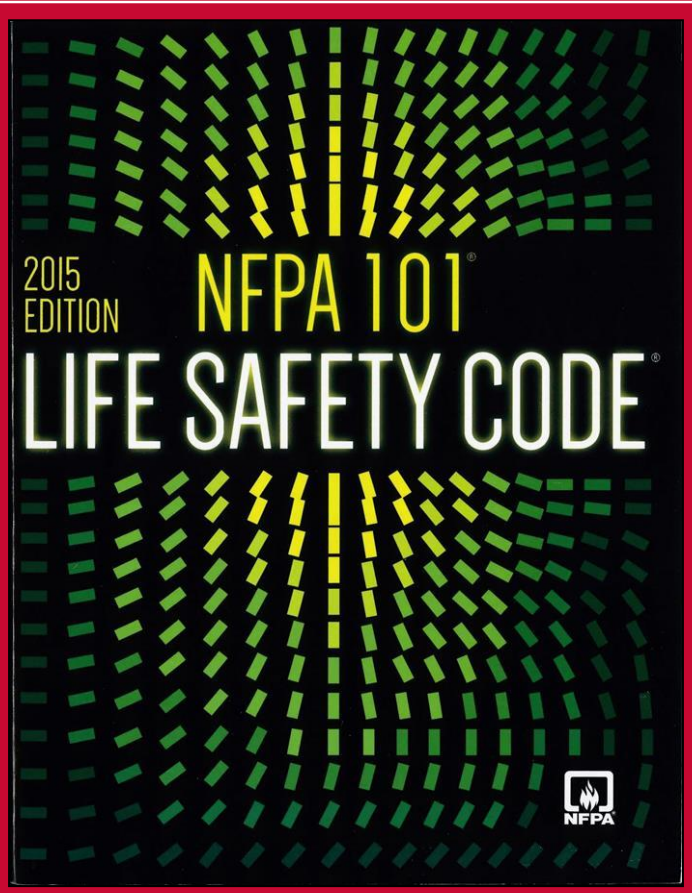
Fire Door / Fire Window Assemblies Under Test

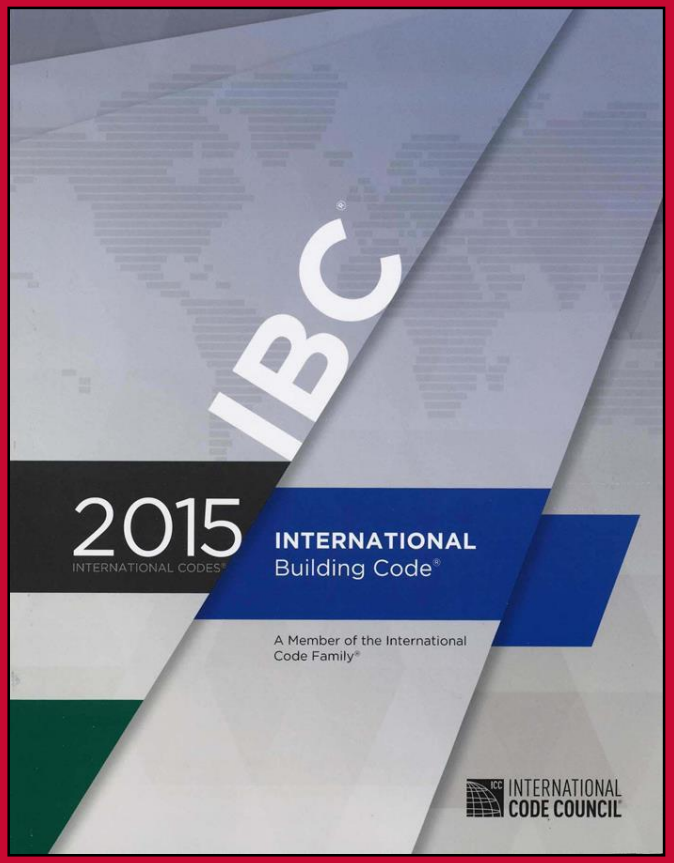
Fire Door Assemblies with Glazing Under Test

Hose Stream Test



Code Requirements for Fire-Rated Glazing





Component Approach Used for Fire Door and Fire Window Assemblies

- Both documents prescribe a component approach for fire door and fire window openings
- IBC and NFPA 101 by referencing NFPA 80 require fire door components to be Listed and Labeled

Component Approach Used for Fire Door and Fire Window Assemblies

- Approval of the finished opening protective relies on Listing and ratings of individual components with final decision up to the Code Official

Glazing in Fire Doors

- Section 716.5 of the 2015 IBC
- 716.5.1 – Side-hinged or pivoted swinging doors shall be tested to UL 10C or NFPA 252
- 716.5.2 – Other types of doors shall be tested to UL 10B or NFPA 252
- Table 716.5 – Establishes requirements for rating on door based on required vertical assembly rating

TABLE 716.5 OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL[e]	MINIMUM SIDELIGHT/ TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4	3	Not Permitted	Not Permitted	Not Permitted	4	Not Permitted	W-240
	3	3[a]	Not Permitted	Not Permitted	Not Permitted	3	Not Permitted	W-180
	2	$1^1/_2$	100 sq. in.[c]	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
	$1^1/_2$	$1^1/_2$	100 sq. in.[c]	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	$1^1/_2$	Not Permitted	W-90
Shaft, exit enclosures and exit passageway walls	2	$1^1/_2$	100 sq. in.[c, d]	≤100 sq.in. = D-H-90 > 100 sq.in.= D-H-T-or D-H-T-W-90	Not Permitted	2	Not Permitted	W-120
Fire barriers having a required fire-resistance rating of 1 hour: Enclosures for shafts, exit access stairways, exit access ramps, interior exit stairways, interior exit ramps and exit passageway walls	1	1	100 sq. in.[c, d]	≤100 sq.in. = D-H-60 >100 sq.in.= D-H-T-60 or D-H-T-W-60	Not Permitted	1	Not Permitted	W-60

Glazing in Fire Doors Cont.

- 716.5.8.3 - Glazing in fire doors shall be labeled
- 716.5.8.4 - Glazing in and around fire doors must meet safety glazing criteria
  - Wired glass not permitted in or around fire doors

Glazing in Fire Windows

- Section 716.6 of the 2015 IBC
- 716.6.1 – Fire-protection-rated glazing tested to positive pressure UL 9 or NFPA 257 test. Must meet fire and full duration hose stream requirements.
- 716.6.4 – Glazing in and around fire windows must meet safety glazing criteria
  - Wired glass not permitted in or around fire doors

Glazing in Fire Windows Cont.

- 716.6.4 – Maximum size of fire-protection-rated glazing shall comply with NFPA 80
- 716.6.8 – Glazing shall be labeled

History Behind Wired Glass

- 2003 and earlier editions of IBC required glazing in areas subject to human impact in hazardous locations to meet safety glazing requirements
- 2406.1.1 – All glazing in hazardous location shall comply with CPSC 16 CFR 1201
  - Exception: Wired glass in fire doors and fire windows complying with ANSI Z97.1

History Behind Wired Glass Cont.

- Nominal ¼ in. wired glass does not comply with CPSC, but does comply with ANSI Z97.1. As such, it was permitted.
- Exception relating to ANSI Z97.1 removed from 2006 edition of IBC. As such, nominal 1/4 in. wired glass no longer complies.

Fire-resistance-rated Glazing

- Fire-resistance-rated glazing may be utilized where
  - Required size of glazing exceeds code allowance
  - Code does not permit openings protected with fire-protection-rated glazing

Marking Requirements for Fire-rated Glazing

Without some identification, how does one distinguish the various types of glazing?

You can Not!!!

Marking Requirements for Glazing

- Code required marking provides an easy method to confirm code compliance both at time of installation and during annual inspections

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Marking Requirements for Glazing Cont.

- 2006 and later codes contain requirements for marking glazing with respect to its fire performance
- Requirement in 2012 IBC have changed
- 2012 and newer requirements define marking required for each code application of glazing

2015 IBC Marking Requirements for Glazing

TABLE 716.3 MARKING FIRE-RATED GLAZING ASSEMBLIES

FIRE TEST STANDARD	MARKING	DEFINITION OF MARKING
ASTM E 119 or UL 263	W	Meets wall assembly criteria.
NFPA 257 or UL 9	OH	Meets fire window assembly criteria including the hose stream test.
NFPA 252 or UL 10B or UL 10C	D H T	Meets fire door assembly criteria. Meets fire door assembly "Hose Stream" test. Meets 450ºF temperature rise criteria for 30 minutes
	XXX	The time in minutes of the fire resistance or fire protection rating of the glazing assembly

•Note: 450˚ F = 250˚ C

2015 IBC Marking Requirements for Glazing Cont.

- For fire-protection-rated glazing used in Fire Door Assemblies, glazing marked: D – H – XXX, where:
  - D indicates glazing meets the door assembly criteria
  - H indicates the glazing has been subjected to hose stream test
  - XXX indicates fire-protection rating in minutes

2009 IBC Marking Requirements for Glazing Cont.

- For fire-protection-rated glazing used in Fire Door Assemblies, glazing marked: D – H or NH – T or NT – XXX, where:
  - D indicates glazing meets the door assembly criteria
  - H or NH indicates if glazing has been subjected to hose stream test or not
  - T or NT indicates if glazing meets 450ºF temperature rise for 30 minutes or not
  - XXX indicates fire-protection rating in minutes

2015 IBC Marking Requirements for Glazing Cont.

- For fire-resistance-rated glazing used in Fire Door Assemblies, glazing marked: D – H – T – W-XXX, where:
  - D indicates glazing meets the door assembly criteria
  - H indicates the glazing has been subjected to hose stream test
  - T indicates the glazing meets 450ºF temperature rise
  - W indicates the glazing meets the wall assembly criteria
  - XXX indicates fire-protection rating in minutes

2015 IBC Marking Requirements for Glazing Cont.

- For glazing used in Fire Window Assemblies, glazing marked: OH – XXX, where:
  - OH indicates glazing indicates glazing meets the fire window criteria including the hose stream test
  - XXX indicates fire-protection rating in minutes

2015 IBC Marking Requirements for Glazing Cont.

- For fire-resistance-rated glazing used as a wall, glazing marked: W – XXX, where:
  - W indicates glazing meets the wall assembly criteria
  - XXX indicates fire-resistance rating in minutes

Installation Standards

Both the IBC and the NFPA Life Safety Code reference NFPA 80, Standard for Fire Doors and other Opening Protectives, and NFPA 105, Standard for Smoke Door Assemblies and Other Opening Protectives

NFPA 80 - Scope

- This standard regulates the installation and maintenance of assemblies and devices used to protect openings:
  - in walls,
  - in floors,
  - and in ceilings

“against the spread of fire and smoke”

NFPA 80 Requirements - General

- **4.2 Listed and Labeled Products**
  - **4.2.1** Listed items shall be labeled
  - **4.2.2** Labels shall be applied in locations that are visible
  - **4.2.4** Specification of items of a generic nature, such as hinges, that are not labeled shall comply with the specifications contained in this standard.

NFPA 80 Requirements - Glazing

- **4.4.1*** Only labeled fire-resistance-rated or fire-protection-rated glazing material shall be used in fire door assemblies when permitted by the door listing.
- **4.4.2** Fire-protection-rated glazing and fire-resistance-rated glazing shall meet all applicable impact safety standards.

NFPA 80 Requirements – Care and Maintenance Cont.

- **5.1.3 Replacement** When replaced, fire doors, shutters windows and component parts shall be replaced with components which meet the rating required for new installations.

NFPA 80 Requirements – Care and Maintenance Cont.

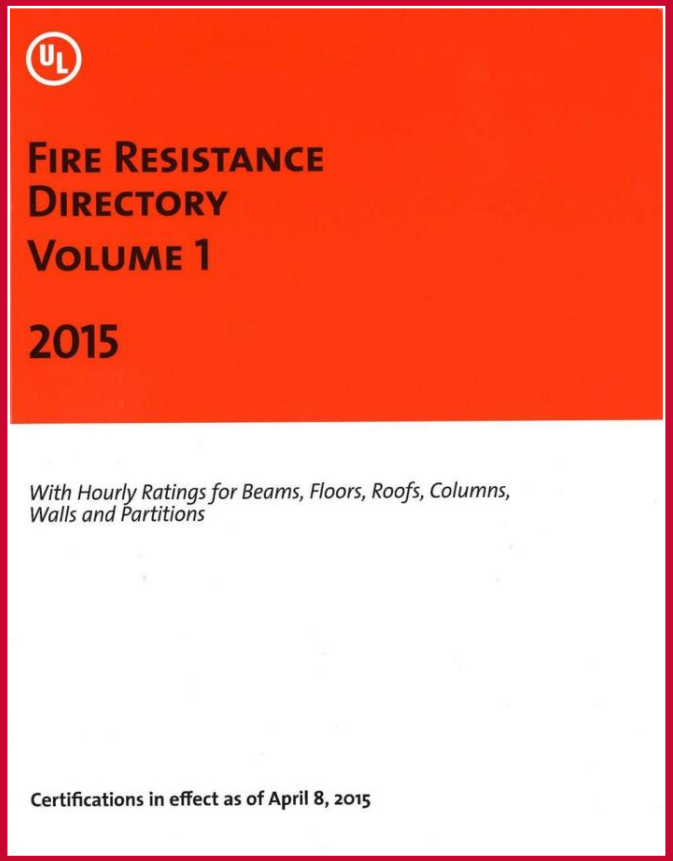
- **5.2.4 Periodic Inspection and Testing**
  - **5.2.4.1*** Periodic inspections and testing shall be performed not less than annually.
  - **5.2.4.2** Requires inspection to same criteria as original acceptance testing.

NFPA 80 Requirements – Care and Maintenance Cont.

- **5.5 Maintenance**
  - **5.5.1*** Repairs shall be made, and defects that could interfere with operation shall be corrected without delay.
  - **5.5.2** Damaged glazing material shall be replaced with labeled glazing.
  - **5.5.3** Replacement glazing materials shall be installed in accordance with their individual listing.

Where are Listings Found?

Hard Copy



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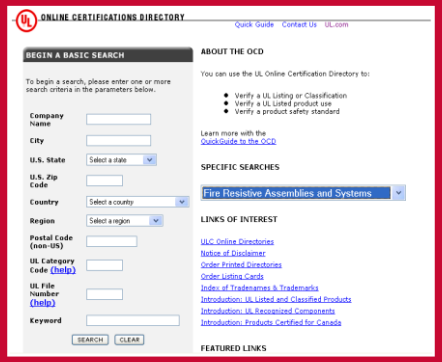
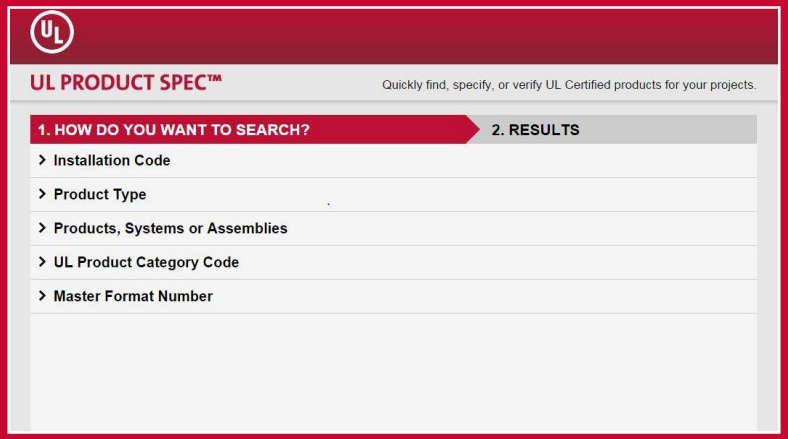
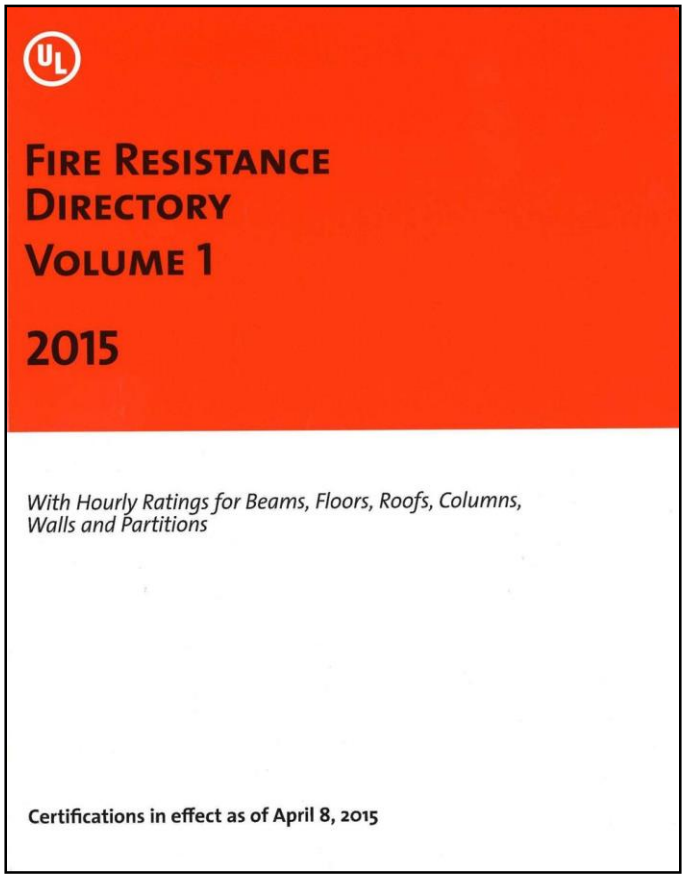
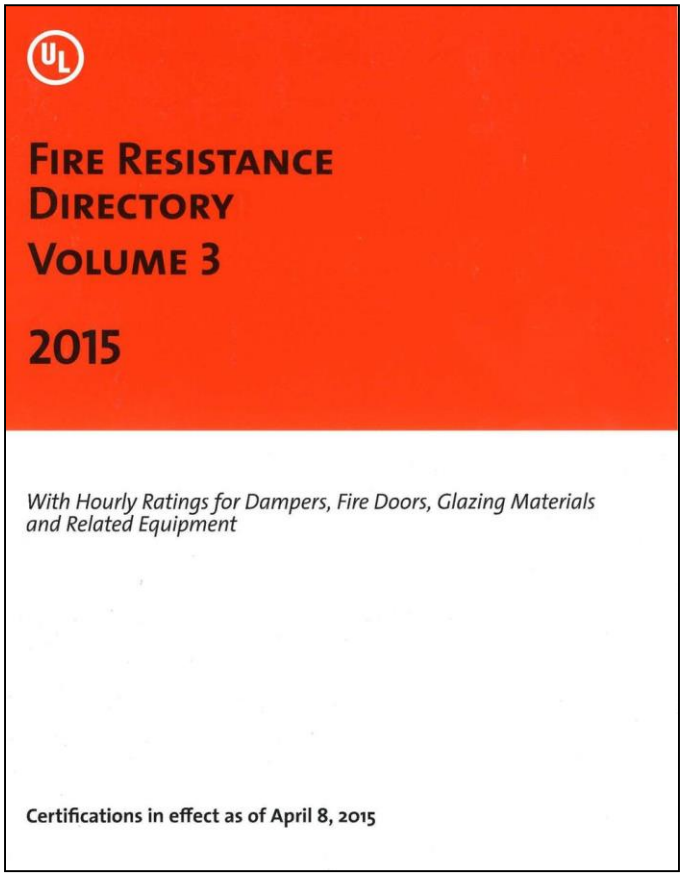




Fire Resistance Directory Volumes 1 and 3





Product Categories

- Fire-resistance-rated Glazing Materials (CCET) – Volume 1 of Directory
- Fire-protection-rated Glazing Materials (KCMZ) – Volume 3 of Directory

UL's Online Resources

- Online Certifications Directory
- Product Spec™
- Code Link

Thank You for Attending!!!

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