# WINDOWS IN RATED APPLICATIONS

## A SUMMARY OF RATED WINDOWS, ATRIA, & WINDOW SPRINKLERS

Updated March 29, 2023 | Joseph Meyer, P.E., originally published at meyerfire.com/blog

Protection of windows within a rated assembly is a surprisingly complex and perhaps often misinterpreted topic within the construction industry. Windows create openings in walls, and when the wall is part of a fire-resistance-rated assembly, the windows could compromise the integrity of that assembly.

#### PASSIVE VS. ACTIVE SYSTEMS

Passive fire protection works at all times, without intervention, to delay the growth a fire. Active systems, like fire sprinklers, operate on a few continuing needs, including valves needing to be open, a sufficient water supply, unobstructed pipe, and in some cases with a fire pump, proper operation of the pump and a power supply for the pump.

Mixing or "swapping" passive and active systems may not always lead to a desired result, and they're not necessarily interchangeable. The International Building Code does allow for some applications in which combining passive and active systems would be a code-compliant approach; but these are limited. There are essentially three approaches available to architects and engineers looking to address windows within fire-resistance-rated applications; (1) a fire-resistance-rated window assembly, (2) closely-spaced sprinklers specifically for atrium enclosures, and (3) the use of special application window sprinklers.

#### **REFERENCES CITED**

The following summary is a starting point for comparison, which considers requirements from the International Building Code (2000-2021 Editions), NFPA 13 (only 2016-2022 Editions have related requirements), NFPA 101 (2003-2021 Editions), ICC-ES ESR-2397 Report (2018-2020 Issuance), and published manufacturer's product data. Refer to the cited codes and standards for full details and requirements. Here are all of the different ICC ESR reports and available sprinkler models as of this writing:

Reliable ICC ESR-4700 Report [Report] | Window Sprinklers [Models] Tyco ICC ESR-2397 Report [Report] | Window Sprinklers [Models] Victaulic ICC ESR-4913 Report [Report] | Window Sprinklers [Models] Viking ICC ESR-4288 Report [Report] | Window Sprinklers [Models]

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## **CODE REFERENCES**

APPLICATION	RATED WINDOW(S)	CLOSELY-SPACED FOR ATRA	WINDOW SPRINKLERS
Where is this Concept Applied?	Fire Partitions & Fire Barriers	In lieu of Atrium 1-hour Enclosure [IBC 2000-06 404.5, 2009-21 404.6, or NFPA 101 2003-21 8.6.7(c)]	Fire Partitions (IBC 708), Fire Barrier (IBC 707), or Exterior Wall (IBC 705) for up to 2-hour fire- resistance rating [ICC-ES ESR-2397 3.1, 5.3]
Is this an Alternative to Code? (Need AHJ Approval)	Not a code-alternative; fire-resistance-rated glazing can meet prescriptive code requirements.	Not a code alternative. [IBC 2000-06 404.5, 2009-21 404.6, or NFPA 101 2003-21 8.6.7(c)]	Yes; this is an alternate method for a rated partition or barrier. [IBC 2003-21 104.11] [ICC-ES ESR-2397, ESR-4288, ESR- 4700, ESR-4913] [NFPA 101 2003-21 1.4.3]



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Supporting Documentation for Use & Approval	(n/a)	(n/a)	ICC-ES ESR Reports: Reliable ICC ESR-4700 [Link] Tyco ICC ESR-2397 [Link] Victaulic ICC ESR-4913 [Link] Viking ICC ESR-4288 [Link]
Does Building Code Criteria Apply?	Yes; this is a prescriptive approach.	Yes; this is a prescriptive approach.	No; this is a code-alternative approach.
Does NFPA 13 Criteria Apply?	(n/a)	No; there is no specifics from NFPA 13 regarding atrium criteria. [NFPA 13 2016 A.8.15.26(3), 2019-22 A.9.3.15(3)]	Yes; NFPA 13 provides criteria specifically for window sprinklers. [NFPA 13 2016 A.8.15.26(3), 2019-22 A.9.3.15(3)]
Are there Limits for Separation Distance for Exterior Use?	(n/a)	(n/a)	Yes; see the ICC ESR Report for the listing of the sprinkler provided. [Links above]
Can this be Used In Lieu of Firewall?	-	No; this is regarding atria only. [IBC 2000-06 404.5, 2009-21 404.6, or NFPA 101 2003-21 8.6.7(c)]	No; cannot be used at Firewalls. [ICC-ES ESR Report, Section 5.9 of each report]

## **GLASS & WALL CONSTRAINTS**

	RATED WINDOWS	CLOSELY-SPACED FOR ATRA	WINDOW SPRINKLERS
Are Doors Permitted?	<b>Yes</b> ; the use of a fire- resistance-rated door assembly is permitted.	<i>IBC:</i> Yes, self- or automatic-closing doors are permitted. [IBC 2012 404.6.1.1.2, 2015-21 404.6.1.1.3] <i>NFPA 101:</i> Yes, but doors must resist smoke and be self-or automatic- closing upon smoke detection. [NFPA 101 2003-21 8.6.7(c)(v, vi)]	<b>No, the glazing must be fixed.</b> [NFPA 13 2016 8.15.26(3), 2019-22 9.3.15(3)]
What Glazing Types are Permitted?	Any type which carries the fire-resistance-rating under its tested criteria.	NFPA 101: Ceramic, laminated, tempered, wired. [NFPA 101 2003-21 8.6.7(c)(iii)]	<ul> <li>ICC: ¼-in thick heat-strengthened or tempered glass</li> <li>[See ICC-ES ESR Reports, §3.3, 3.4]</li> <li>NFPA 13: Glass ceramic, heat- strengthened, or tempered.</li> <li>[NFPA 13 2016 8.15.26(3), 2019-22 9.3.15(3)]</li> <li>Product Data: See product data for glazing limitation types</li> <li>[See Product Data, Links above]</li> </ul>
Permitted Gasketing System?	Any type which carries the fire-resistance-rating under its tested criteria.	Must deflect in gasketed frame w/o breaking before sprinklers operate. [IBC 2000-06 404.5(1), 2009-21 404.6(1)] [NFPA 101 2003-21 8.6.7(c)(iii)]	Metallic frame, elastomeric seal. [See ICC-ES ESR Reports, §3.3, 3.4]
Allowed to be Load Bearing?	Yes, where permitted by the IBC.	No defined criteria.	Not Permitted. [NFPA 13 2016 8.15.26(5), 2019-22 9.3.15(5)] [See ICC-ES ESR Reports, §3, 5]
Are Horizontal Mullions Permitted?	Yes.	NFPA 101: No, horizontal mullions are not permitted. [NFPA 101 2009-21 8.6.7(c)(vi)]	ICC: No. [See ICC-ES ESR Reports, §3.3, 3.4] NFPA 13: horizontal members cannot interfere with uniform distribution of water.



			[NFPA 13 2016 8.15.26(6), 2019-22 9.3.15(6)]
Any Obstruction Permitted?	(n/a)	NFPA 101: No window treatments or obstructions that would interfere with wetting of glass surface. [NFPA 101 2009-21 8.6.7(c)(vii)]	No; obstructions cannot obstruct water distribution. [NFPA 13 2016 8.15.26(6), 2019-22 9.3.15(6)]
Maximum Height of Glass?	-	-	<b>13-ft (4 m)</b> [See ICC-ES ESR Reports, §3.3, 3.4] [See Product Data, Links above]
Are Combustibles Allowed Near Glass?	(n/a)	(n/a)	All combustibles must be 2-in (51 mm) from glass. Can be 36-in rated "pony wall". No deflagration or detonation hazards. [See ICC-ES ESR Reports, §4.1] [See Product Data, Links above]

## **SPRINKLER CONSTRAINTS**

	RATED WINDOWS	CLOSELY-SPACED FOR ATRA	WINDOW SPRINKLERS
Sprinkler Type?	(n/a)	<b>Any</b> type permitted (commonly standard-spray pendent recessed or concealed)	Only Listed Window Sprinklers Permitted; See Links for Models on Page 1 of this Summary
System Type?	(n/a)	-	Wet-pipe systems only. [NFPA 13 2016 8.15.26(2), 2019-22 9.3.15(2)] [See ICC-ES ESR Reports]
Sprinklers Required on Both Sides?	No.	<i>IBC:</i> Yes, or on room-side-only if there is no walkway on the atrium side. [IBC 2000-06 404.5(1), 2009-21 404.6(1)] <i>NFPA 101:</i> Yes, or only on non-atrium side where there is no walkway or other floor area on atrium side above main level. [NFPA 101 2003-21 8.6.7(c)(iv)]	Yes, where assembly is required to be protected by both sides. [NFPA 13 2016 8.15.26(4), 2019-22 9.3.15(4)] [See ICC-ES ESR Reports]
Distance from Glass	(n/a)	<i>IBC</i> : 4-in (102) to 12-in (305 mm) [IBC 2000-06 404.5, '09-21 404.6] <i>NFPA 101</i> : 12-in (305 mm) or less [NFPA 101 2003-21 8.6.7(c)(ii)]	<ul> <li>Horizontal Sidewall: Deflector ½- 4" (12.7-102 mm) from glass and 1-3" (25-76.2) down from frame.</li> <li>Vertical Sidewall: 4-12" (102-305) from face of glass and 2-4" (51- 102) below top frame.</li> <li>Pendent: Deflector 6-12" (152- 305) from face of glass, 0-4" (102) above top frame.</li> <li>[See ICC-ES ESR Reports]</li> <li>[See Product Data, Links above]</li> </ul>
Entire Surface Wet?	(n/a)	Yes; entire surface must be wet upon activation [IBC 2000-06 404.5(1), 2009-21 404.6(1)] [NFPA 101 2003-21 8.6.7(c)(ii)]	Yes, as governed by listing and ICC-ES Report. [See ICC-ES ESR Reports] [See Product Data, Links above]



Sprinkler Spacing (along glass)	(n/a)	6-ft (1830 mm) on center [IBC 2000-06 404.5(1), 2009-21 404.6(1)] [NFPA 101 2003-21 8.6.7(c)(i)]	Spacing depends on sprinkler type and model; can range from 6-ft (1830 mm) minimum up to 12-ft ( 3567 mm) maximum [See ICC-ES ESR Reports] [See Product Data, Links above]
Sprinkler Distance from Vertical Mullion	(n/a)	No criteria specified.	4-in (101.6 mm) minimum Maximum depends on model. [See ICC-ES ESR Reports] [See Product Data, Links above]

#### **HYDRAULICS**

	RATED WINDOWS	CLOSELY-SPACED FOR ATRA	WINDOW SPRINKLERS
Sprinkler Type?	N/A	Any permitted (commonly standard- spray pendent recessed or concealed)	Only Listed Window Sprinklers Permitted; See Links for Models on Page 1 of this Summary [See ICC-ES ESR Reports]
Water Supply Duration	N/A	-	Not Less than Required Rating (Typically 1 or 2-hour) [NFPA 13 2016 8.15.26(7), 2019-22 9.3.15(7)] [See ICC-ES ESR Reports]
Maximum Pressure	N/A	(Per listing of sprinkler)	Horizontal Sidewall: 175-250 psi (1207 kPa) when separated by vertical mullion, or 70 psi (483 kPa) when not separated Vertical Sidewall/Pendent: 175 psi (1207 kPa) [See ICC-ES ESR Reports] [See Product Data, Links above]
Remote Area	N/A	Not specifically addressed; NFPA 13 provides similar criteria for Water Curtains to meet minimum remote area length of NFPA 13 [NFPA 13 2002 11.2.3.8.2, 2007-16 11.3.3.2, 2019 19.4.3.2, 2022 19.3.3]	Most demanding 46.5 linear feet (14.2 m), or 36 linear feet where quick-response reduction is used. Added to remote area. [See ICC-ES ESR Reports]
Window Sprinklers Added to Remote Area?	N/A	Not specifically addressed; NFPA 13 requires both closely-spaced and adjacent sprinklers be calculated for Water Curtains where a single fire can cause operation of window and ordinary sprinklers. [NFPA 13 2002 11.2.3.8.3, 2007-16 11.3.3.3, 2019 19.4.3.5, 2022 19.3.3]	Yes, where a single fire can cause operation of window and ordinary sprinklers. [See ICC-ES ESR Reports] [NFPA 13 2016 11.3.5, 2019 19.4.4, 2022 19.3.5]
Minimum Flow per Sprinkler	N/A	Not specifically addressed; NFPA 13 provides similar criteria for Water Curtains of 3 GPM per lineal foot (37 L/min per lineal m), and not less than 15 GPM (57 L/min) each [NFPA 13 2002 11.2.3.8.1, 2007-16 11.3.3.1, 2019 19.4.3.1, 2022 19.3.3]	Varies by sprinkler type, model, and spacing: Ranges 15-20 gpm (57-76 LPM) [See Product Data, Links above]

