

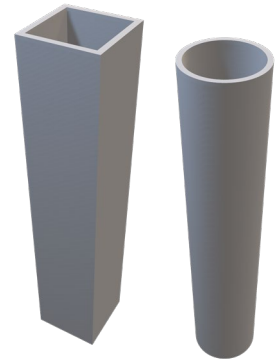
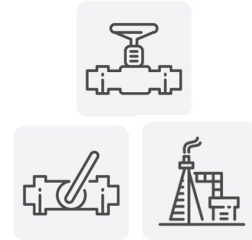
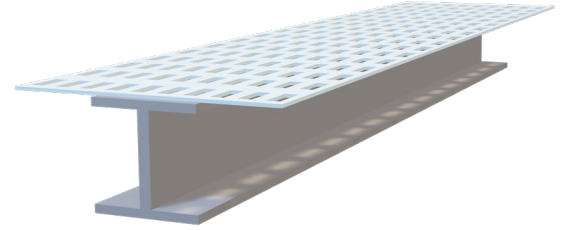


UL 1709 updates

PFPNet Technical Event 2025 – Houston

Kevin Hyland, principal engineer

May 1, 2025

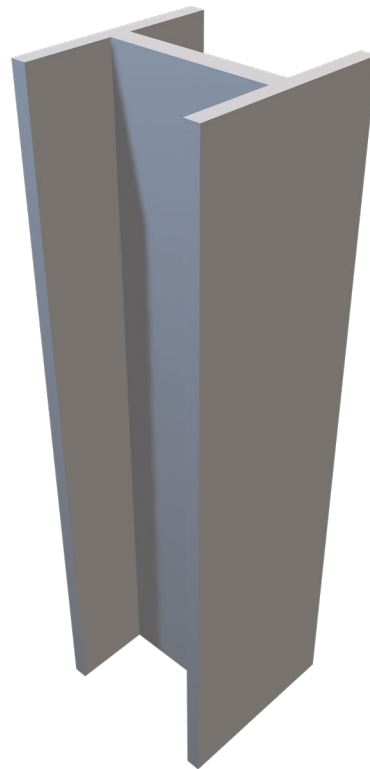


Agenda

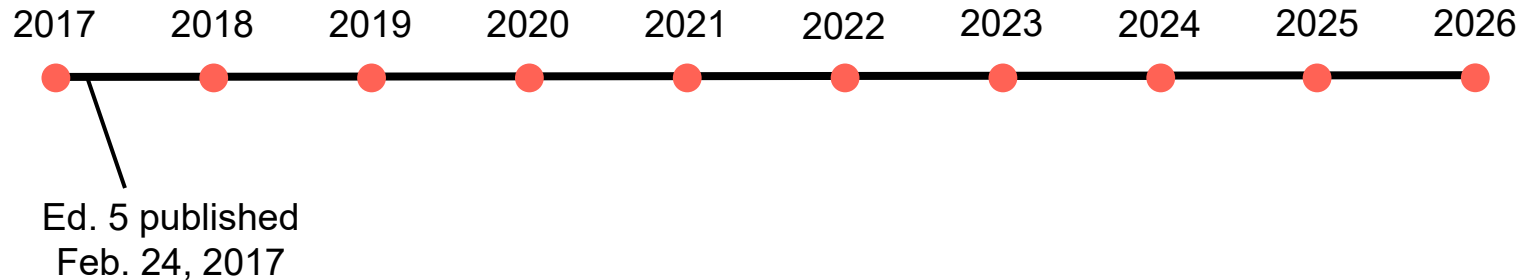
1. UL 1709, the Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel
2. Recent revisions
3. Proposed seventh edition
4. Under discussion – Horizontal beams, blockouts and repairs
5. Critical process control equipment (CPCE) test method overview

UL 1709

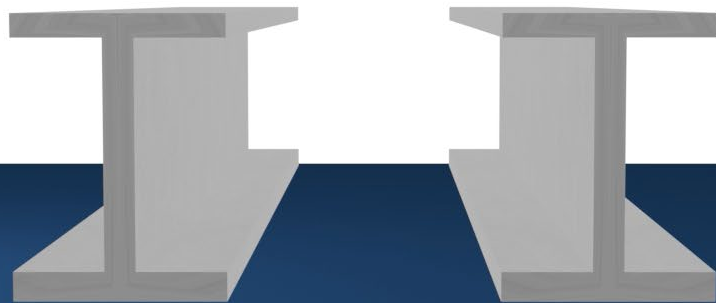
- Vertical steel column
- 2,000°F (1,093°C) in five minutes, exposed on all four sides
- Required total heat flux – 65,000 Btu/h · ft² (204 kW/m²)
- Furnace calibrated every 10 years
- Column not loaded during test
- Four sections of thermocouples
- Limiting temperatures – 1,000°F (538°C) average; 1,200°F (649°C) individual
- Durability of protection material in hydrocarbon environments
- API 2218, Fireproofing Practices in Petroleum and Petrochemical Processing Plants



UL 1709: Recent revisions



- Comparative beam test method – Stickability of materials on horizontal beams
- Durability testing – UL 2431, the Standard for Durability of Fire Resistive Coatings and Materials
- Annexes – Data analysis methods for classification, multi-temperature assessment



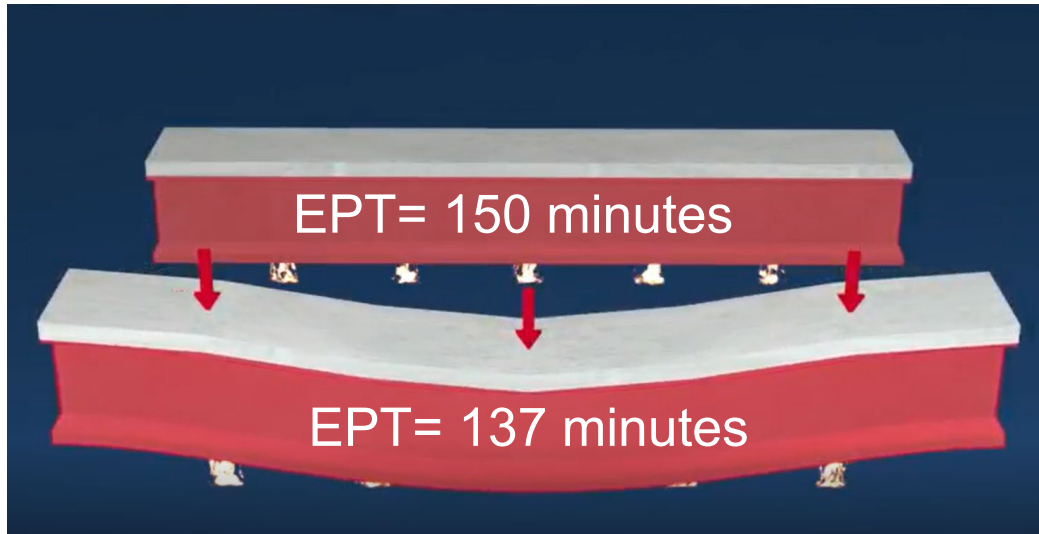


*End point time (EPT)

UL 1709 beam testing: Comparative method

A correction factor (C) is calculated: $C = EPT_{\text{reference beam}} / EPT_{\text{loaded beam}}$

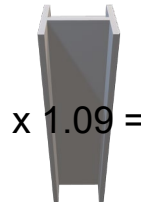
C =



$$= \frac{150}{137} = 1.09$$

UL 1709 beam testing: Comparative method

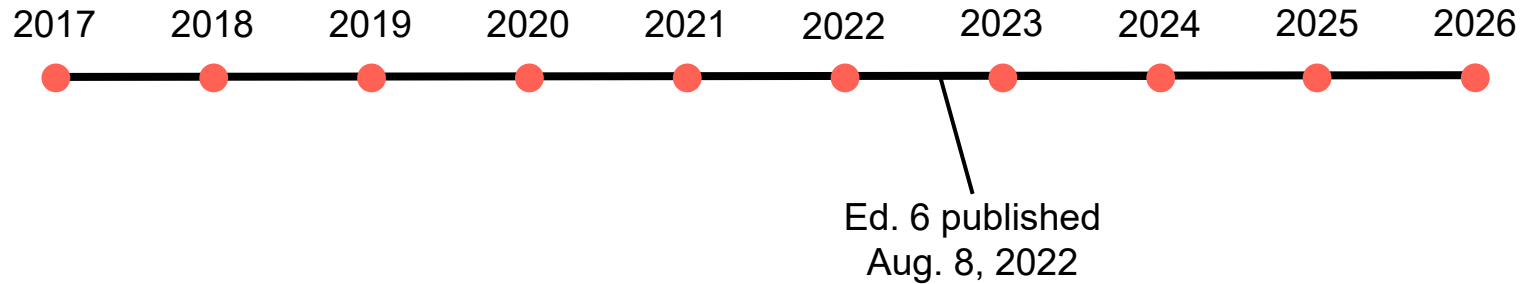
Rating, hour	Thickness, mm (W10x49 column)	x C	Thickness, mm (W10x49 beam)
1	8.63	x 1.09 =	9.41
2	14.99	x 1.09 =	16.34
3	27	x 1.09 =	29.43



Comment on comparative method

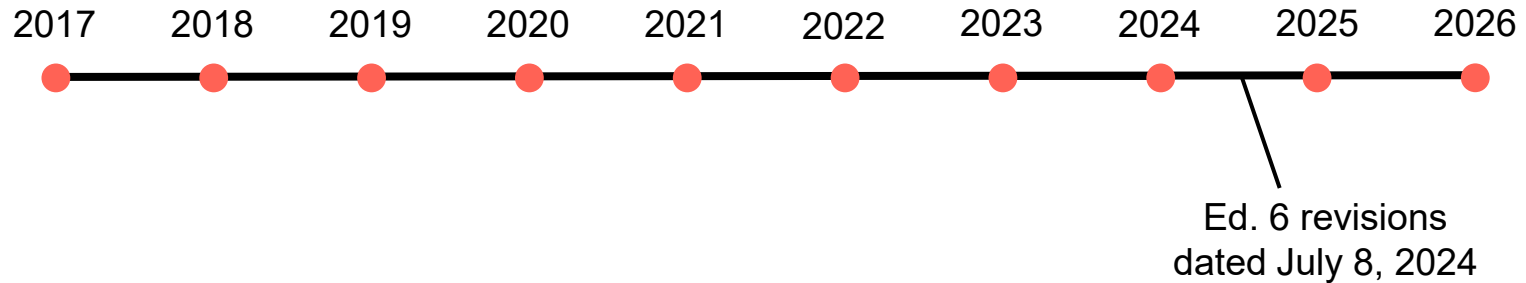
- UL 1709 proposal dated Feb. 23, 2024
- Revisions (enhancements) to comparative beam test
- Proposal rejected
- “The [currently published] test arrangement as described [in UL 1709] is configured to allow a test to be carried out within the constraints of what can be achieved with a[n] [existing] furnace, rather than to represent a typical structural arrangement from a hydrocarbon facility.”
- Comparative beam test still in UL 1709

UL 1709



- Reorganized into two parts
- Part 1 – General Requirements; Part 2 – Structural Steel
- No technical changes

UL 1709



- New Annex A5 – Hollow section column test protocol for reactive materials
- New Part 3 – Fire test procedures for passive fire protection (PFP) systems for CPCE

UL 1709: Hollow section columns

- For reactive products, test both rectangular shape and circular shape of same shape factor (A/P)
- The worse-case shape can be considered representative of the other and be used for the remainder of the hollow section test program.
- No change for nonreactive products (spray-applied fire-resistive materials, gypsum board, mineral batts, etc.)

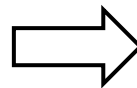
Alternatively, if large spread in performance, can test full program of both shapes



Test rectangular shape



Test circular shape



Worse-performing shape used for remainder of hollow section program

UL 1709

Proposed seventh edition



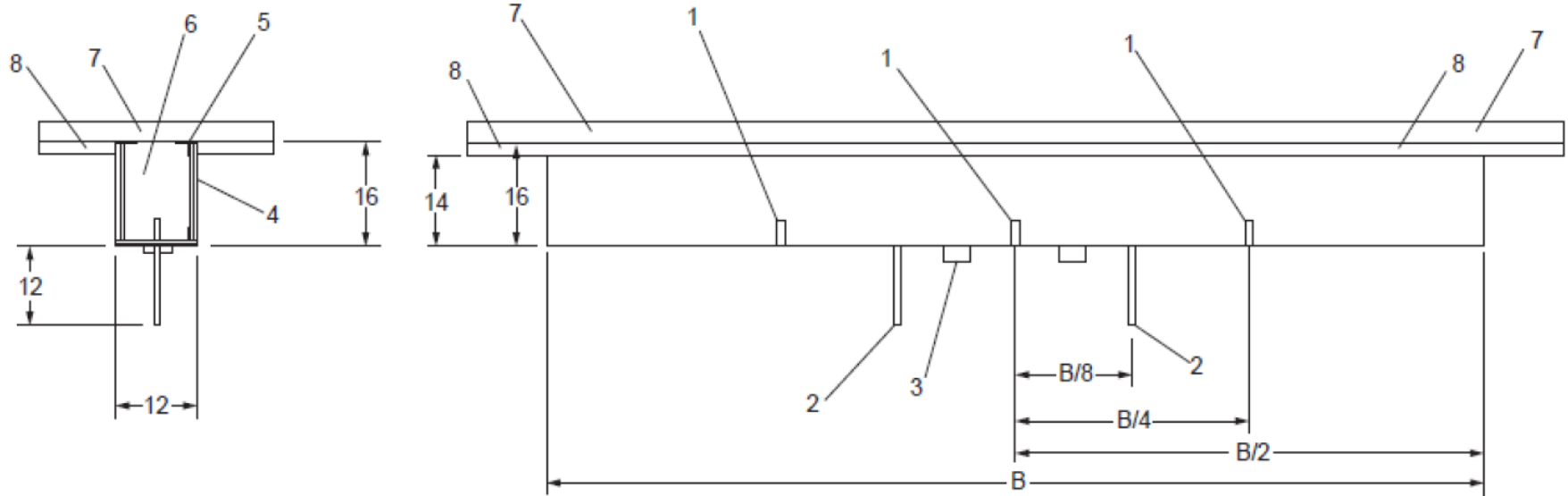
UL 1709, proposed seventh edition

- Proposal viewable in UL Standards & Engagement's Collaborative Standards Development System (CSDS)
- [csds.UL.org](https://csds.ul.org)
- Ballot period opened April 18, 2025
- Ballot period closes June 17, 2025
- Proposed by Robert Berhinig, UL 1709 Technical Committee (TC) member
- Introduction
- Part 1 – General Requirements
- Part 2 – Tests of Structural Elements
- Part 3 – Tests for PFP for CPCE
- Annexes

UL 1709, proposed seventh edition

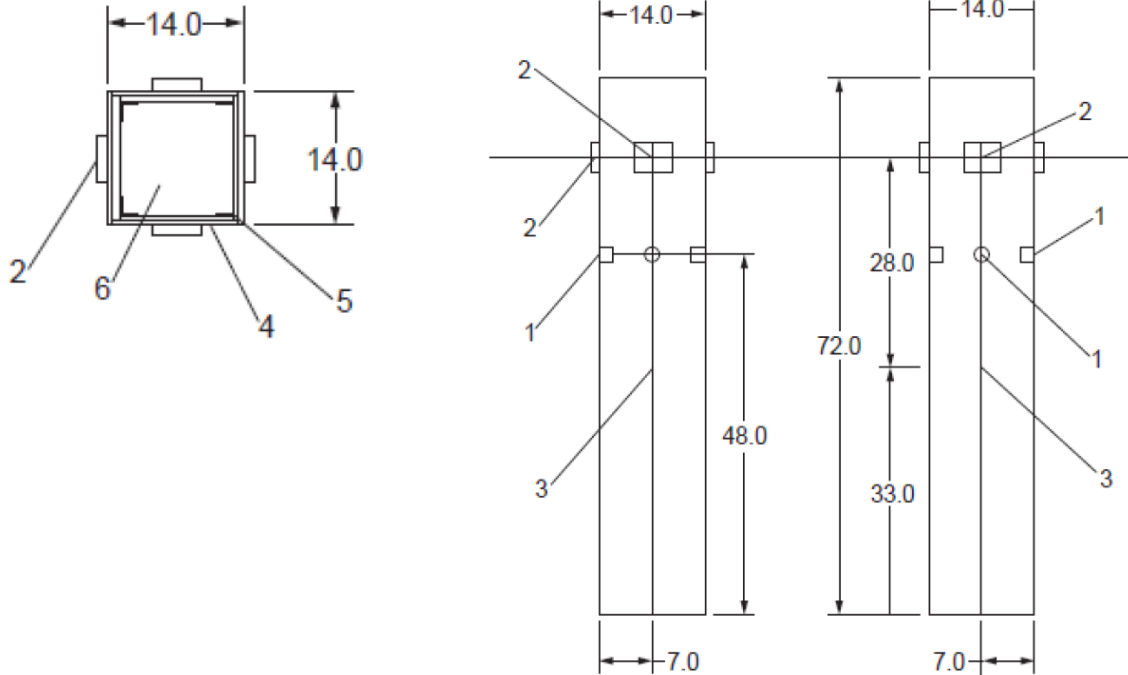
- Key proposed changes
- Calibration of horizontal furnaces – New
- Calibration of engulfment (column) furnaces – Revision
- Fire test on loaded columns (reference to UL 263, the Standard for Fire Tests of Building Construction Materials) – New
- UL 2431, the Standard for Durability of Fire Resistive Coatings and Materials, durability/environmental requirement applies to all parts of UL 1709 (including CPCE) – Revision
- Horizontal beam test (reference to UL 263) – New
- Annex A4, “Multi-duration, multi-section classification assessment method” – Corrected
- Annex C, “Comparative beam test” – Correction factor equation corrected

Calibration specimen for floor furnace



Three-sided box component

Calibration specimen for engulfment (column) furnace



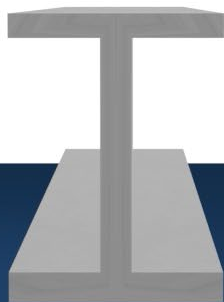
Participation in UL 1709

- American National Standards Institute-approved
- TC
- Interest categories – AHJ/regulator, commercial–industrial user, consumer, general, government, international delegate, producer, supply chain, testing and standards organization
- CSDS
- csds.UL.org
- Anyone can comment
- Not on a cycle
- Standards need minimum reaffirmation every five years
- TC project manager – anna.roessing-zewe@UL.org

Under discussion

Horizontal beams, blockouts and repairs





Blockouts (connections) and repairs

- Blockouts
 - Thirty percent to 40% of a project
 - Expected and planned for aspect of a project
 - Present at an unspecified frequency
- Repairs
 - Potential to be large
 - Not planned for
 - Present at an unspecified frequency
- Ad hoc testing
- Standardize testing for blockouts and repairs?
- Treat blockouts and repairs separately; address like-for-like materials
- Summarize issues and bring to UL 1709 TC for discussion

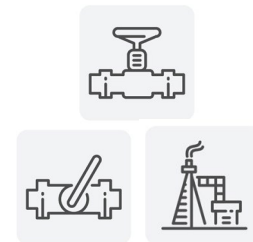
UL 1709

CPCE test method overview



Critical process control equipment

- “In the oil, gas and petrochemical industry, precision control of the flow of product through valves in the system is vital, and modulation of that flow depends on the valve actuator. These critical pieces of equipment must perform reliably and safely under the most extreme conditions.”
- “Additional requirements in the oil and gas industry may be called for, such as fireproof versions of actuators that reliably maintain all functionality, even during the direct impact of fire. In the event of a fire, the enclosure absorbs the heat and ensures reliable actuator operation, ensuring that the valve still functions.”



<https://www.valvemagazine.com/articles/electric-actuators-in-the-oil-and-gas-industry>

Three categories of test specimens

Category of test specimen	Description	Test type applicability
Functional specimen	An item of CPCE, operated during the fire test at a regular interval	Functional (see note)
Nonfunctional specimen	An item of CPCE, inoperative during the fire test	Nonfunctional
Characteristic specimen	A dummy specimen of equivalent size and section factor to an item of CPCE	Nonfunctional

Note: Functional tests can also be used to generate temperature data as per nonfunctional tests.

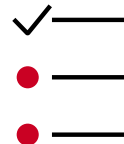
Category	Purpose	When to use	Test specimen	Other	Thermocouples
Functional specimen	Test operation of item during fire	When failure criteria of CPCE is unknown	Representative of actual item of CPCE in field installation	Needs limit switch to confirm correct operation of item	Optional

Category	Purpose	When to use	Test specimen	Other	Thermocouples
Functional specimen	Test operation of item during fire	When failure criteria of CPCE is unknown	Representative of actual item of CPCE in field installation	Needs limit switch to confirm correct operation of item	Optional
Nonfunctional specimen	Characterize temperature response of item	When failure criteria of CPCE is known	Representative of actual item of CPCE in field installation		Required

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Functional specimen	Test operation of item during fire	When failure criteria of CPCE is unknown	Representative of actual item of CPCE in field installation	Needs limit switch to confirm correct operation of item	Optional
Nonfunctional specimen	Characterize temperature response of item	When failure criteria of CPCE is known	Representative of actual item of CPCE in field installation		Required
Characteristic	Characterize temperature response of item	Test without actual CPCE; characterizes PFP material vs. section factor	Steel; section factor greater than or equal to CPCE item; boxes and pipe sections or combo	For CPCE predominantly made of steel	Required

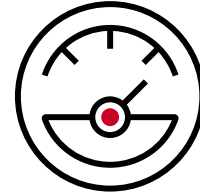
Test setup

- Verify test specimens against construction drawings
- Fire protection system applied in a manner representative of practice; protect entirety of test specimen
- Fire protection system thickness measured at various locations, with different thicknesses of installed material noted
- Test specimen shall be mounted on supports a minimum of 20 in. (0.5 m) above furnace floor
- Electrical, hydraulic or pneumatic connections for operational specimens



Performance criteria

- Operability – Successful completion of an operation cycle or continuity of signal
- Specimen temperature – Time–temperature profile at each measurement position on body of test specimen
- Integrity of systems and assemblies
 - Consider penetration of flames or hot gases through cracks, holes or breaches in joints
 - Effectiveness of fixing system



Test report

- Report basics (test laboratory, dates, test sponsor, product identification, product manufacturer, etc.)
- Test specimen category
- Test specimen construction details, photographs, conditioning
- Material properties related to fire performance
- Test results
 - Thermocouple locations and temperature data
 - Operability of specimen
 - Classification attained, duration for each performance criteria





Thank you

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