

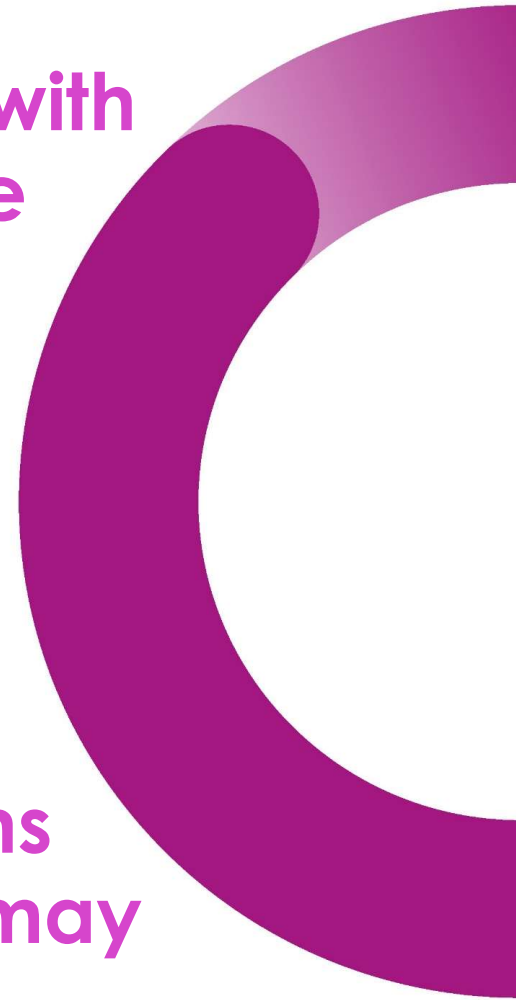
2024 BC Building Code Changes



A Plumbing + Mechanical Perspective

This presentation is for educational purposes only. The information is given with honest conviction that it is accurate. The presenter and association take no responsibility for application of any concepts or interpretations in this presentation.

The slides must not be considered complete or exhaustive. Code provisions have been generally represented and may not reflect all exceptions.





Making Sense of the Changes



How the
Change
is Written



Why the
Change



What Does
it Mean

DWV Pipe Transitions

3.1.9.4. **7)** Except as provided in Sentence (8), penetrations of a *fire separation* that incorporate transitions between *combustible* and *noncombustible* drain, waste and vent piping shall be sealed by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

A-3.1.9.4.(8) Combustible Branches. Combustible branches for drain, waste and vent piping are permitted to be used to connect to a plumbing fixture within a fire compartment. The integrity of the fire separation is maintained through the use of a firestop system where the vertical stack piping penetrates the fire separation.

DWV Pipe Transitions

2018 BCBC

- Limited reference to transitions through vertical fire separations, silent on horizontal fire separations.
- **Transitions are permitted by most so long as all other code requirements are met.**
- Speculation led to inconsistent field interpretations and resulted in several interpretations being issued by BCBC Interpretations Committee.

2024 BCBC

- The **change is based on extensive testing** which was reviewed by a diverse group of experts as part of the code development process.



FIGURE 1: Common pipe transition in a DWV piping system

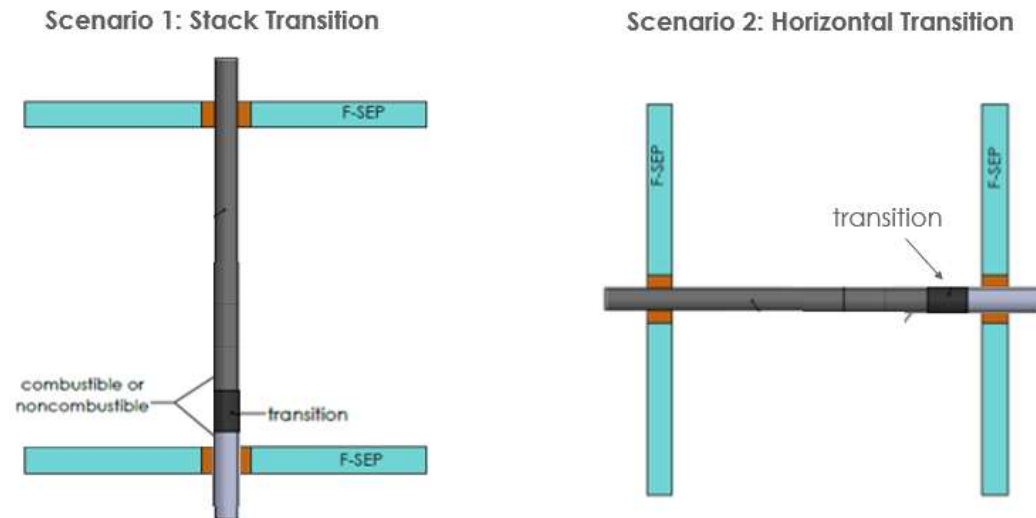
What Does
it Mean

DWV Pipe Transitions

2020 NBC

3.1.9.4.(7)

- Transitions between combustible and noncombustible DWV pipes that penetrate vertical and horizontal fire separations are permitted.
- Firestops tested to ULC-S115 that incorporate a transition within the proximity of the penetration are ideal, but not necessary by code.



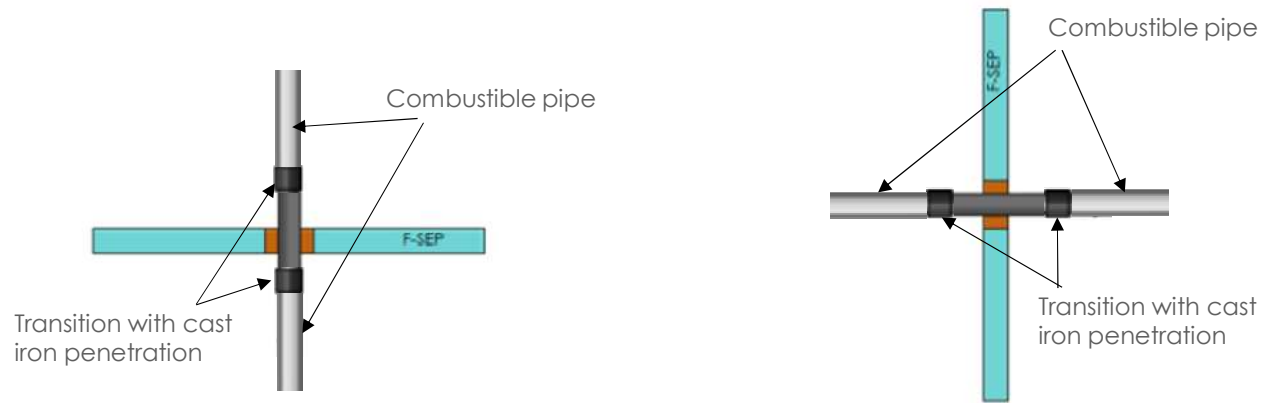
What Does
it Mean

DWV Pipe Transitions

2020 NBC

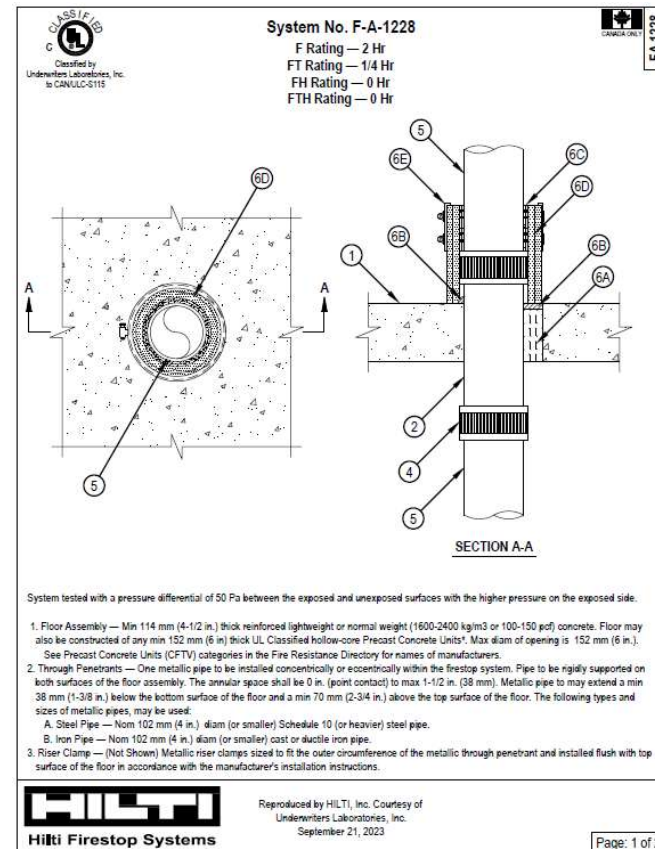
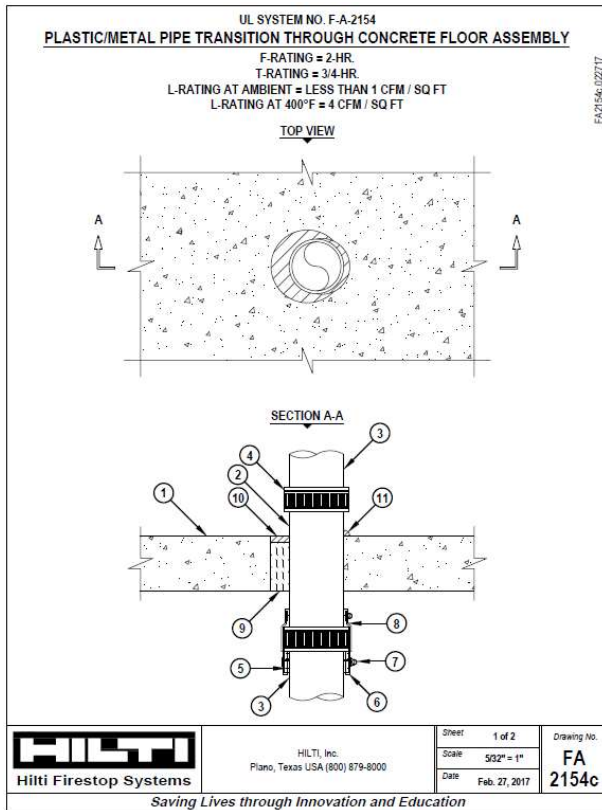
3.1.9.4.(7)

- Unless an S115 listed firestop system allows it, transitioning to cast iron on both sides of a fire separation is not permitted



What Does
it Mean

DWV Pipe Transitions



DWV Pipe Transitions

8) Transitions between vertical *noncombustible* drain, waste and vent piping and *combustible* branches for drain, waste and vent piping are permitted on either side of a *fire separation*, provided they are not located in a *vertical service space*. (See Note A-3.1.9.4.(8).)

2020 NBC

3.1.9.4.(8)

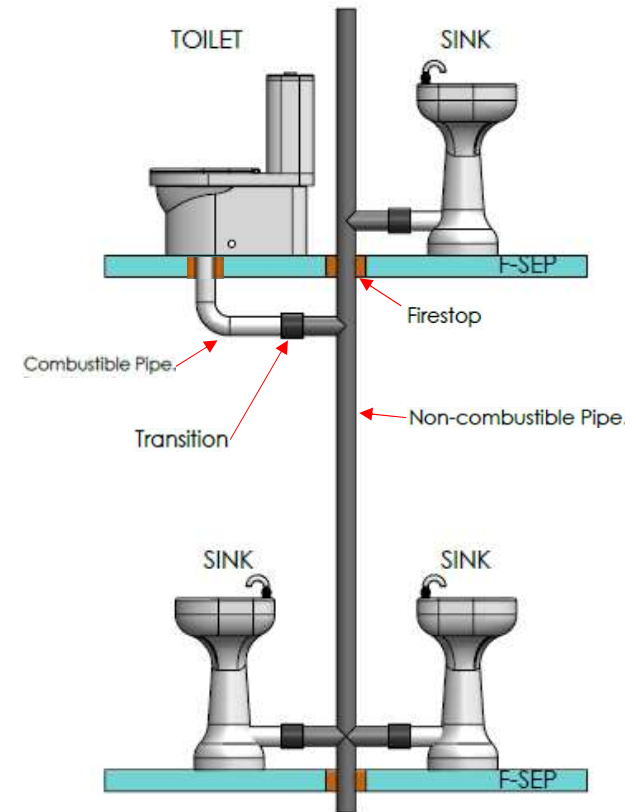
- Transitions from noncombustible stack to combustible branches permitted on both sides of *fire separation*:
 - Transitions permitted above and below rated floors.
 - Transitions permitted on both sides of a rated wall.
- Membrane penetration on either side of rated wall requires firestopping (*previous codes required this, nothing new*).

What Does it Mean

Examples of Installations Permitted by 3.1.9.5.(8)

Scenario 3: Branch Transitions without Wall/Unrated Wall

- Combustible fixture drain/trap arm/branch transitions from noncombustible stack.
- No wall
- Firestop required at horizontal fire separation penetrations.

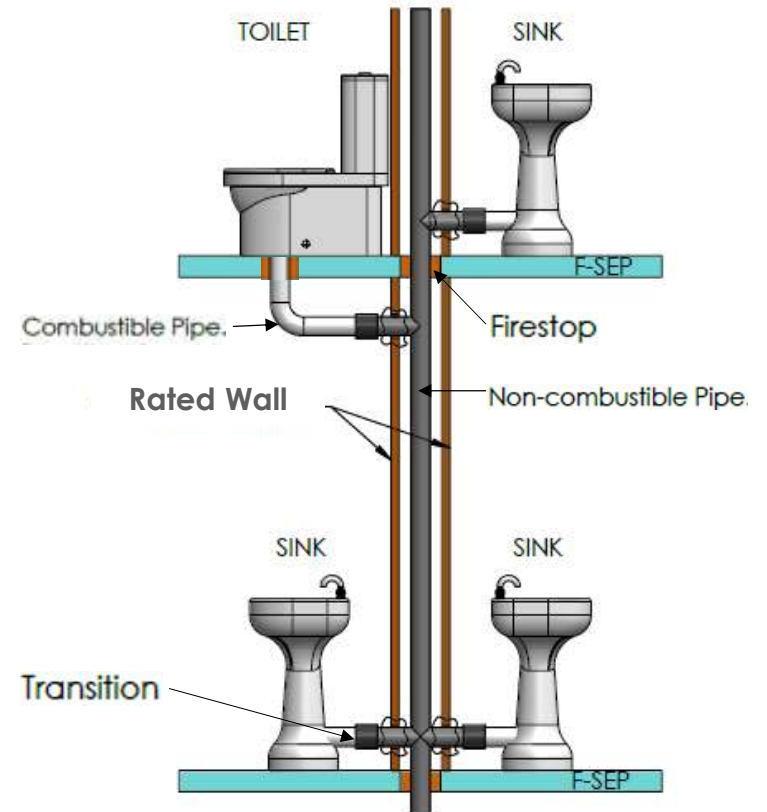


What Does it Mean

Examples of Installations Permitted by 3.1.9.5.(8)

Scenario 4: Branch Transitions with Rated Wall

- Combustible fixture drain/trap arm/branch transitions from noncombustible stack.
- Rated wall
- Firestopping not required by 3.1.9.5.(8) at rated wall, but needed at membrane penetration to maintain fire resistance rating of wall as per other code requirements.
- Firestop required at horizontal fire separations.

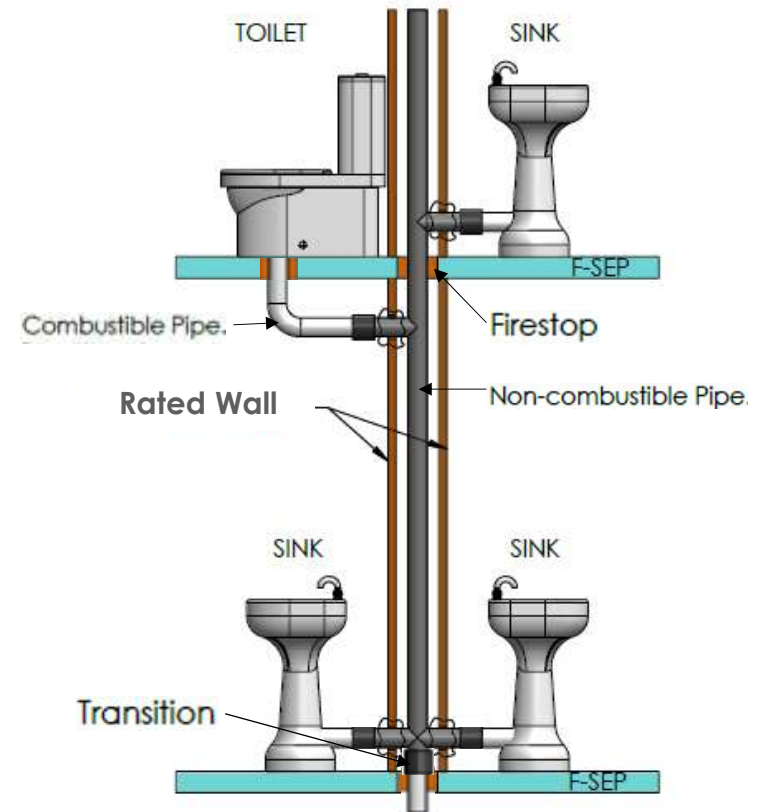


What Does it Mean

Examples of Installations Permitted by 3.1.9.5.(8)

Scenario 5: Branch Transitions with Stack Transition

- Combustible fixture drain/trap arm/branch transitions from noncombustible stack **permitted by 3.1.9.5.(8)**.
- Rated wall
- **Stack transition permitted by 3.1.9.5.(7)**.
- Firestopping not required by 3.1.9.5.(8), but needed at membrane penetration to maintain fire resistance rating of wall as per other code requirements.
- Firestop required at horizontal fire separation.



Transitions-Public Comments

CONCERNS ADDRESSED BY FIRE TESTING OF TRANSITIONS

9.10.9.7. OF NBC 2015 USERS GUIDE ALLUDES TO SMOKE MOVING FROM ONE FIRE COMPARTMENT TO ANOTHER

Lets review the testing and results
the working group reviewed

SUGGESTS ADDING NEW SENTENCE (9) TO PROHIBIT TRANSITIONS IN UNRATED WALLS

WANTS APPENDIX/NOTES TO MENTION CONCERN FOR FIRE SPREAD DUE TO COMBUSTIBLE BRANCH TRANSITIONING TO NONCOMBUSTIBLE STACK 'SPRAY BOTTLE ATOMIZER' EFFECT.



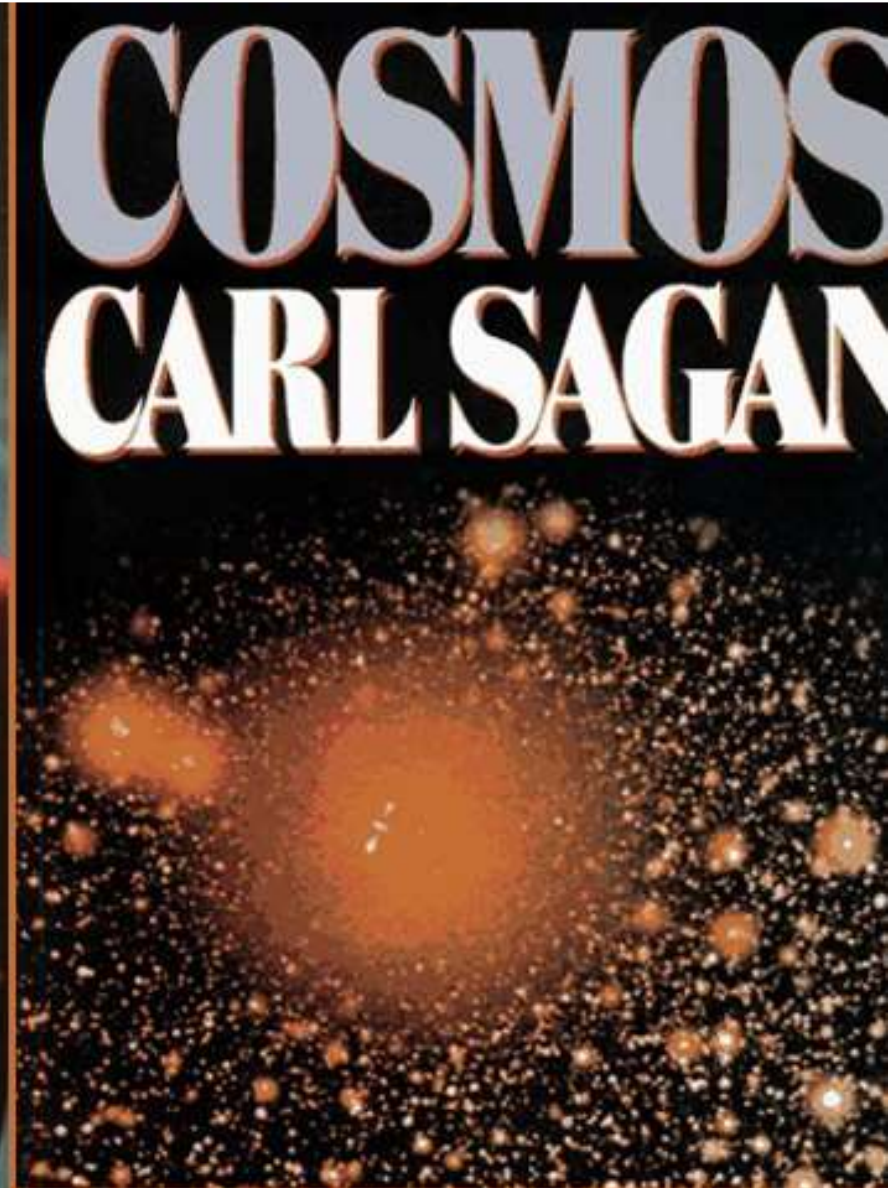
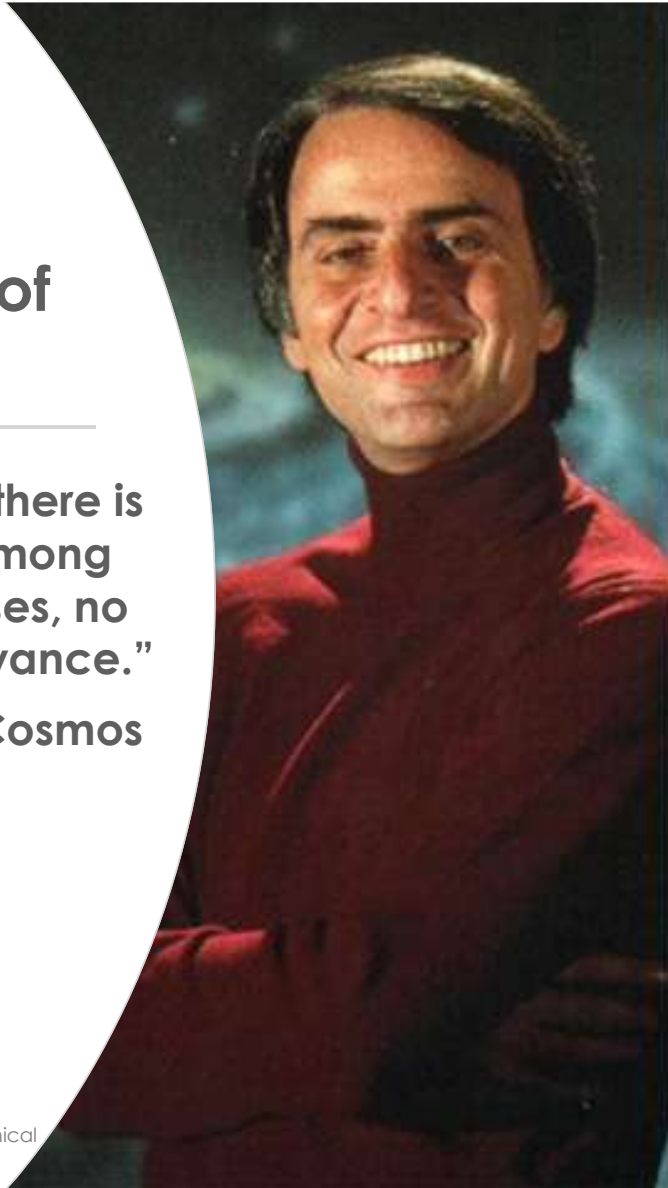
Pipe Transitions Research

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The Importance of Experimentation

“Without experiment, there is no way to choose among contending hypotheses, no way for science to advance.”

Carl Sagan - Cosmos

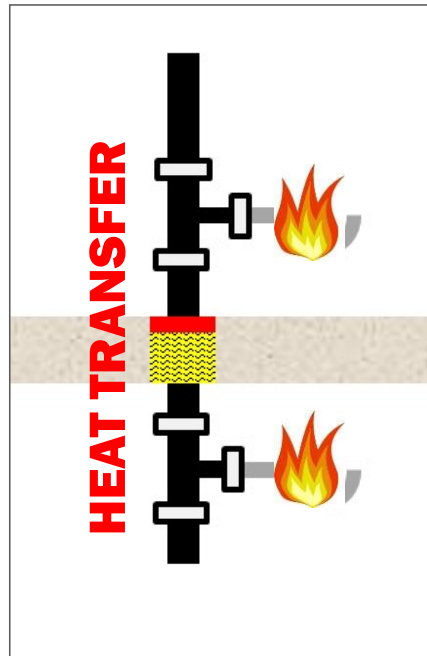


Background

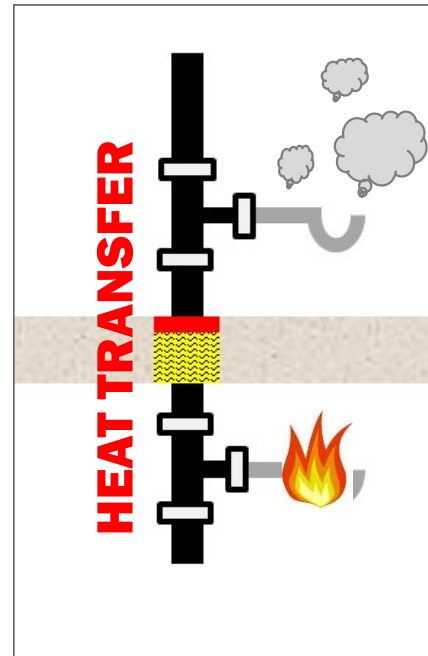
Some **opinions** exist that oppose transitions

1. In a hybrid system, the non-combustible pipe can be heated above the fire separation and could **melt** or **ignite the combustible pipe**
2. The water in the P trap above could **evaporate** in a fire and permit smoke to pass through to the non-fire side of the assembly.
3. Stack transitions lead to same issues as #1 and #2

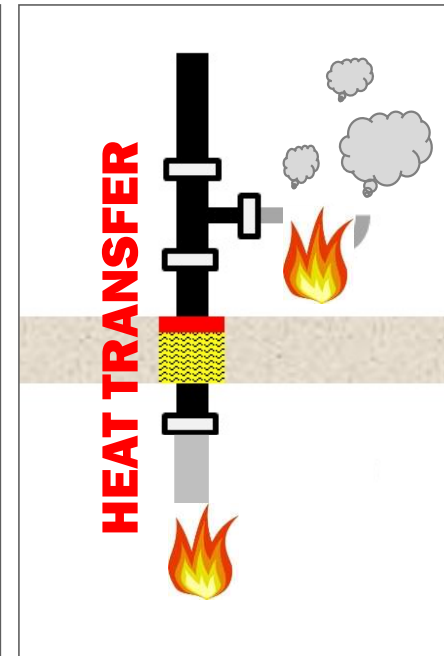
Assumption #1



Assumption #2



Assumption #3

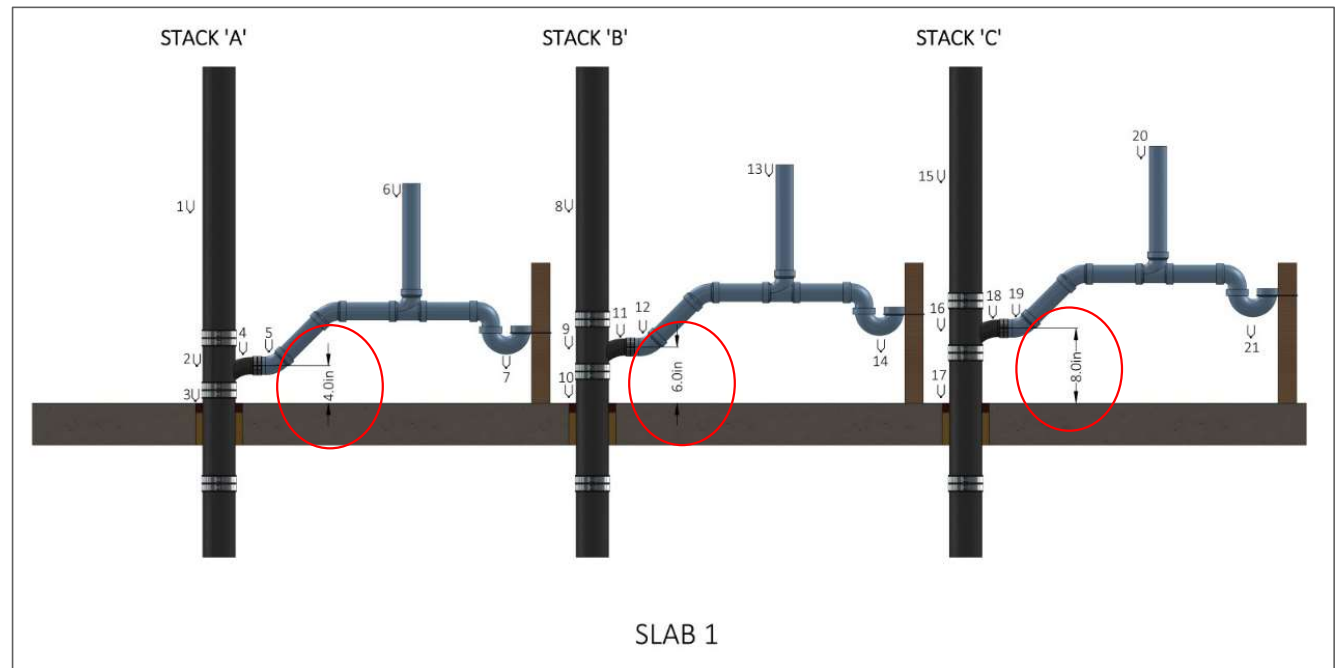


Research Testing

- In late 2017, testing was conducted to evaluate the fire performance of piping systems consisting of both **combustible and non-combustible piping components** in close proximity of the fire separation
- Underwriters' Laboratories (UL) of Northbrook, IL was the accredited test facility chosen for this research
- Testing was performed in accordance with the temperature curve of **CAN/ULC-S115-11**
- **9 Piping Arrangements** were tested
 - Hybrid Systems (System XFR branch laterals/traps with Cast-Iron stacks)

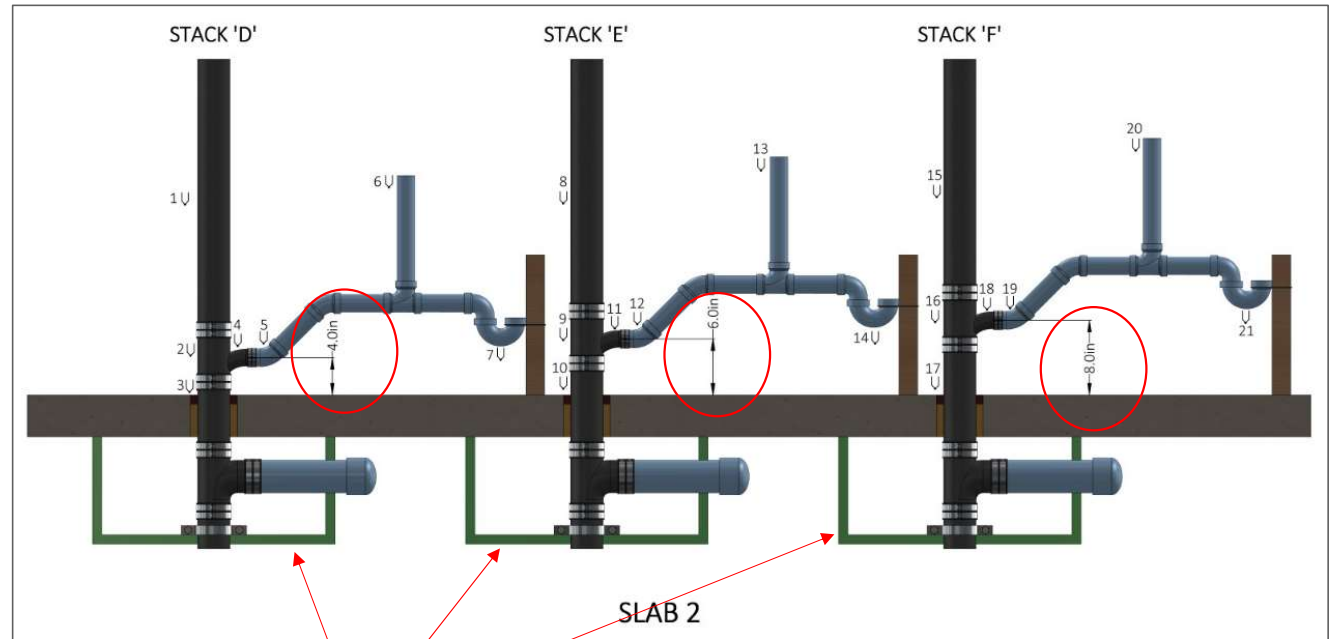
Piping Configurations (Slab 1)

- Hybrid System
 - Vented 1-1/2" PVC Branches (non-fire side)
 - 3" Cast-Iron Stacks
- P-Traps filled with water
- 7 Thermocouples per assembly
- Transition on 1-1/2" branch at distances 4", 6" and 8" from top of slab



Piping Configurations (Slab 2)

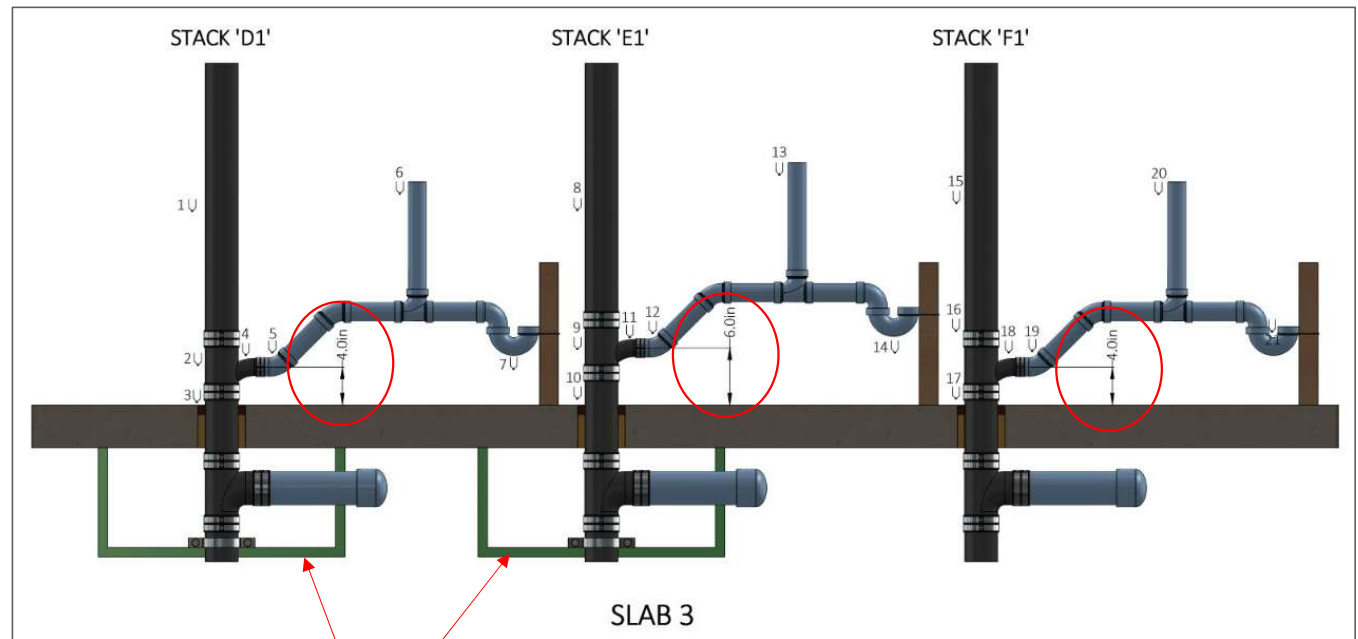
- Hybrid System
 - Vented 1-1/2" PVC Branches (non-fire side)
 - 3" PVC Branches (fire side)
 - 3" Cast-Iron Stacks
- P-Traps filled with water
- 7 Thermocouples per assembly
- Transition on 1-1/2" branch at distances 4", 6" and 8" from top of slab
- Transition on 3" branch within 4" of bottom of slab
- Fully supported on fire side



Fully supported

Piping Configurations (Slab 3)

- Hybrid System
 - Vented 1-1/2" PVC Branches (non-fire side)
 - 3" PVC Branches (fire side)
 - 3" Cast-Iron Stacks
- P-Traps filled with water
- 7 Thermocouples per assembly
- Transition on 1-1/2" branch at distances 4" and 6" from top of slab
- Transition on 3" branch within 4" of bottom of slab
- D1/E1 fully supported on fire side (same as D/E in Slab 2)



Fully supported

Piping Configurations (Stack F1)

BC BUILDING CODE INTERPRETATION COMMITTEE
 A joint committee with members representing
AIBC, APEGBC, BOABC, POABC

File No: 06-0070 **INTERPRETATION** **Page 2 of**

buildings in accordance with Subsection 3.2.6. In accordance with Subsection 3.1.9, all penetrations must have a listed fire stop assembly consistent with the material utilized.

See drawings below illustrating these piping transition principles.

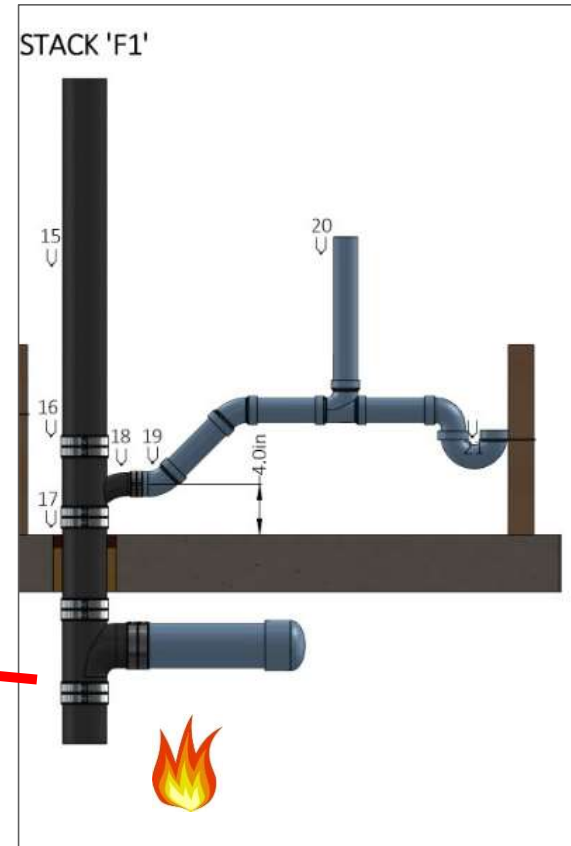
The example marked Not Permitted indicates that the transition from combustible to noncombustible piping is not acceptable anywhere within that storey. If the combustible pipe melts off due to a fire located within that storey it would result in an opening through the upper floor/ceiling fire separation, and therefore compromising the fire stop assembly.

Also, see previous Interpretation 98-0139 which contains the same conclusion.

① PERMITTED ① PERMITTED ① PERMITTED ② NOT PERMITTED

COMBUSTIBLE PIPING
 NONCOMBUSTIBLE PIPING

LISTED FIRESTOP ASSEMBLY FOR COMBUSTIBLE PIPE PENETRATIONS
 LISTED FIRESTOP ASSEMBLY FOR NONCOMBUSTIBLE PIPE PENETRATIONS



Piping Configurations (Stack F1)

BCAB #1797 - Combustible Piping Used in a Drain, Waste, and Vent Piping System

May 18, 2017

BCAB #1797

Re: Combustible Piping Used in a Drain, Waste, and Vent Piping System

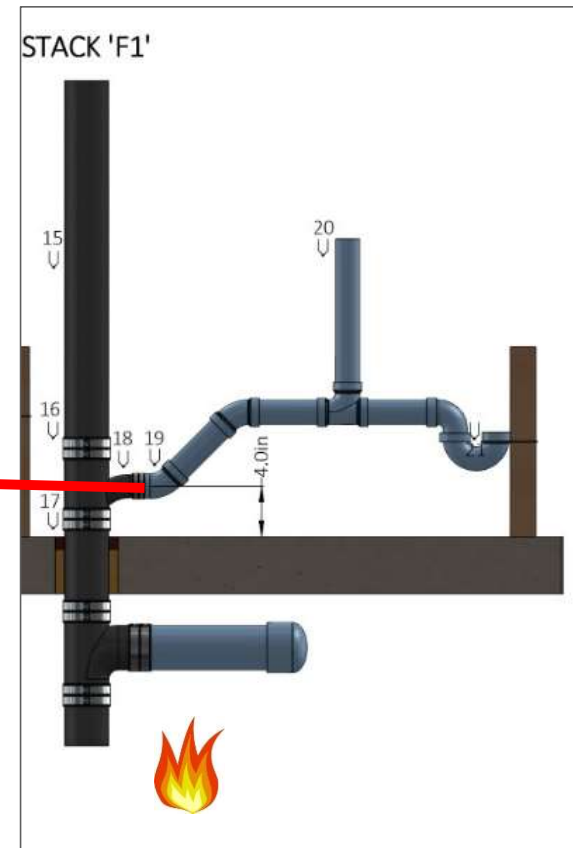
Appeal Board Decision #1797

It is the determination of the Board that the exceptions in Sentences 3.1.9.4.(4) and (5) are not applicable to the subject circumstance of this appeal. Sentence 3.1.9.4.(3) does not give permission for combustible traps and trap arms on one side of a vertical wall which is not a fire separation.

Reason for Decision

The Board supports Appeal Board decision #1365. "As in several previous appeals (see #1205, #1260 and #1280) it is the determination of the Board that Sentence 3.1.9.4.(3) is applicable and does not permit the kitchen waste arms or washing machine standpipes and p-traps to be of combustible plastic pipe because the DWV system penetrates fire separations. The Board recognizes that this Sentence is very restrictive and imparts unreasonable requirements on the DWV system but a code change is required to correct this problem."

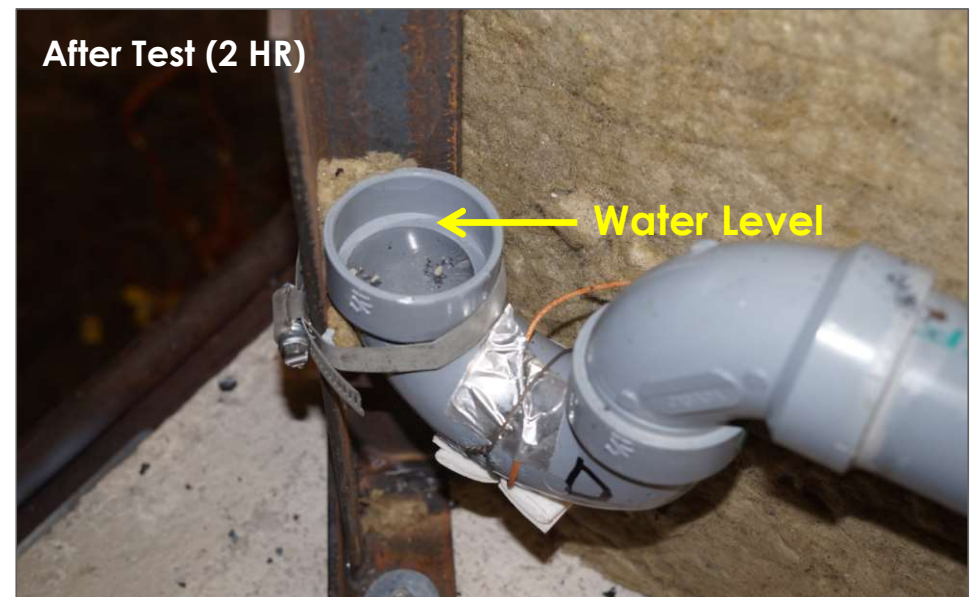
The Board acknowledges the continued ambiguity of Sentence 3.1.9.4.(5) and will bring this matter to the attention of the provincial regulators.



Condition of the P-Traps

P-Traps (above slab)

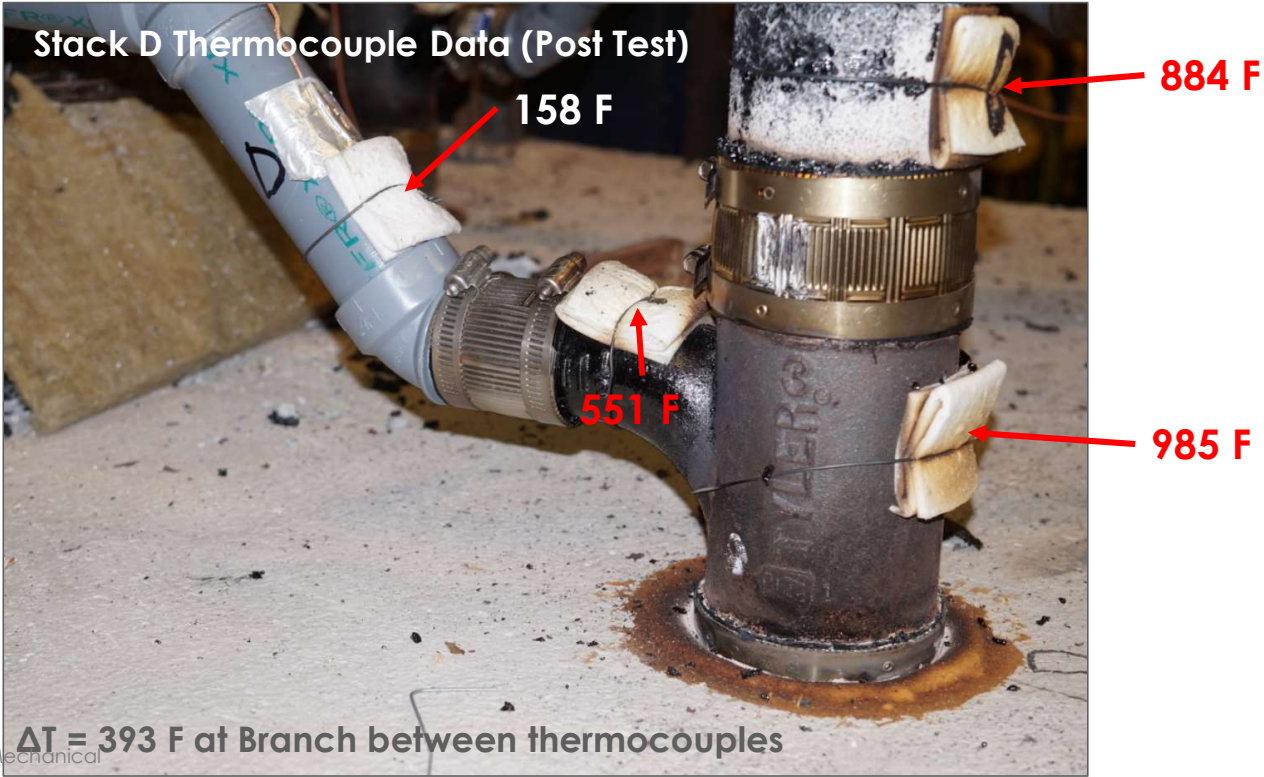
- After 2 hours, the temperature at the P-Traps **ranged from 116F to 163F** for all 3 slabs
 - The boiling point of water is 212F
 - The melting point of PVC is ~320F
- The traps **remained full** for the duration of the test
- **No passage of smoke** occurred through the P-Traps



Condition of the Plastic Pipe

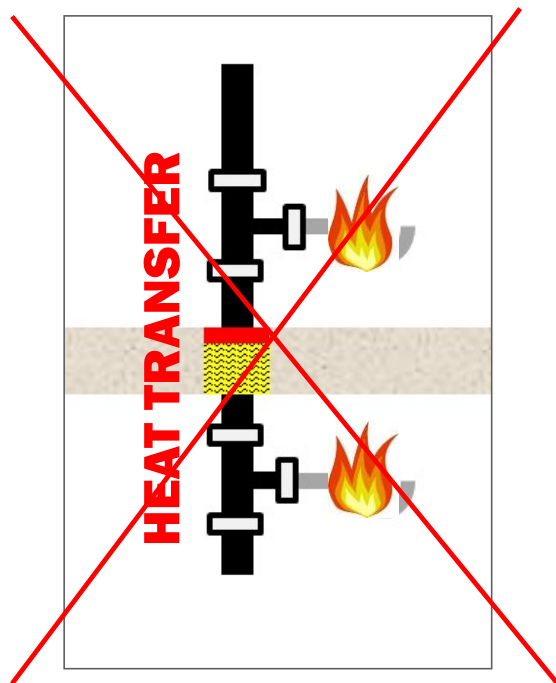
Pipe Transition (4" above slab)

- Visual inspection shows that System XFR at the pipe transition above the slab was unaffected by the fire in the furnace.

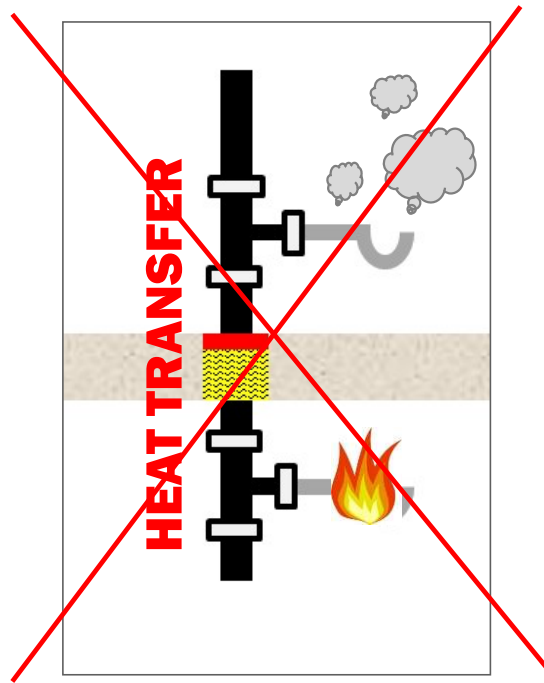


Test Results

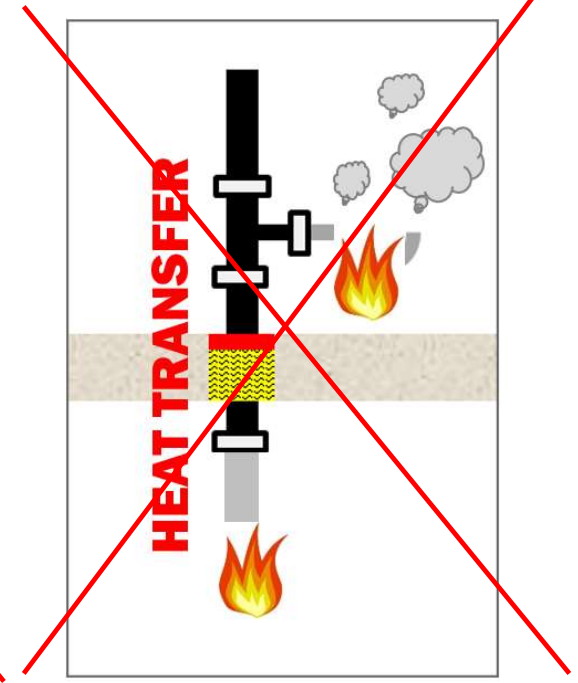
Assumption #1



Assumption #2



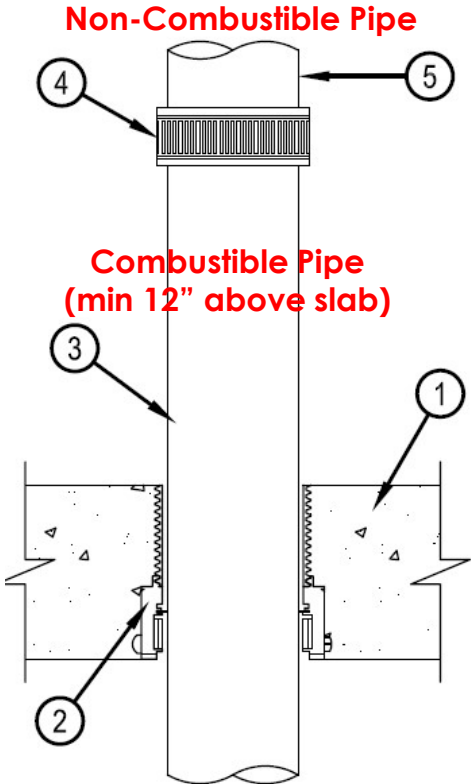
Assumption #3



Test Results

1. The level of water in the P-Traps was not affected by the fire.
2. PVC branches were not affected by the heat transfer passing through the separation to the unexposed side of the assembly.
 - Max recorded temperature on the PVC was 199 F (or ~62% of PVC's melt temperature)
3. The presence of a branch transition did not contribute to a breach of the horizontal fire separation.
4. PVC branches can be installed as close as 100mm (4") on either side of the concrete slab fire separation.
5. Testing was done with stack exposed (ie: no wall, rated or otherwise).

Stack Transition Listings



F-B-2009
(50 Pa)

Branch Transition Listing

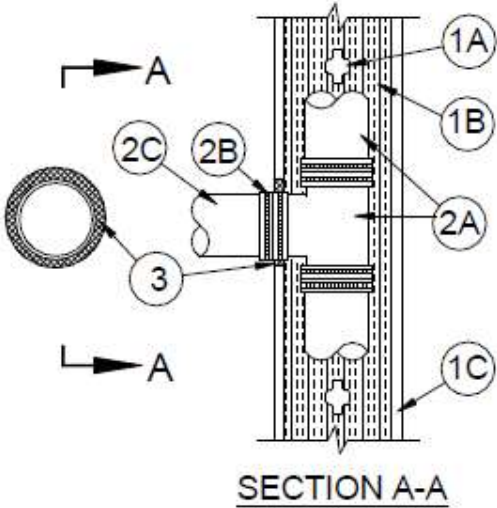
System No. W-L-1315

F Rating - 1 Hr

T Rating - 1 Hr

L Rating At Ambient – Less Than 1 CFM / Sq. Ft.

L Rating At 400°F – 3 CFM / Sq. Ft.



Areas for Improvement Regarding Transition Sentences

1. More firestop listings that incorporate cast iron drains which transition to combustible piping.
2. Appeal #1797 conclusion is proved incorrect by transition testing, must not be carried forward to 2024 BCBC.
3. Address conflict with Sentence 5.

5) *Combustible drain, waste and vent piping is permitted on one side of a vertical fire separation provided it is not located in a vertical service space.*

Firestop Exemption for Cast in Place Penetrants

2024 BCBC

3.1.9.1.

Firestops

1) Except as provided in Sentences (2) to (7) and Article 3.1.9.3., penetrations of a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* shall be

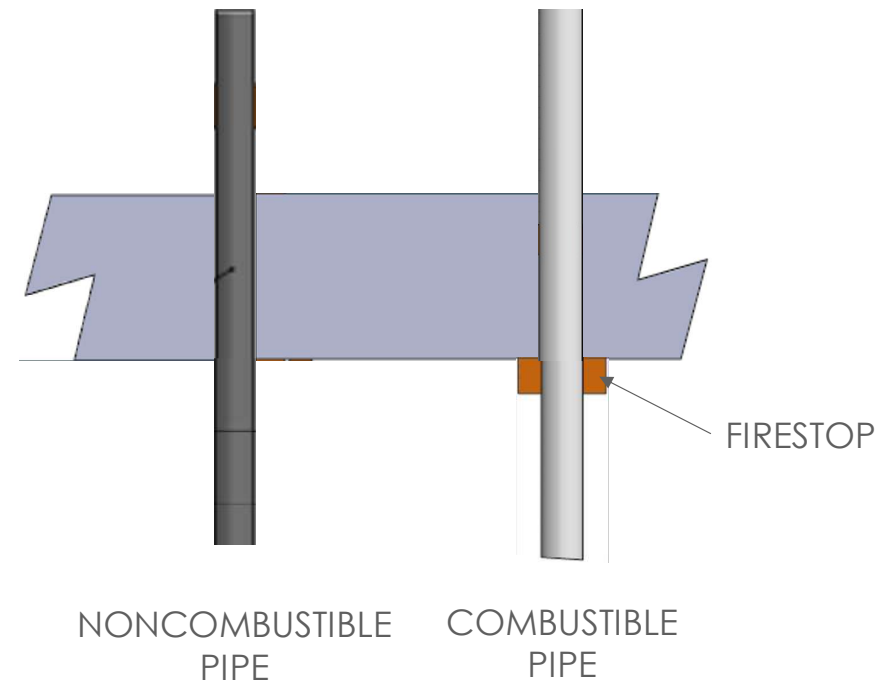
- a) sealed by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the required *fire-resistance rating* of the *fire separation*, or
- b) cast in place, where the item penetrating the *fire separation* is steel, ferrous, copper, concrete or masonry (see Note A-3.1.9.1.(1)(b)).

(See also Article 3.1.9.4. for requirements regarding penetrations by *combustible* drain, waste and vent piping.)

What Does it Mean

Firestop Exemption for Cast in Place Penetrants

- Combustible pipes need to be firestopped regardless of whether they are cast in or not.
- Code continues to evolve from the 'all noncombustible penetrant' perspective it started with.



Combustible Water Pipe Allowed in Vertical Service Spaces

2024 BCBC

3.1.9.4.

Combustible Piping Penetrations

1) Combustible sprinkler piping is permitted to penetrate a fire separation provided the fire compartments on each side of the fire separation are sprinklered.

2) Combustible water distribution piping is permitted to penetrate a fire separation that is required to have a fire-resistance rating, provided the piping is protected at the penetration with a firestop in conformance with Clause (4)(a) or (b).

3) Except as permitted by Sentences (4), (5), (7) and (8), combustible piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates

- a) a fire separation required to have a fire-resistance rating, or
- b) a membrane that forms part of an assembly required to have a fire-resistance rating.

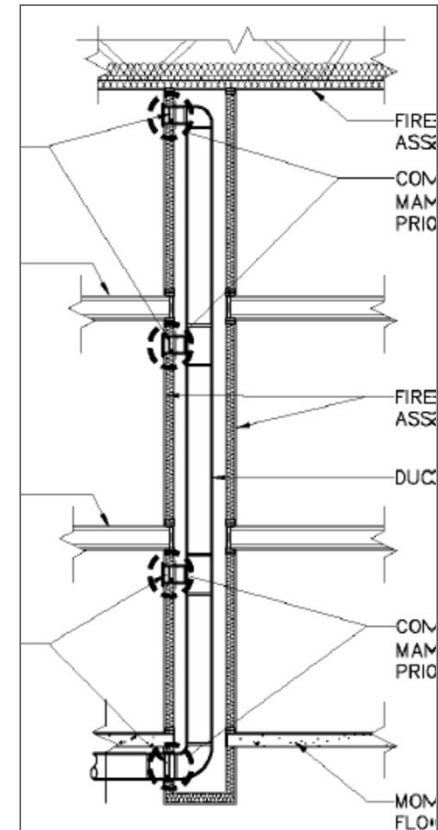
4) Combustible drain, waste and vent piping is permitted to penetrate a fire separation required to have a fire-resistance rating or a membrane that forms part of an assembly required to have a fire-resistance rating, provided

- a) except as provided in Clause (b), the piping is sealed at the penetration by a firestop that has an F rating not less than the fire-resistance rating required for the fire separation when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems,"
- b) in buildings more than 3 storeys in building height, the piping is sealed at the penetration by a firestop that has an F rating not less than the fire-resistance rating required for the fire separation when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and
- c) the piping is not located in a vertical service space.

Why the Change

Combustible Water Pipe Allowed in Vertical Service Spaces

- Ambiguous reference between the combustible potable distribution piping and DWV requirements.
- Led to assumption that plastic pipe of ANY type wasn't permitted in vertical service spaces.
- Fact that potable pipes generally assumed to be filled with water mitigates perceived life safety risk of plastic pipe in the vertical service space.



50Pa Waived Under 4-Storeys

2024 BCBC

3.1.9.4. Combustible Piping Penetrations

4) *Combustible* drain, waste and vent piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided

a) except as provided in Clause (b), the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems"

b) in *buildings* more than 3 *storeys* in *building height*, the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems" with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

c) the piping is not located in a *vertical service space*.

50Pa Waived Under 4-Storeys

2015 NBC

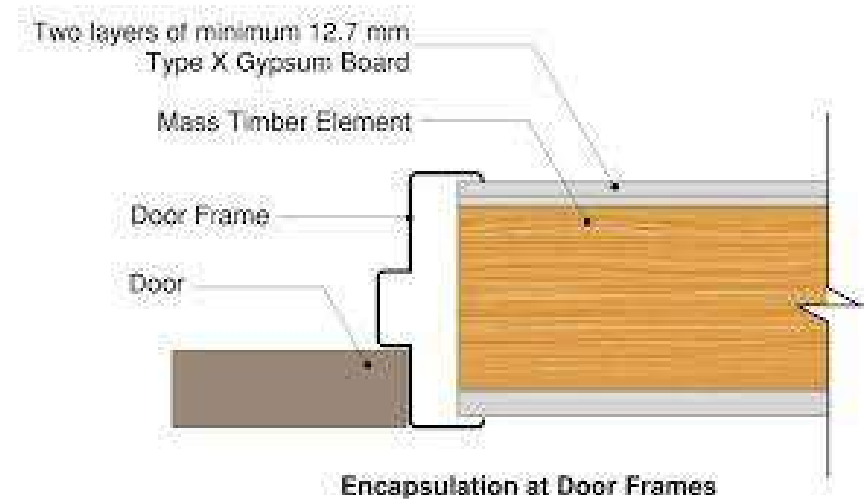
- 50Pa pressure differential across assemblies for combustible penetration listings was required for all penetrations regardless of building height.
- Current requirements **ignore the influence of building height on pressure differentials.**
- Findings from computer modeling done in the 1960's by Tamura to solve the pressure pattern in a 20-storey building have been **misapplied to low rise structures.**



ENCAPSULATED MASS TIMBER CONSTRUCTION

2020 NBC

- **EMTC is a new type of construction** in which a degree of fire safety is attained by the use of encapsulated Mass Timber elements with an Encapsulation Rating.
- All combustible and noncombustible material requirements in all codes still apply.
- **EMTC will be permitted as an alternative, or used in combination with, combustible and noncombustible construction up to 6-storeys.**
- **EMTC will be permitted as an alternative, or used in combination with, noncombustible construction from 7- to 12-storeys (Group C & D).**



PENETRATIONS THROUGH EMTC

2020 NBC

- Many resources available on EMTC including EMTC Practice Guideline from AIBC & EGBC.
- Consumption of encapsulation materials and char of mass timber make firestopping penetrations challenging.
- US listings are starting to come out for Structural Mass Timber, **but practically all penetrations require engineering judgements/alternate solutions in Canada.**

Hilti Corporation
Design Number HI/FF 120-09
Through Penetration
FS-ONE MAX Intumescent Firestop Sealant
ASTM E814, UL 1479
Rating: See Table 1
Pressure Differential: Positive, 0.01 in. w.g. (2.5 Pa)

HI/FF 120-09

TABLE 1. RATINGS

	ASTM E814, UL 1479
F-Rating	2 Hr
T-Rating	3/4 Hr

FIGURE 1. THROUGH PENETRATION FIRESTOP SYSTEM

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc.
Courtesy of Intertek Group
January 21, 2022

Intertek

Page: 1 of 2

What Does it Mean

NPC 2020 CHANGES OF NOTE

2.1.4.1.(1): Seismic Protection of Plumbing Systems

- Although the requirements of the NBC already apply to plumbing systems designed in conformance with the NPC, this change serves as a reminder to designers.

2.7.2: Introduces Requirements for Non-Potable Rainwater Harvesting Systems (NPRH)

- Changes enable the inclusion of NPRH systems within restructured Section 2.7.

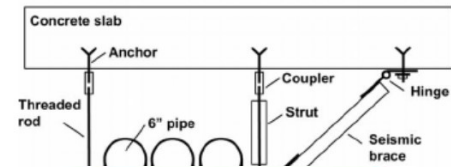


Table 2.2.5.15.
Permitted Uses of Polyethylene of Raised Temperature (PE-RT) Tube
Forming Part of Sentence 2.2.5.15.(2)

Type of Tube	Plumbing Purposes ⁽¹⁾								
	Drainage System		Building Sewer	Venting System		Potable Water System			
	Aboveground inside building	Underground under building		Above-ground	Under-ground	Cold	Hot	Under building	Outside building
PE-RT	N	N	N	N	N	P	P	P	P

What Does
it Mean

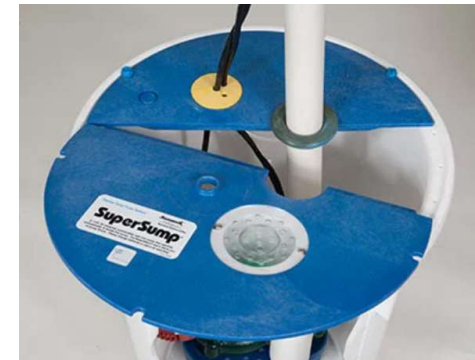
NPC 2020 CHANGES OF NOTE

2.4.6.3.(3): Minimization of Soil Gases

- Sump/tank collecting subsurface water to have airtight cover to prevent ingress of radon into the building.

2.2.5.16: Cellular Core PVC

- Adds cell core PVC schedule 40 DWV with grey pipe and fittings by referencing ASTM F3128 & CSA-B181.2.
- Limited to residential buildings with 1 or 2 dwelling units and row houses up to 3-storeys.



Cell core PVC must not be used in Part 3 buildings!!!

PVC Cell Core

– 2020 NPC/2024 BCBC Book II (Plumbing Systems)

2.2.5.16. Cellular Core PVC Pipe and Fittings

- 1)** Cellular core PVC pipe shall
 - a) conform to ASTM F3128, “Standard Specification for Poly(Vinyl Chloride) (PVC) Schedule 40 Drain, Waste, and Vent Pipe with a Cellular Core,” and
 - b) be light grey, as specified in CSA B181.2, “Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings.”
- 2)** Fittings and solvent cements for cellular core PVC pipe shall conform to CSA B181.2, “Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings.”
- 3)** Cellular core PVC pipe shall only be used in residential *buildings* containing 1 or 2 *dwelling units* and in row houses that do not exceed 3 *storeys* in height.

****Combustible Construction ONLY****

Thank you.



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