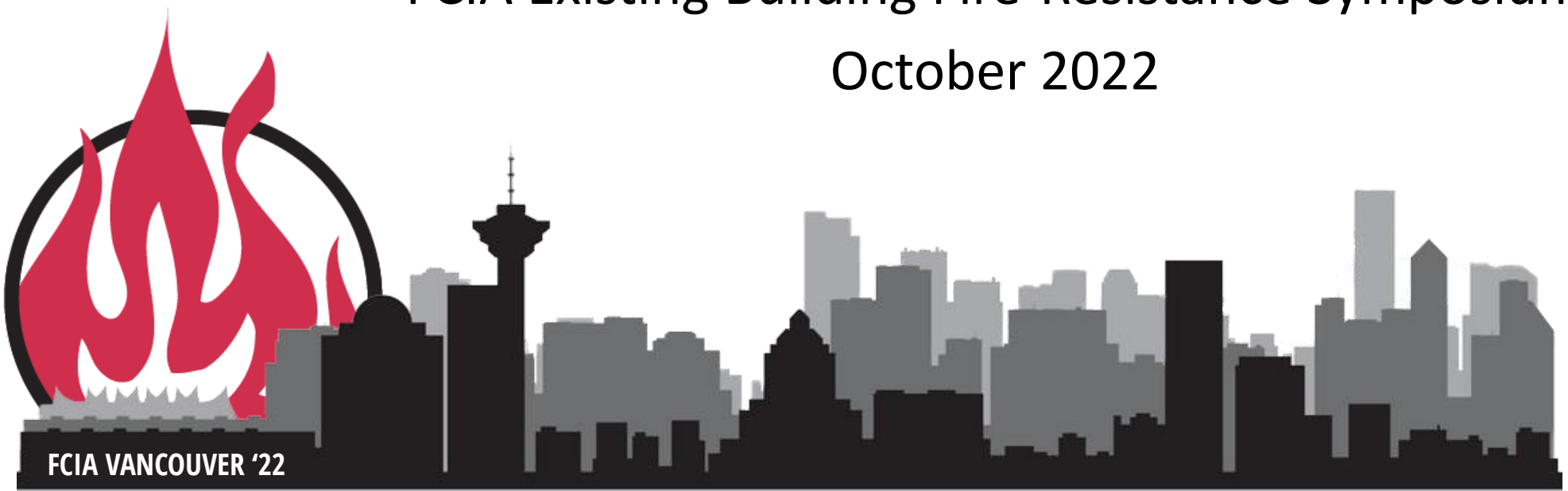
Firestopping Basics for Combustible Pipes

FCIA Existing Building Fire-Resistance Symposium

October 2022



Presenters

Scott Millburn (Aquatherm)

Matthew Winston (Hilti)

Cory Norman (IPEX)

Julio Lopes (STI)

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PIPE COMPATIBILITY WITH FIRESTOPPING MATERIALS

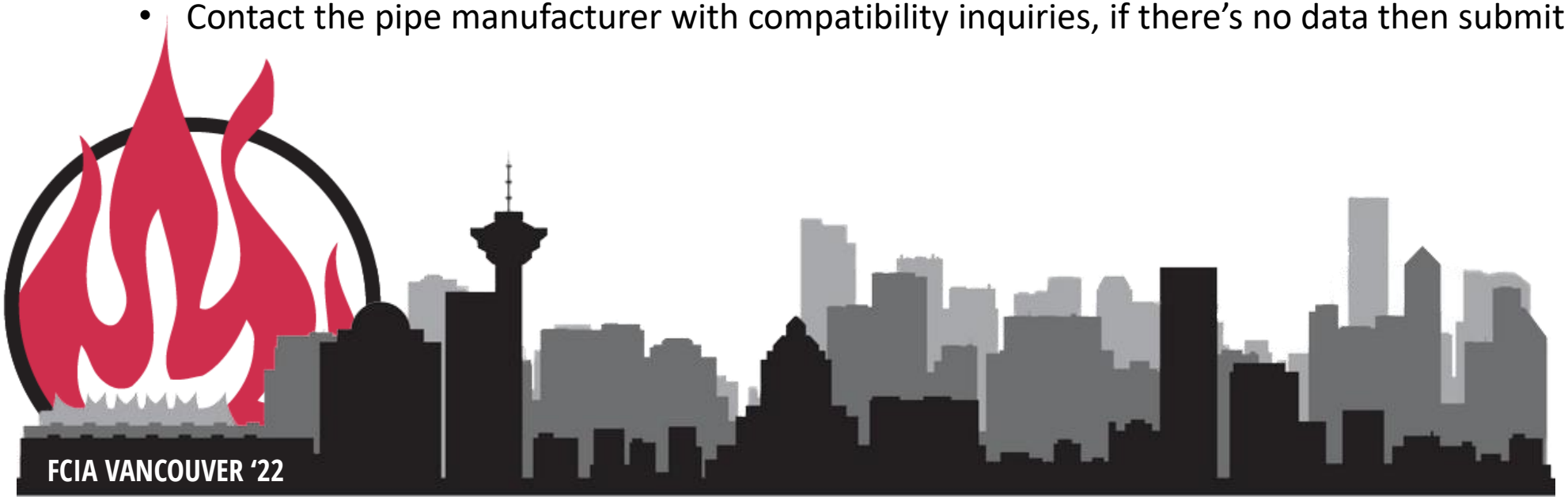
Pipe manufacturers have different approaches to addressing compatibility:

- Tables
- Searchable database
- Compatibility program

CPVC

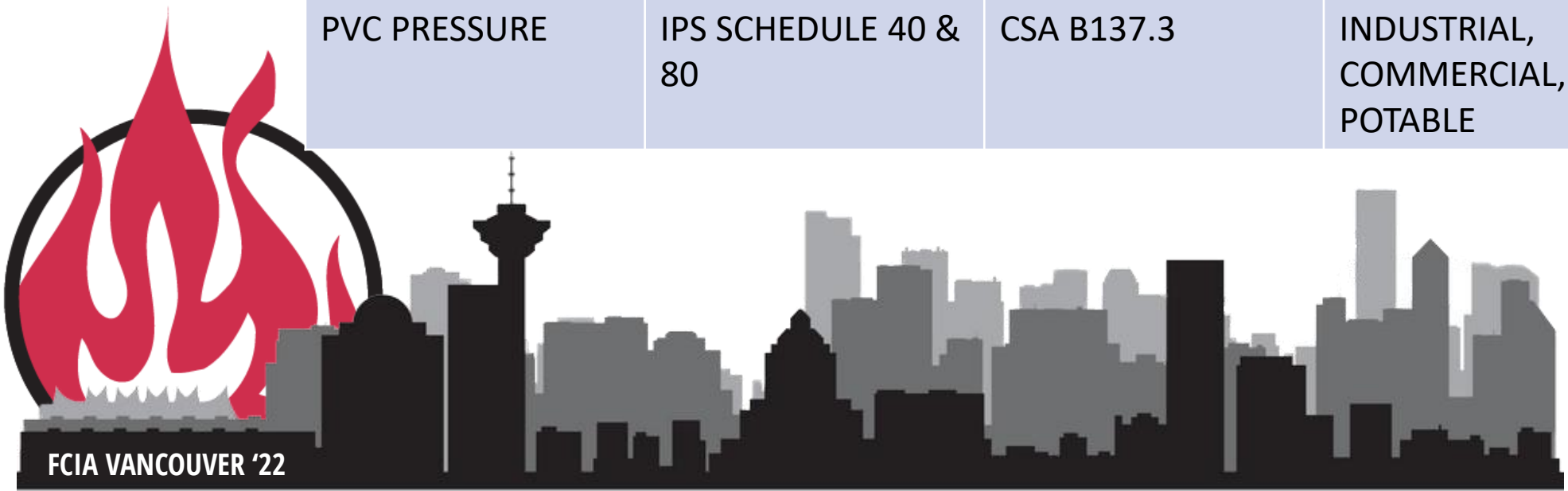
- pipes used for sprinkler, potable water, industrial applications typically has resin sourced from Lubrizol made with FlowGuard, BlazeMaster, Corzan, or TempRite Technology.
- Reference the FBC System Compatible Program from Lubrizol: https://www.lubrizol.com/CPVC/FBC-System-Compatible-Program

- Contact the pipe manufacturer with compatibility inquiries, if there's no data then submit for it to be tested.



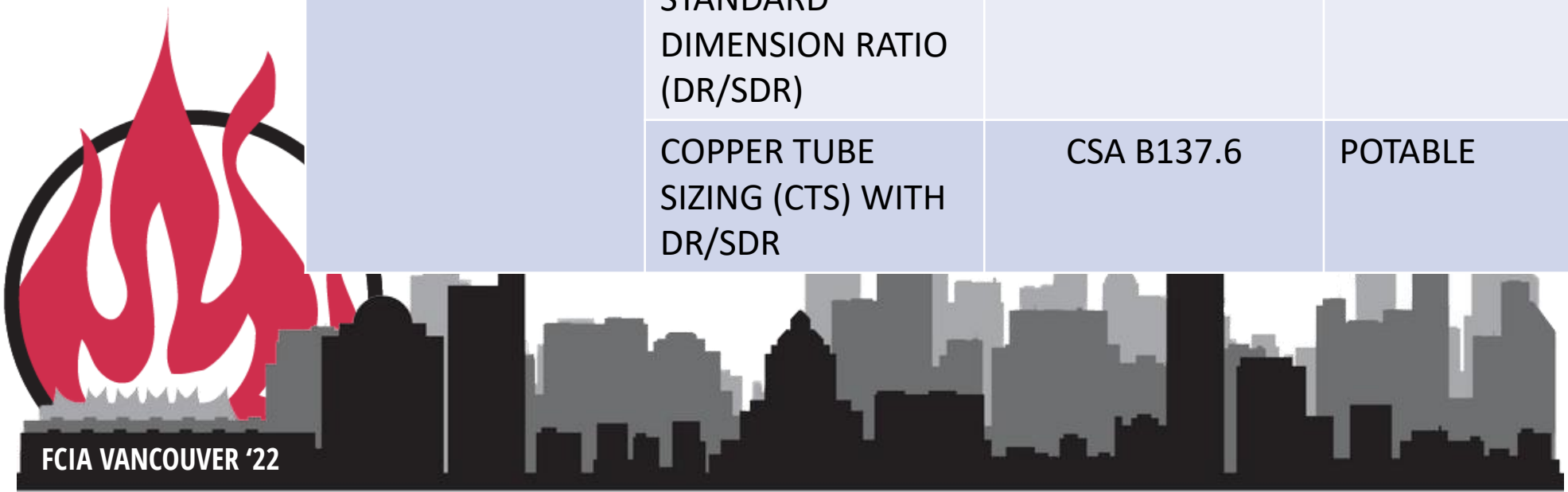
PLASTIC PIPE SIZING VS APPLICATION

MATERIAL	SIZING METHOD	STANDARD	APPLICATION
PVC DWV	IRON PIPE SIZE (IPS) SCHEDULE 40 SOLID WALL	CSA B181.2	DRAINAGE, WASTE AND VENTING
PVC DWV	IPS SCHEDULE 40 CELLULAR CORE	ASTM F3128	DRAINAGE, WASTE AND VENTING (SINGLE, DUPLEX, 3 STOREY ROW HOMES ONLY)
PVC PRESSURE	IPS SCHEDULE 40 & 80	CSA B137.3	INDUSTRIAL, COMMERCIAL, POTABLE



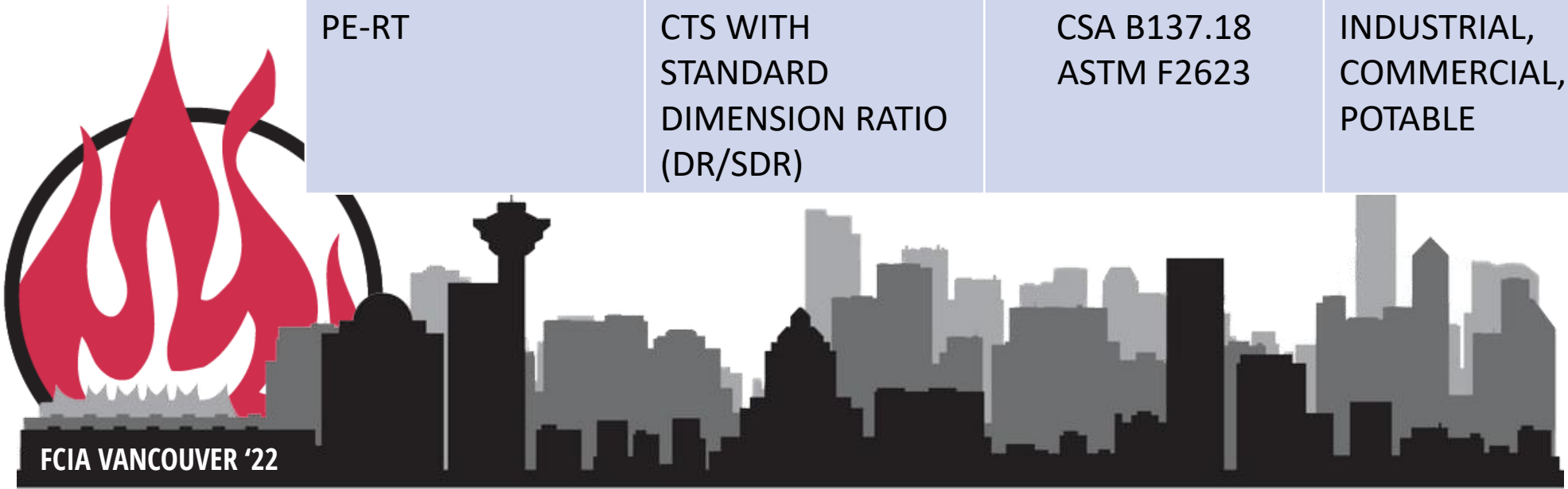
PLASTIC PIPE SIZING VS APPLICATION

MATERIAL	SIZING METHOD	STANDARD	APPLICATION
ABS DWV	IPS SCHEDULE 40	CSA B181.1	DRAINAGE, WASTE AND VENTING
ABS DWV	IPS SCHEDULE 40 CELLULAR CORE	ASTM F628	DRAINAGE, WASTE AND VENTING
CPVC PRESSURE	IPS SCHEDULE 40 & 80	ASTM F441	INDUSTRIAL, COMMERCIAL
	IPS WITH STANDARD DIMENSION RATIO (DR/SDR)	CSA B137.6	POTABLE
	COPPER TUBE SIZING (CTS) WITH DR/SDR	CSA B137.6	POTABLE



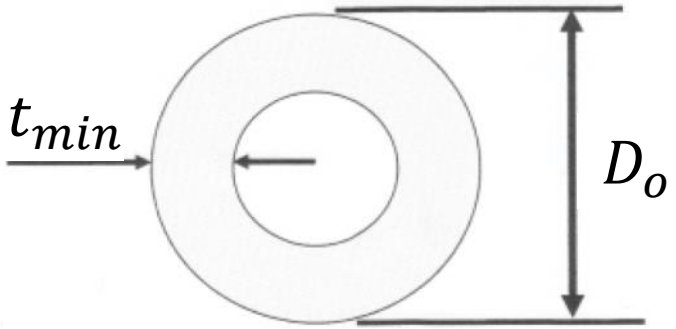
PLASTIC PIPE SIZING VS APPLICATION

MATERIAL	SIZING METHOD	STANDARD	APPLICATION
PP-R/PP-RCT	METRIC WITH STANDARD DIMENSION RATIO (DR/SDR)	CSA B137.11 ASTM F2389	INDUSTRIAL, COMMERICAL, POTABLE
PEX	CTS WITH STANDARD DIMENSION RATIO (DR/SDR)	CSA B137.5 ASTM F876	INDUSTRIAL, COMMERCIAL, POTABLE
PE-RT	CTS WITH STANDARD DIMENSION RATIO (DR/SDR)	CSA B137.18 ASTM F2623	INDUSTRIAL, COMMERCIAL, POTABLE



DIMENSION RATIOS EXPLAINED

- DR = Dimension Ratio
- SDR = Standard Dimension Ratio
  - Relationship between outside diameter and wall thickness.
  - Inverse relationship, higher SDR = thinner wall, decreased pressure rating
  - Same maximum operating pressure and pipe stiffness for same DR/SDR for all diameters (schedule pipe pressure changes based on diameter)

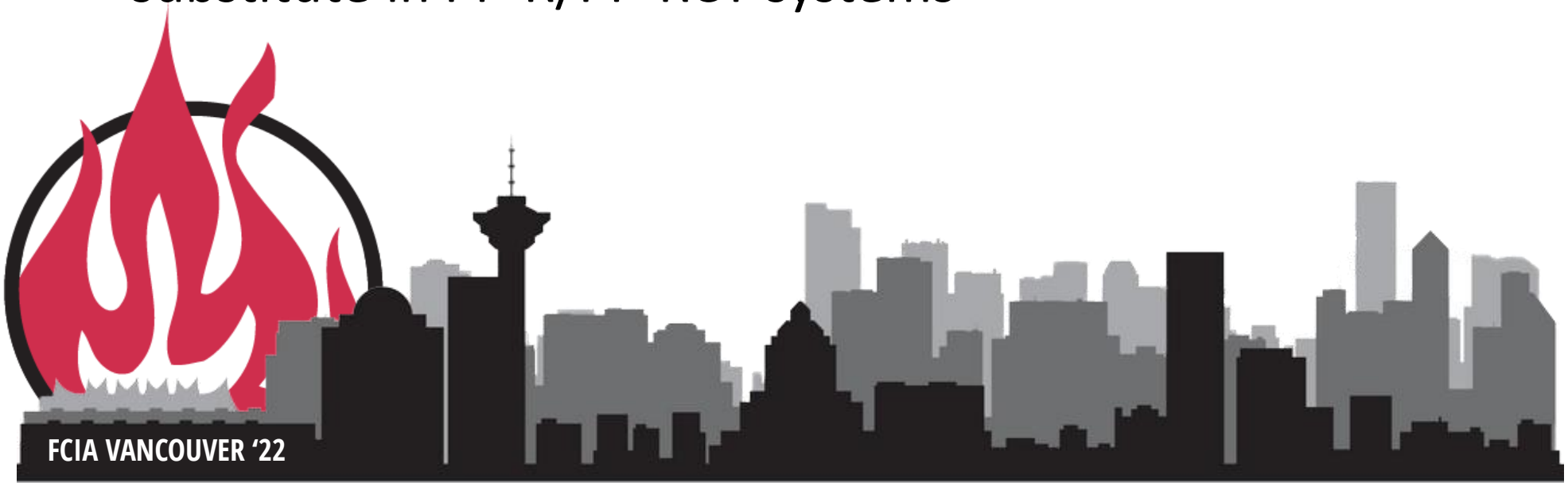


$$DR = SDR = \frac{D_o}{t_{min}}$$

COMMON MISTAKES APPLYING FIRESTOP LISTINGS

Standard PVC vs System XFR

- System XFR uses a PVC resin, but the compound that gives the 25/50 flame and smoke performance changes the fire behavior of the pipe.
- System XFR must be stated explicitly in the firestop listing, do NOT use a generic PVC firestop listing for System XFR!!
- Fire resistant acid waste polypropylene pipe listings cannot be used as a substitute in PP-R/PP-RCT systems

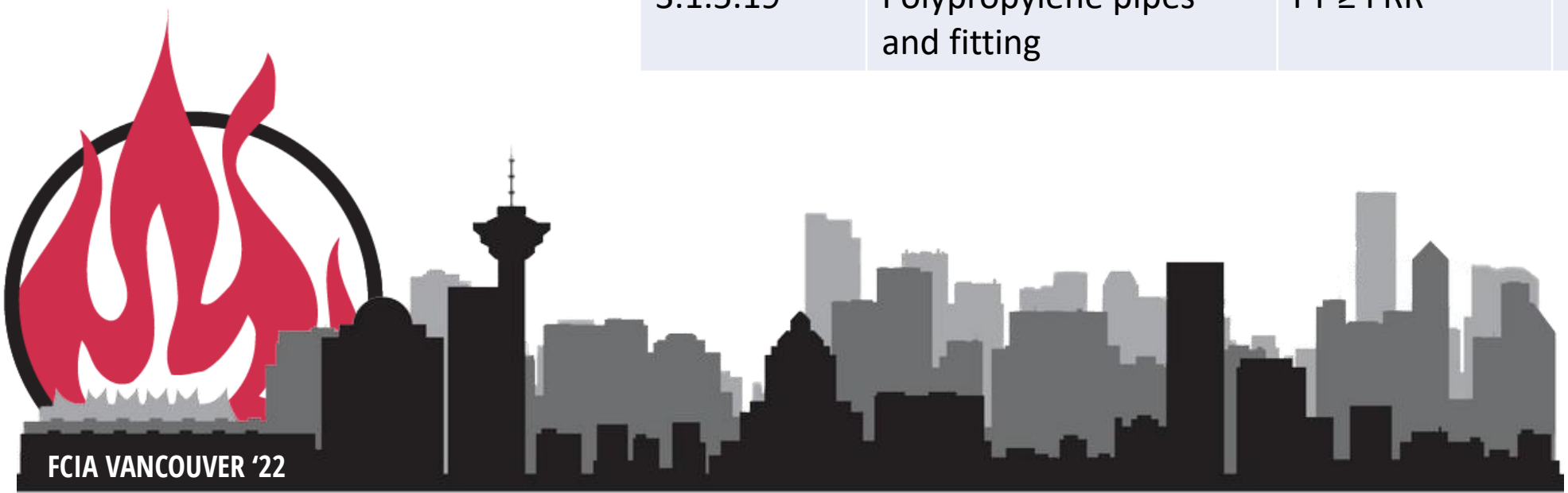


Penetration Test Requirements Unique to Canada

Standard (CAN/ULC S115) Imposed

- All pipes tested as vented (open) piping systems

NBC Code Article	Type/Application	Rating Required	50 Pa?
3.1.9.5.(2)	Water Distribution	F ≥ FRR	Yes
3.1.9.5.(4)	Drain, waste and vent piping	F ≥ FRR	Yes
3.1.9.5.(6)	Central vacuum systems	F ≥ FRR	Yes
3.1.5.19	Polypropylene pipes and fitting	FT ≥ FRR	Yes



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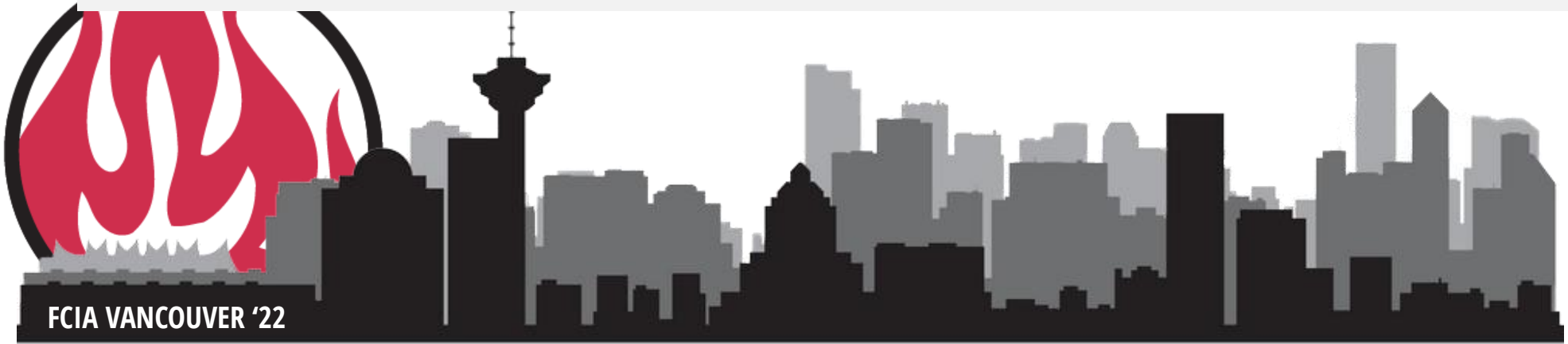
Penetration Test Requirements Unique to Canada

- Always testing pipes as vented – interesting given real-world applications. Neither ASTM nor EN standards place this restriction
  - Also affects metallic pipes systems – shower drain membrane penetrations for example
- 50 Pa – The only place in a building where this pressure is expected to be reached – shaft stairwells
  - A fire in a stairwell is a complete life safety system failure that goes beyond firestop
- CAN/ULC S101 does not have a positive pressure – fire resistance rating for walls/floors
- Following slides compare a closed pipe system vs. an open pipe system at 50 Pa



Closed Pipe System Example (UL F-A-2322) - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 2.5 Pa

Exposed side view before fire endurance. Shows pipe closed on exposed side. Firestop block solution.

Nonexposed side view before fire endurance showing pipe closed on exposed side.

Nonexposed side view before fire endurance.

Closed Pipe System Example (UL F-A-2322) - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 2.5 Pa

Nonexposed side, end of fire endurance

Nonexposed side, end of fire endurance

Nonexposed side, post fire endurance

Closed Pipe System Example (UL F-A-2322) - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 2.5 Pa

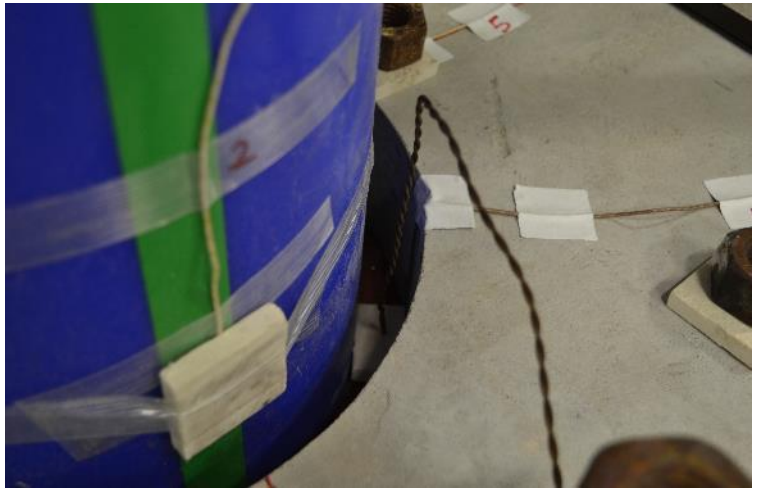
Exposed side, end of fire endurance

Exposed side, post hose stream

Nonexposed side, post hose stream

Vented Pipe System Example - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 50 Pa

Exposed side, before fire endurance. Pipe capped on exposed side. Solution same as cUL C-AJ-2836, wrap strip housed in metal enclosure.



Nonexposed side, before fire endurance

Nonexposed side, fire endurance, pipe has not fully vented

Vented Pipe System Example - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 50 Pa

Nonexposed side, pipe vented at 45 minutes

Exposed side, post fire endurance (46 minutes). Damage to steel enclosure from expanding intumescent

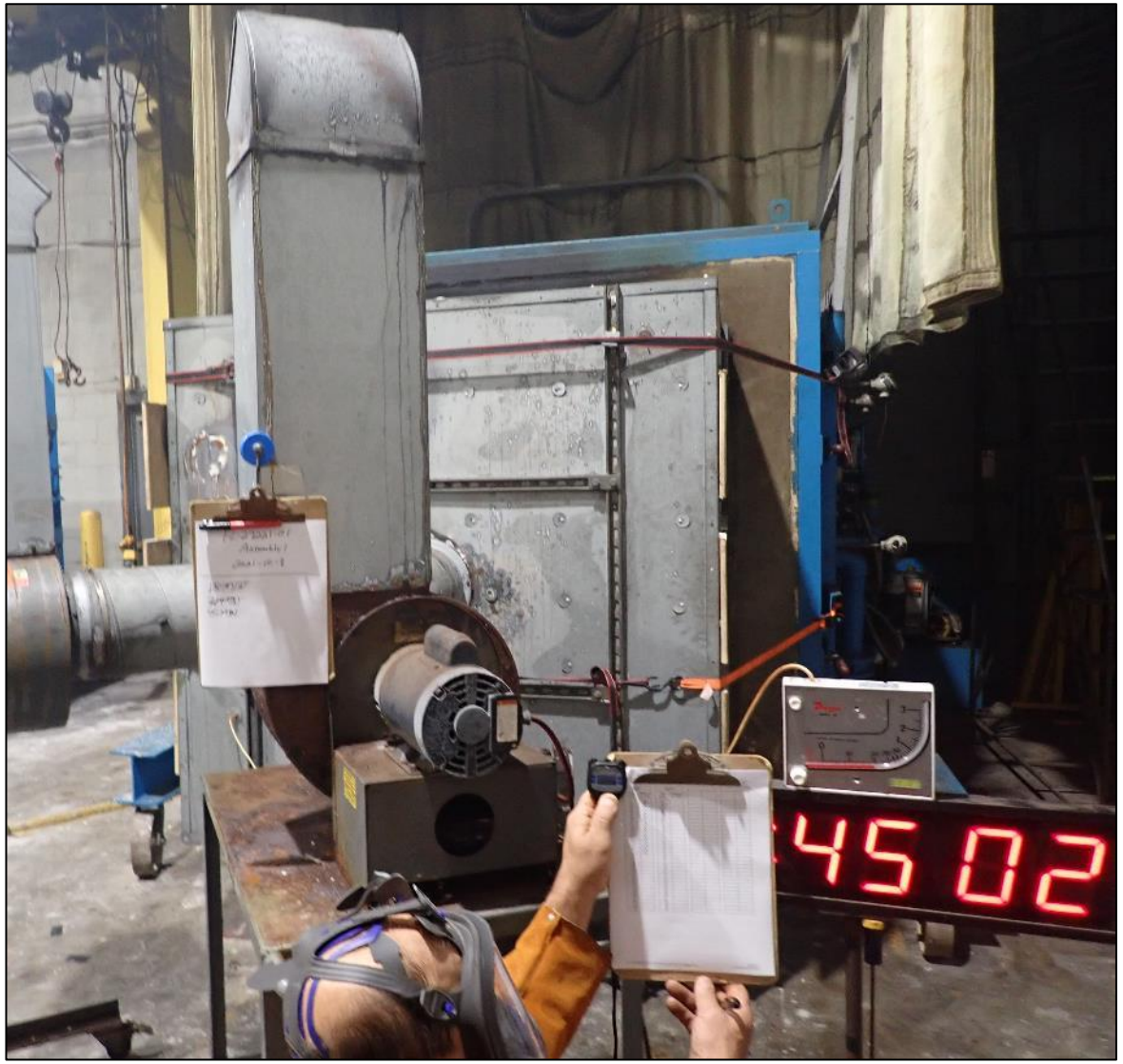
Exposed side, post fire endurance (46 minutes). Damage to steel enclosure from expanding intumescent

Vented Pipe System Example - Nominal 12” (315mm OD) Aquatherm Bluepipe (SDR 11), 50 Pa

Nonexposed side, post fire endurance, showing pipe left open/vented

- The same pipe behaves entirely differently when closed vs. when open
  - It would likely pass if closed and tested at 50 Pa.
- Pipes designed to be closed (pressure, distribution) are more robust than pipes designed to be open
  - Adding 50 Pa adds further severity for any nonmetallic pipe test

50 Pa Suck Box Test – Gypsum wallboard walls



Suck Box (3 Pa in furnace + 47 Pa in box) @ 45 minutes

Pipes on Unexposed Side After 2 hours

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50 Pa Suck Box Test – Gypsum wallboard walls

Closer Look of Pipes on Unexposed Side After 2 hours

50 Pa Suck Box Test – Gypsum wallboard walls

Exposed Side After 2 Hours

Hose Stream Test after 2 Hours
38 Seconds @ 30 PSI

General guidelines for firestopping 50 Pa

- Difficult to give based on the code requirement and test standard complexities.
- Up to 2” Trade Size Pipes (or smaller) may be protected with sealant only.(SYSTEMS)
  - Not for every pipe type or application.
  - Generally, for PVC & XFR or CPVC (@2.5 Pa)
- 3 to 4” Trade Size Pipes (or smaller) may be protected w/wrap strip tuck-in SYSTEMS.
  - Firestop Collar a better option.
- 4” Trade Size Pipes (or larger) should be protected with firestop collar SYSTEMS.
- Ensure that pipe type and size are clearly referenced in the Listing or Judgment.

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General guidelines for firestopping 50 Pa

Some variables to consider that can affect performance.

- Pipe type
- Pipe Wall Thickness
- Opening Diameter
- Firestop Positioning
- Wall or Floor Test
- Concrete Floor Thickness

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Complexities of testing for Canadian Market

- Canada has many new/diverse sets of plastic pipes.
  - XFR, HRS-2550, NAPSYS – HR PVC, Aquatherm, Niron PP-RTC, Etc.
- 50 Pa testing is very critical, and any minor change can affect performance.
- UL will therefore only list the specific type and manufacturer of pipes that are tested.
- Tests are critical so less penetrations are generally tested per assembly.
- And success rate is lower than non-50 Pa testing.
- Pace of new systems is slower than we would like.

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