Presentation to Fire Stop Contractors
Edmonton, Alberta

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Outline

• Introduction and QAI overview
• Why and how are products tested and certified
  – Code requirement
  – Building code who publishes and how is it adopted by each province
  – Connection to SCC and accreditation requirements
• Canadian Requirements
  – Brief history of fire resistance testing
  – Overview of furnace and testing
  – Review of CAN/ULC S115
• US Requirements
• Questions
Who is

YOUR GLOBAL PARTNER FOR INDEPENDENT THIRD-PARTY TESTING, INSPECTION AND CERTIFICATION
WHO IS QAI

Founded in 1994 QAI has grown to be one of the leading Building Products testing, Inspection and certification companies in North America. We have over 100 engineers, technician and support staff.

Five Laboratories around North America
A new alternative to UL or Intertek.

QAI accreditations provide acceptance in the US and Canada and it close affiliation with agencies like ICC-ES and CCMC help insure it can provide market access for the widest range of clients.
QAI SERVICES

QAI OFFERS A WIDE VARIETY OF TESTING, INSPECTION AND CERTIFICATION SERVICES. OUR CORE CATEGORIES INCLUDE:

- BUILDING PRODUCTS
- EMC/EMI
- FIRE TESTING
- PHYSICAL & MECHANICAL PROPERTIES
- ELECTRICAL
- RV & TRAILER
- PLUMBING
ELECTRICAL

OFFERING A FULL SPECTRUM OF ELECTRICAL TESTING, INSPECTION AND CERTIFICATION SERVICES, QAI ACCURACY, TIMELINESS AND FLEXIBILITY ALLOW YOU TO EXPEDITE YOUR PROCESS TO MARKET.
EMC/EMI

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). More than just a testing facility – QAI is your regulatory compliance partner.
FIRE TESTING

With a wide range of testing services: flammability and fire resistance, ignition, burn rate, smoke density, radiant panel, toxicity, combustibility, QAI can help deliver accreditation data specific to your accreditation needs.
RVS & TRAILERS

All facets of RV & Auto industry accreditation must be timely, accurate and on-budget. Let QAI help walk you through the process.
PHYSICAL & MECHANICAL PROPERTIES

QAI'S TESTING LABS EMPLOY THE LATEST EQUIPMENT FOR TESTING PHYSICAL AND MECHANICAL PROPERTIES FOR RECOGNIZED CSA, UL, ANSI, IAPMO AND NSF STANDARDS.
PLUMBING

QAI can perform virtually any plumbing test in our laboratories to recognized CSA, UL, ANSI, IAPMO and NSF standards. We also accept data from accredited labs making transferring certification certification reports from other agencies a piece of cake.
QAI ACCREDITATIONS
WHY YOU CAN RELY ON QAI

- NRTL ACCREDITED
- STANDARDS COUNCIL OF CANADA (SCC) ACCREDITED
- AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
- INTERNATIONAL ACCREDITATION SERVICE (IAS) ACCREDITED
  - INSPECTION
  - TESTING
  - CERTIFICATION
INSPECTIONS

QAI PROVIDES A WIDE RANGE OF ISO 17020 ACCREDITED INSPECTION SERVICE GLOBALLY TO SUPPORT ITS OWN CERTIFICATION SERVICES AS WELL AS OTHER PROVIDING COST EFFECTIVE, PROFESSIONAL INSPECTION SERVICES TO A VARIETY OF OTHER AGENCIES.
FIRE RESISTANCE TESTING

QAI conducts a wide variety of fire testing to support code approvals of building products. Tests are primarily conducted at our Burnaby, Rancho and Tulsa facilities.
Burnaby, B.C. Canada

THE CORPORATE HEAD OFFICE OF QAI IT IS THE ENGINEERING CENTER AND DOES FULL SCALE ULC S101 / ASTM E119 TESTING AS WELL AS A HOST OF OTHER FIRE RESISTANCE TEST FOR HORIZONTAL AND VERTICAL WALLS, PENETRATIONS AND FLOOR CEILING ASSEMBLIES

ULC S 101 FIRE ENDURANCE OF BUILDING CONSTRUCTION AND MATERIALS
ULC S104 FIRE TESTS OF DOOR ASSEMBLIES
ULC S105 FIRE DOOR FRAMES
ULC S106 FIRE TESTS OF WINDOW AND GLASS BLOCK ASSEMBLIES
ULC S112 FIRE TEST OF FIRE-DAMPER ASSEMBLIES
ULC S115 STANDARD METHOD OF FIRE TESTS OF FIRESTOP SYSTEMS
RANCHO
CUCAMONGA, CA

OUR LA AREA OFFICE CONDUCTS A WIDE VARIETY OF PHYSICAL TESTS ON BUILDING PRODUCTS AND SPECIALIZES ON BOTH LARGE AND SMALL SCALE FLAMMABILITY TESTING SUCH AS ULC S102 /ASTM E84, E108, E136, UL 723, NFPA 701 TO NAME A FEW
ULC S102 TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS AND ASSEMBLIES
ULC S107 FIRE TESTS OF ROOF COVERINGS
ULC-S126 FIRE SPREAD UNDER ROOF-DECK ASSEMBLIES
TULSA, OK

TULSA CONDUCTS THE MAJORITY OF OUR FIRE TESTING AND WE ARE IN THE PROCESS OF BUILDING A CUSTOM 30,000 SQFT FACILITY TO EXPAND THIS. TESTING INCLUDES A WIDE RANGE OF MATTRESS AND OTHER FLAMMABILITY TESTING. WHEN COMPLETED THIS SITE WILL ALSO OFFER ASTM E119 VERTICAL / HORIZONTAL, NFPA 285 AND OTHER LARGE SCALE BURNS.

ULC S102 TEST FOR SURFACE BURNING CHARACTERISTICS OF B.M.
ULC S127 CORNER WALL METHOD OF TEST FOR FLAMMABILITY CHARACTERISTICS ON NON-MELTING FOAM PLASTIC BUILDING MATERIALS
ENGINEERING AND LISTINGS

WITH A NUMBER OF THE LEADING EXPERTS IN OBTAINING CODE APPROVALS QAI WORKS CLOSELY WITH AGENCIES LIKE ICC-ES AND CCMC FOR OBTAINING APPROVALS FOR NEW AND INNOVATIVE PRODUCTS THROUGH OUT NORTH AMERICA.
How the Canadian Code Compliance system Works

- Who sets the Rules for how you can build a building?
- Who sets the Rules for what products are acceptable and how are they tested?
- How are the Rules Enforced (Testing and Certification of products)
- Are there options to the above Rules?
Canadian National Standards System

In many ways Canada has a very good and integrated system

- We have a system for writing one consensus model Code that is adopted by various Provinces and Territories (with or without provincial deviations)
- We have a national system for identifying who and can write standards and in what areas they can write standards
- We have a national system that accredits Agencies that can approve products to Canadian recognized standards. (Certification Bodies or CB’s)
  - This allows all CB’s to play by the same rules and user to have confidence in different CB’s
  - It provides one place to see who is acceptable
  - Requires the CB’s to meet unique Canadian requirements
  - Requires product labels to be in both official languages
  - Requires to CB’s to attend annual meetings with the AHJ’s of each Province
Canadian National Standard System

• NBC – National Building Code of Canada
  – Developed by the Canadian Commission on Building codes and Fire codes
  – Independent body made of interested groups from across the country
  – Publish National Model Codes, thought NRC that are then adopted by the provinces and becomes regulation

• NBC establishes minimum requirements
  must relate too: in code or in reference standards
  – Safety
  – Health
  – Accessibility for persons with Disabilities
  – Fire and structural protection of buildings
  – environment

• NBC does not deal with who is responsible assessing conformity
  This responsibility is usually established by Government Legislation by each Province or Territory
Who Qualifies Agency to Write Standards or Test and Certify Products

• NSS – is a federation of accredited organizations concerned with standards development, certification, testing and inspection
  – Generally strives to have only once Code or Standard for an application

  – Standards Writing Organizations SWO (8) ISO/IEC Guide 59
  – Certification Organizations CB’s (36) ISO 17065
  – Testing Agencies TL’s (344) ISO 17020
  – Registration Organizations Varies depending on scope

• All Provinces and Territories have recognized SCC as the acceptable accrediting agency for Standards Writing and Certification organizations.

• AHJ, CB’s and SWO meet once a year to discuss issues (Fire, Plumbing, Gas …)
What does SCC do

• SCC accesses and then on an ongoing bases audits agencies to validate that they are proficient in the areas of their published scope.

• For Testing and Certification SCC will determine if:
  – You are independent
  – Do you have staff knowledgeable to make testing and certification decisions
  – Do you have a document quality system that is followed and meets the applicable ISO requirements (ISO 17025, ISO 17065 etc.)
  – Do you have the required test equipment
    • Is the equipment calibrated and maintained
  – Can you do inspections to verify products are the same as tested
  – Do you have procedures to take action if a product is not compliant
  – Do you have a recognized mark you control
  – Do you have a public listing of approved manufacturers or products
Contrast to the United States

The US is similar to Canada but there are more options and hence more confusion:

• While in the past the US had a number of different Building codes by enlarge the major Building code in the US is now the International Building Code (IBC)
• With respect to standards there is much more Variation with multiple SWO producing standards for the same product. This is not that bad for Firestopping with ANSI/UL 1479 and ASTM E814 but in other areas NFPA, UL, ASTM and other all publish similar standards for the same product.
• For Product Certification there is no one accreditation agency like SCC but there are a number IAS, ANSI, A2LA and OSHA. For some products relating to Work place Safety OSHA is the primary agency.
• There is no Central Regulatory group or council to discuss common issues between Accrediting agencies, AHJ and CB’s
Canadian National Building Code (NBC)

• NBC is an Objective Based code (3 sections)
  Division A—defines the scope and objectives
  – Objectives define the goals the NBC is intended to achieve
    • OS1.2 Fire or explosion impacting areas beyond its point of origin
  – Functional statements are more detailed than objectives and they describe conditions in the building that help satisfy the objectives.
    • F01 To minimize the Risk of accidental ignition
    • F02 To limit the severity and effects of effects of a fire or explosion
    • F03 To retard the effects of fire on areas beyond its point of origin
National Building Code (cont.)

Division B – Acceptable Solutions (technical requirements)

• Traditional code – details tried and true methods

3.1.9.1 Fire Stops

1) Except as provided in Sentences (2) to (5) and Article 3.1.9.4., 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 fire stop that when subjected to the fire test method in CAN/ULC S115 “Fire Tests of Firestop Systems” has an F rating not less than in conformance with Table 3.1.8.4

Division C – Administrative Procedures

• Generally who can do design work and the type of information required
Requirements for Fire Stopping (Div A)

• Based on Division A – the Objective requirements of the code Fire stopping is expected to:
  • Fire Safety
    – OS1.1 - Fire or explosion Occurring
    – OS1.2 - Fire or Explosion impacting areas beyond its point of Origin
    – OS1.4 - Fire safety system failing to function as expected
    – OS1.5 - Person being delayed in or impeded from moving to a safe place during a fire emergency
  • Structural Safety
    – OS2.3 - Damage to or deterioration of building elements
• Also requirements, must be safe, minimize noise, not effect other performance of the membrane.
3.1.9.1 Fire Stops

1) Except as provided in Sentences (2) to (5) and Article 3.1.9.4., 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 fire stop that when subjected to the fire test method in CAN/ULC S115 “Fire Tests of Firestop Systems” has an F rating not less than in conformance with Table 3.1.8.4
   b) cast in place (Service penetration through concrete- no gaps between building service and membrane)

Table 3.1.8.4

<table>
<thead>
<tr>
<th>Fire Resistance Rating of Fire Separation</th>
<th>Minimum Fire-Protection Rating of Closure</th>
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<tbody>
<tr>
<td>45 min</td>
<td>45 min</td>
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<tr>
<td>1 h</td>
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<tr>
<td>3 h</td>
<td>2 h</td>
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<tr>
<td>4 h</td>
<td>3 h</td>
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</tbody>
</table>
Specific Requirements for Fire stopping (cont.) Exceptions

2. Penetrations of a firewall or a horizontal fire separation that is required to have a fire-resistance rating in conformance with Article 3.2.1.2. shall be sealed at the penetration by a fire stop that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an FT rating not less than the fire-resistance rating for the fire separation.

3. Penetrations of a fire separation in conformance with Sentence 3.6.4.2.(2) (Horizontal Service Space) shall be sealed by a fire stop that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an FT rating not less than the fire-resistance rating for the fire separation of the assembly.

4. Sprinklers are permitted to penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating without having to meet the fire stop requirements of Sentences (1) to (3), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Installation of Sprinkler Systems."

5. Unless specifically designed with a fire stop, fire dampers are permitted to penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating without having to meet the fire stop requirements of Sentences (1) to (3), provided the fire damper is installed in conformance with NFPA 80, "Fire Doors and Other Opening Protectives."

- Fire separation – a construction assembly that acts as a barrier to the spread of fire
- Firewall type of fire separation of non-combustible construction that subdivides a building or separate buildings
Combustibility of Service Penetrations

3.1.9.2 Except as permitted by Articles 3.1.9.3. and 3.1.9.5., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a fire-resistance rating shall be noncombustible, unless the assembly was tested incorporating that service equipment.

• 3.1.9.3

1) Optical fibre cables and electrical wires and cables in totally enclosed noncombustible raceways are permitted to penetrate an assembly required to have a fire-resistance rating without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2.
3.1.9.4 Penetration by Outlet Boxes

1) Except as provided in Sentence (2), outlet boxes are permitted to penetrate the membrane of an assembly required to have a fire-resistance rating, provided they are sealed at the penetration by a fire stop that has an FT rating not less than the fire-resistance rating of the fire separation when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems."

2) Except as provided in Sentences 3.1.9.1.(2) and (3), noncombustible outlet boxes that penetrate a vertical fire separation or a membrane forming part of an assembly required to have a fire-resistance rating are permitted to be waived, provided a) they do not exceed
   i) 0.016 m$^2$ in area, and
   ii) an aggregate area of 0.065 m$^2$ in any 9.3 m$^2$-of surface area, and
   b) the annular space between the membrane and the noncombustible electrical outlet boxes does not exceed 3 rom.

3) In addition to the requirements of Sentence (2), outlet boxes on opposite sides of a vertical fire separation having a fire-resistance rating shall be separated by
   a) a horizontal distance of not less than 600 rom, or
   b) a fire block conforming to Article 3.1.11.7.
3.1.9.5 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 without being incorporated the assembly at the time of testing as required by Article 3.1.9.2., provided the piping is protected at the penetration with a fire stop in conformance with Sentence (4).

3) Except as permitted by Sentences (4) to (5), 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 rating.
3.1.9.5 Combustible Piping
Penetrations Cont.

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) the piping is sealed at the penetration by a fire stop 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, "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
   b) the piping is not located in a vertical service space.

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.

6) Combustible piping for central vacuum systems is permitted to penetrate a fire separation provided the installation conforms to the requirements that apply to combustible drain, waste and vent piping specified in Sentence (4).
Product Testing and Evaluation
Testing for Canada and the US are essentially the same

- ULC S101 STANDARD METHODS OF FIRE ENDURANCE TESTS OF BUILDING CONSTRUCTION AND MATERIALS
- ASTM E119 (UL 263, NFPA 251) STANDARD METHODS OF FIRE ENDURANCE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

Throughout the world, similar fire test methods are published by international organizations such as the International Organization for Standardization (ISO). These basic fire test standards are the foundation for many other test methods that focus upon fire containment within building structures.

- The fire-protection-testing method may appear to have remained unchanged for decades, but the quantity and the accuracy of the data obtained during the tests have advanced greatly.
- The time-temperature curve is intended to represent an intense, fully developed fire within a building.
- The value of the time-temperature curve in ASTM E119 is its reproducibility and its relationship to the past knowledge and performance of products (108 years worth)
The Furnace
The Furnaces

- Pilot Scale 6 x 6 opening
- Full Scale
  12 x 12 opening
The Standard Time Temperature Curve

This basic fire model has been in use for the last century. While no two fires are the same this does allow us to compare products.
Cross Section of Furnace and test sample

Pressure Probe.
10 min into test the pressure in the furnace should be +2.5 Pa above outside
The testing – Selecting what to test

The Certification Body will review the range of products to be tested. Generally the following will guide what is to be tested:

• The different size of the products usually the largest Diameter
• Depending on geometry, other sizes may also be tested
• Type of services the firestop is to protect
  – Wire & Cables
  – Metal Pipe
  – Plastic Pipe (Different types of Pipe PVC, ABS etc.
• Ratings required (Time, Temperature and others)
• The type of wall or ceiling construction
Sample Prep.

• Generally with since Firestops are small multiple samples can be tested at the same time.
• Samples are installed per the manufactures instructions
• Support provided similar to the field
• Samples are required to condition
Mounting and Conditioning

• Prior to testing both the membrane and the Samples are required to condition.
• In the case on concrete it is often many month so many labs have pre-made slabs that just need to have holes cut.
• Thermocouples are attached to the samples to measure temperatures
  – 25mm from penetration
  – On the surface of the firestop material
  – On the frame installed around the perimeter of FS
  – On the membrane 100mm from opening
  – 25mm away on the through penetrating item
  – Any other area of concern or interest
The Testing

The Furnace is started.
Temperatures and pressures are recorded on the product for the duration of the test.

Visual observation are noted on both the exposed and unexposed sides of the sample, noting Flaming, Deformation, spalling, cracking etc.
The Testing

- A computer data acquisition and Control system is used to monitor and record the furnace during the test.
The Testing

• End of the test, front of the furnace has been removed for observations

• While the membrane is not being evaluated it must also last through the test
After the Test

- On completion the sample is removed.
- This is a horizontal assembly that one removed from the furnace was rotated vertically and subjected to the impact, erosion and cooling effects of the Hose Stream test. The sample must remain in place (1 to 5 min)
Analysing the Results

- Temperature data is reviewed to determine compliance and the T rating
- Visual observation are noted for flaming or other issues
- Pictures & Video
RATINGS

Five ratings may be established for each firestop system (F, FT, FH, FTH and L).

• An F rating is based upon no flame occurrence on the unexposed surface.
  – System must remain in place with no passage of flames through the opening or any flaming on the unexposed side

• An FT rating is based upon temperature rise criteria as well as flame occurrence on the unexposed surface.
  – Meet above F criteria as well as
  – The temperatures measured on the unexposed surface of the Firestop system do not exceed 181°C above the initial temperatures.
Ratings (Cont.)

• When a test sample is also subjected to a hose stream test, FH and FTH ratings may be established.
• An FH rating is based upon flame occurrence on the unexposed surface and acceptable performance during the hose stream test.
• An FTH rating is based upon a temperature rise criterion, flame occurrence on the unexposed surface and acceptable performance during the hose stream test.
  – Firestop must remain in place and not develop an opening that will permit a projection of water beyond the unexposed side
ULC-S115, Standard Ratings

Ratings

• An L rating is an air leakage rating, this test is done separate and generally before the fire test.
• It is a measurement of the volume of air flowing, through the openings around the test sample under a specified pressure difference.
• The hourly ratings apply only to the complete systems. Individual components are designated for use in a specific system to achieve specified ratings.
• The individual components are not assigned ratings and are not intended to be interchangeable between systems.
• The rating of a firestop system applies to its use in the specific assembly of materials, penetration and floors or walls in which it was tested.
US testing

- UL 1479 / ASTM E814 Through-penetrations - firestop systems, which are specific constructions consisting of a wall or floor assembly, a penetrating item passing through an opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings.

- UL 2079 / ASTM E1966 Joint Systems - joint systems, which are specific constructions consisting of adjacent wall and/or floor assemblies and the materials designed to prevent the spread of fire through a linear opening between the wall and/or floor assemblies.
F, T, L and W ratings for firestop systems.

- The F-rating criteria prohibits flame passage through the system and requires acceptable hose-stream test performance.
- The T-rating criteria prohibits flame passage through the system and requires the maximum temperature rise on the unexposed surface of the wall or floor assembly, on the penetrating item and on the fill material not to exceed 325°F (181°C) above ambient, and requires acceptable hose-stream test performance.
- The L-rating criteria determines the amount of air leakage, in cu feet per minute per square foot of opening (CFM/sq ft) or in cu feet per minute per unit (CFM/unit) for fixed-size opening units, through the firestop system at ambient and/or 400°F air temperatures at an air-pressure differential of 0.30 in. W.C.
- The L ratings are intended to assist Authorities Having Jurisdiction and others in determining the suitability of firestop systems for the protection of penetrations and miscellaneous openings in floors and smoke barriers for the purpose of restricting the movement of smoke in accordance with ANSI/NFPA 101, "Life Safety Code."
ANSI/UL 1479 Rating Only

• The Class 1 W rating determines the capability of the firestop system to maintain watertightness of the penetration through a floor or wall construction at ambient air conditions under 3 ft of water pressure head (1.3 psi) for a period of 72 hours. The W rating may be applicable for building structures whose floors are subjected to incidental standing water and/or for buildings that house critical equipment as described in ANSI/NFPA 75, "Fire Protection of Information Technology Equipment," and ANSI/NFPA 76, "Fire Protection of Telecommunications Facilities."

• Acceptance is based upon the ability of the firestop system to withstand the applied pressure without the passage of any water through the firestop system. After the Class 1 watertightness test, the firestop system is conditioned in accordance with the requirements of ANSI/UL 1479 and the fire and hose stream tests described in the standard are conducted.

• The W rating is intended to assist Authorities Having Jurisdiction and others in determining the suitability of firestop systems in applications where submersion in water may be a factor.
QUESTIONS