Expansion Joints 101
Introduction to Expansion Joint Technology
Onsite Firestop Inspection Service

- As experts in testing, inspection and certification of building materials, UL ensures proper installation of firestop systems.
  - Proper installation of these critical life safety systems helps protect the building and its occupants should a fire occur.
- System components and installation procedures are critical to those used by today’s contractors, and engaging with UL to complete the on-site inspection enables us to leverage our extensive understanding of these life-safety systems.
- The UL Firestop Inspection Service helps ensure the system was installed in accordance with the system requirements.
- Working with UL delivers other benefits like:
  - Accurate and complete inspections
  - Fast response times and flexible scheduling
  - An independent, third party partner that is widely recognized and accepted by Authorities Having Jurisdiction.

For more information, contact Ruben Sandoval at Ruben.Sandoval@ul.com or 480.290.6987.
UL Qualified Firestop Contractor Program

- The UL Qualified Firestop Contractor Program allows contractors to demonstrate their commitment to properly installed firestop systems.
  - Firestop systems serve as critical safeguards
  - A contractor must properly select and install a firestop system
  - The building codes require these breaches be protected and UL QFCP denotes contractors providing additional quality assurance

UL Qualified Firestop Contractors have implemented a stringent quality management system. To obtain certification, a Qualified Firestop Contractor must:

1. Employ at least one individual with firestop expertise
2. Pass the UL Firestop Exam
3. Maintain a management system evaluated through an annual audit

The benefits of working with a qualified contractor include increased confidence, easy identification of contractors, and superior installations.

For more information, contact Ruben Sandoval at Ruben.Sandoval@ul.com or 480.290.6987.
• Let UL audit your site specific firestop installations to determine conformance with our 10 Element Program Requirements.

The MACC Program provides stakeholders the confidence that the firestop systems installation and maintenance of their building was completed by a UL Qualified Firestop Contractor and audited to our requirements.

The easiest way to verify that your firestop installation and maintenance was completed by a UL Qualified Firestop Contractor and audited to our stringent 10 Element Program Requirements is through the MACC program.

BENEFITS INCLUDE:

• A jobsite-specific management system audit and improved documentation
• A renewable jobsite/annual assessment-specific certificate
  • Annual assessments per the 2018 International Fire Code

If you’re interested in UL joining a pre-construction meeting, contact Ruben Sandoval (below).

For more information, contact Ruben Sandoval at Ruben.Sandoval@ul.com or 480.290.6987.
Expansion joint assemblies are installed on floors, walls, ceilings, roofs and exterior walls as well as open air areas and plazas.

They are designed to cover the gaps and continue the building design elements across them while allowing movement to occur.

Aesthetics, Fire Rating, Sound Dampening and Waterproofing are critical design elements.
Purpose of Expansion Joints

Buildings move in response to forces like:

• Hot and cold temperature changes
• Storms with high winds
• Earthquakes
Purpose of Expansion Joints

Support Column

Expansion Joint with Cover
Purpose of Expansion Joints

Expansion Joints separate the structure completely through the building.
Purpose of Expansion Joints

- Temperature
- Wind Forces
- Seismic Activity
Purpose of Expansion Joints

Expansion Joint Covers and fire barriers cover the separations and provide functional performance.
### Purpose of Expansion Joints

Commercial and Institutional construction projects have large footprints that require separation between building elements:

<table>
<thead>
<tr>
<th>Hospitals</th>
<th>Shopping Malls</th>
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<tbody>
<tr>
<td>Schools</td>
<td>Universities</td>
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<tr>
<td>Airports</td>
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<td>Hotels</td>
<td>Convention Centers</td>
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<td>Data Centers</td>
<td>Assisted Living Centers</td>
</tr>
<tr>
<td>Multi-Family Housing</td>
<td>Office Buildings</td>
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Architectural Expansion Joint Components

Interiors and Exteriors
What is an Expansion Joint Assembly required to do?

- Move with the building
- Conform with adjacent construction materials
- Support the required traffic and elements
- Provide Life Safety Elements
- Last longer than just the warranty
- Work with materials like Concrete, Gypsum...
Performance
Expansion Joint Terminology

- Nominal (Static) Width

- Minimum (Closed) Width

- Maximum (Opened) Width
• **Movement** is the distance between maximum and minimum joint widths and also acceleration.
• Expressed as either a **numerical value** or a **percentage** of nominal width.
• Typically joint systems are described as:
  
  \[
  \pm 25\%, \pm 50\%, \pm 100\% \text{ Movement}
  \]

- **Nominal** = 2 inches
- **Maximum** = 3 inches
- **Minimum** = 1 inch

(50% plus and minus model)
ADA Chapter 3 Changes in Level 303

Changes in Level [§303]

Changes in level can be up to $\frac{1}{4}''$ without treatment or $\frac{1}{2}''$ if beveled with a slope no steeper than 1:2. Changes in level above a $\frac{1}{2}''$ must be treated as a ramp or curb ramp (or a walkway if a slope no steeper than 1:20 can be achieved). These specifications apply to all portions of accessible routes, including thresholds and carpet trim.
Performance
Expansion Joint material

• ADA Chapter 3 Slip Resistance 302.1
  • No conclusive method
  • ADA and OSHA often refer to ANSI Standard C1028
  • Tested by James Machine for SCOF wet and dry
    • 0.6 Excellent
    • 0.5 Adequate
    • 0.4 Caution
Product Materials

Metals:
- Aluminum
- Bronze Brass
- Stainless Steel

Finishes:
- Mill Finish Aluminum, Bronze
- 2B Finish Stainless Steel
- Brushed #4 Satin
- Polished #8 Mirror
- Bead Blasted
- Abrasive
- Wing Walk
Product Materials

- Elastomeric
- Santoprene
- PVC
- EPDM
- Neoprene
- Silicone Extruded or RTV
What kinds are there to choose from?
Types and Use

Interior Floor

Elastomeric Seal System

No Bump System

Surface Mounted Systems

No Bump Recess System
Types and Use
Interior Floor

Elastomeric Seal
Floor System
Types and Use
Interior Floor

NBAF No-Bump Series
Nominal Movement
Types and Use
Interior Floor

Blockout in Concrete then Filled with Grout

Blockout for flush mounted applications
Types and Use

Blockouts

Good Blockouts are critical to installation success.
Types and Use
Interior Floor proper Loads

Loads
- Uniform
- Concentrated
- Pedestrian
- Heavy Duty
- Hospital
- Parking
- Traffic People, Carts, Wheels, Pneumatic tires, Gurneys

Finishes
- Flooring Tile, Carpet, Concrete, Terrazzo
Types and Use
Interior Floor proper Loads

Inspections
- cleaning
- Visual loose screws
- Broken screws
- Bent plates
- Cracked tiles beside joint
- Double Screws on plates
Types and Use

Coordinate shapes and finishes

- Finishes coordinated with joint covers and colors
- Mounting to Substrate like Steel Studs or Concrete
- Vandal resistance or tamperproof
- Hidden Fasteners
Types and Use
Interior Walls

- Elastomeric Seal System
- Seismic Metal System
- Surface Mounted System
- Silicone Compression System
Types and Use

Elastomeric Seal Transitions and Directional Changes
Ceiling

- Acoustical Seal Systems
- Metal System
- Variable Seal System
Exterior Wall & Roof

Elements to Consider

• Exposure to UV and Weather
  • Snow loads, Ozone, Storms
• Roof Traffic Loads for Maintenance
• Wind Loads
• Exterior wall materials Curtain Wall, Stucco, Brick, Wall Panels
• Directional Changes and Transitions in plane and size, Maintain a consistent joint cover size
Exterior Wall

Variable Seal System
Metal Roof Covers require splice covers but have a secondary continuous water barrier below.

Bellows Roof Covers have field splices but are not suitable for heavy snow or very wide joint openings.
Parking Garages

Deck Applications
Parking Garages

Elastomeric – 4” & Smaller Joints

Wing Seal

Elastomeric Seals with Elastomeric Concrete or Epoxies are the most common Expansion Joint Choices for Parking Garages

Top Deck Snow Plow

Retrofit No Blockout
Water Barrier Assembly

- Often used under slabs
- Works as a stand alone water evacuation System
- Works as a supplemental system below expansion joint cover systems
- Can be drained at columns or building edges
Installer Responsibilities

JOBSITE MEETINGS
• Prep for block-out
• Mobilization
• Equipment

FIELD MEASUREMENT
• Size of joints at current temperatures
• Recommend material lengths

COORDINATING SUBMITTALS
• Shop Drawings
• Tech Data Binders
• Product Samples

PROJECT INSTALLATION SCHEDULE
• Material Lead times
• Installation Preparation
WORKING AS AN APPROVED INSTALLER

- Credentials to provide to GC’s
- 5 year Joint Warranty (shared responsibility)
  - Installer is responsible for removal and re-installation
  - Manufacturer is responsible for material and shipping
- Top rate customer service
- Jobsite and Project Inspections
- Hands on Training
- Field Training (as needed)
ES System

- EPDM material
- Accommodates compression, tension and vertical offset
- Installed with a 2 part epoxy adhesive
- Spliced together with cyanoacrylate glue
- Forms a watertight seal
- Applications:
  - Used in vehicular and pedestrian traffic applications
  - Used in vertical applications
  - Retrofit – no existing block-out

ES Series Seal
ES Installation

Verify Joint Opening

[Images of concrete surfaces with a measuring tape showing the joint opening measurement.]
ES Installation

• Cut to length of joint run
• Drill holes into internal webbing on each end
• Cap ends of seal with EPDM sheet
• Trim EPDM around seal perimeter
• Drill a single hole on the top surface for vacuum
• Test vacuum
ES Installation
ES Installation
ES Transitions
CS Seal Splicing

- Two Methods:
  - Splicing Iron (preferred)
  - Cyanoacrylate Glue
- Preheat the splicing iron to ~ 375 degrees F
- Need two forms to hold the CS firmly in place
- Cut ends of CS seal if necessary, to create two flat ends
- Place CS seals into forms, let the CS seal stick out slightly past the form
- Press the ends of the seal onto splicing iron
- When the edges of seal start to curl up, remove from iron, align the two pieces and quickly bring them together
- Use a flat tip solder gun to seal any gaps all the way around the splice
Parking Garages - Metal

Metal is required starting at 4” joint and larger

Recessed Wide Seismic Joint

Heavy Duty Plate

Surface Mounted Dual Hinges
**Purpose of Fire Barriers**

- IBC 715.3 - *fire-resistant joint systems* shall be tested in accordance with the requirements of either **ASTM E1966** or **UL 2079**

- ASTM is a committee-based standards organization comprised of volunteer members from across the industry

- UL (Underwriters Laboratories) is an independent test lab that also develops test standards
• UL 2079 & ASTM E1966

• Establishes the length of time a joint system will contain a fire during a predetermined test exposure
• F Rating – Time the system contains flame
• T Rating – Time cold face temperatures remained below established points
• UL 2079 & ASTM E1966

• Assembly is preconditioned by cycling to simulate movement of expansion joint (ASTM E-1399)
  
  • Class I 500 cycles 1 c/min.
  • Class II 500 cycles 10 c/min.
  • Class III 100 cycles 30 c/min.
  • Class IV 100 cycles 30 c/min.
  400 cycles 10 c/min.

• Tested with a field splice

• Wall systems are then subjected to hose stream

• UL 2079 offers optional air leakage test ("L" rating)
  
  • An “L” rating is the cfm/lf of air able to penetrate the barrier at ambient temperature and 400F
UL 2079 & ASTM E1966

Tested As A System
• Test Laboratories

We Test With:
• Intertek (ETL)
• Underwriters Laboratories (UL)

Walls are subject to hose stream test.

Not Floors.
Purpose of Expansion Joints

Applications

Fire Rated Floors
• 2, 3, 4 hours
• Concrete
• Wood

Fire Rated Walls
• 2, 3, 4 hours
• Gypsum
• CMU
Fire barrier components

- Intumescent Fire Barriers
  - Typically 1” – 4” Joints
  - Swell to fill the void
- Blanket Fire Barriers
  - Larger Seismic Joints
  - Block by Insulating

Floor and Wall Systems available up to a 36-inch joint opening
Fire Rated
Expansion Joints Systems

Vertical Designs
Horizontal Designs

Floor and Wall Systems available 6” max opening
Fire Rated Foam Seals
UL Listed Floor and Wall

- Complete fire rated expansion joint system
- Watertight
- UV stable
- Silicone comes in many colors
- 2 hour Rated F, T, H
- Class II and III Movement
Fire Rated
Expansion Joints Systems

Seismic Designs

Splices and Joinery

Seismic Systems available up to a 72-inch Max joint opening
• SMOKE BARRIER (IBC 709)
  • Carries a minimum 1 hour fire rating, often more (709.3)
  • IBC 715.6 Fire resistant joint systems in smoke barriers shall have an “L” rating of <5cfm/lf per UL 2079

• SMOKE PARTITION (IBC 710)
  • Also a wall, floor, or ceiling assembly that is designed and constructed to restrict the movement of smoke
  • Does not require a fire rating unless noted otherwise
  • IBC 710.7 Joints shall be filled with an approved material to limit the free passage of smoke
• SmokeBlock

• Meets IBC 715.6 (<1CFM/LF per UL 2079)
• Tested in concrete and drywall assemblies
• Can be installed alone or in conjunction with a cover or fire barrier
• Water tight when applied over mastic setting bed
• Typical Wall Penetration
Two Rated Walls Forming a Chase

Two packages of fire barrier required at each end
One Rated Wall Split by Joint

One package of fire barrier required at each end
• Chase Wall With Non-rated Wall

No fire barrier required
How to Specify
Proper EJC for Particular Application

Long Form
3 Part Specification
Section 07 95 13

Consider:
• Joint size
• Movement - thermal or seismic
• Traffic for floors
• Weather for exteriors
• Aesthetics finishes
• Experienced and trained Installers
How to Specify Proper EJC for Particular Application

Short Specification is product specific

Product Data Sheets
How to Specify

Where do you get your information and help?
Website www.balcousa.com
• Local Rep https://www.balcousa.com/rep-locator/
• Customer Service https://www.balcousa.com/customer-support/
• Marketing and design assistance marketing@balcousa.com
• Helpful videos https://www.balcousa.com/videos/
• Galleries of projects https://www.balcousa.com/project-gallery/
Thank you for your time and attention!

This concludes the American Institute of Architects Continuing Education Program