SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing are specified in this section.

B. Formed sheet metal work for wall and roof flashing, roof edge metal, fasciae, and drainage specialties are specified in this section.

C. Metal: Use zinc-tin alloy-coated stainless-steel sheet unless indicated otherwise.
   1. Exception: Flashing provided by the following sections shall be aluminum with finish to match adjacent metal provide by that section:
      a. Section 07 46 15 - Metal Siding.
      b. Section 08 44 13 - Glazed Aluminum Curtain Walls.
      c. Section 08 44 13.3 - Glazed Aluminum Curtain Walls for Dixie.
      d. Section 08 90 00 - Louvers and Vent.

D. Coordinate installation work of this Section with AWB in manner that does not diminish the watertight integrity of AWB system.

E. Products Furnished but not Installed Under this Section:
   1. Furnish stainless steel Reglets for installation in Precast Architectural Concrete to Section 03 45 00.

1.2 RELATED WORK (Items not included in this project manual are available from the construction manager upon request.)

A. Roof curb supports: Section 06 10 00 - Rough Carpentry.

B. Execution: Section 01 73 00.

C. Exterior Wind Enclosure Requirements: Section 01 83 16.13.

D. Masonry flashing: Division 4.

E. Factory Applied Paint Finish: 05 05 13 - Shop Applied Coatings for Metal.

F. Membrane water barrier with transition flashing: Section 07 27 30 - Air Weather Barrier (AWB).

G. Roofing:
   1. Section 07 56 00 - Fluid-Applied Roofing.
   2. Section 07 52 16 - Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing.

H. Flashing components of factory finished wall systems:
   1. Section 07 42 43 - Composite Wall Panels.
   2. Section 07 46 15 - Manufactured Metal Siding.

I. Roof Hatches: Section 07 71 00 - Roof Specialties.

J. Metal Copings: See Section 07 72 00 - Roof Accessories.

K. Roof Accessories: Section 07 72 00.

L. Sealant compound and installation: Section 07 92 00, Joint Sealants.

M. Aluminum Alloy: Section 08 44 13 - Glazed Aluminum Curtain Walls.

N. Curtain wall: Section 08 44 13 - Glazed Aluminum Curtain Walls.

O. Louvers: Section 08 90 00 - Louvers and Vents.

P. Color of factory coated metal and anodized aluminum: Section 09 06 00, Schedule for Finishes.

Q. Paint materials and application: Section 09 91 00, Painting.

R. Fall Protection Anchors: Section 11 24 24.

S. Common Work Results for Plumbing: Section 22 05 11 - Common Work Results for Plumbing, Flashing of Roof Drains: Section 22 05 19 - Meters and Gages for Plumbing Piping, Section 22 05 23 - General-Duty Valves for Plumbing Piping, Section 22 13 00 - Facility Sanitary Sewerage, Section 22 14 00 - Facility Storm Drainage.

1.3 PERFORMANCE/DESIGN REQUIREMENTS

A. Delegated Design: Design flashing and sheet metal, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements and design criteria indicated.

B. General:
1. Flashing and sheet metal assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
2. Sheet metal flashing and AWB from an integral water barrier. Coordinate installation and details with Section 07 27 30 - Air Weather Barrier (AWB) to form a continuous liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.

C. Flashing and sheet metal shall be supplied and installed to positive and negative wind loads, thermally induced movement, and exposure to weather; without failure:
1. Wind Loads: As specified in Section 01 83 16.13 - Exterior Wind Enclosure Requirements.
a. Apply a safety factor of 2 to the wind loads.

D. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Flashing and Sheet Metal shall not have waves, warps, buckles, oil-canning, fastening stresses or distortion.

F. Provide spring-lock counter flashing over edge of roof membrane that is easily removable to allow for reroofing or replacement of roofing. Spring-lock flashing not required at metal copings that act as counter flashing for the roof membrane, and are easily removable and re-installed.

G. Meet or exceed SMACNA requirements.

H. Metal thicknesses stated in the specifications are minimum thickness of metal without coatings and shall be increased as required to meet PERFORMANCE REQUIREMENTS and Construction Document requirements.

I. Flexible membranes flashing materials that deteriorate when exposed to ultraviolet light shall not be used as a material exposed to sunlight in final construction.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Engineer's Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of Professional Engineer. See Professional Engineer under Quality Assurance below, and "Delegated-Design Submittal" below.

C. Shop Drawings: Details shall show adjacent materials and transition of materials to maintain water integrity and design intent.

1. Flashings.
2. Expansion joints and slip joints.
3. Fascia-cant.
4. Pipe penetrations.
5. Conduit penetrations.
6. Roof curbs.

D. Manufacturer's Literature and Data:

1. Two-piece counterflashing.
2. Thru wall flashing.
3. Nonreinforced, elastomeric sheeting.
4. Clear anodized aluminum.
5. Zinc-Tin Alloy-Coated Stainless-Steel Sheet.
6. Fascia-cant.
7. Sealants.

E. Samples:
1. Flashing at Exterior Window Sill Directly above Roof: Provide 12" x 12" sample of interior and exterior corner conditions showing specified construction.
2. End Dam: 12" long section of flashing demonstrating watertight end dam construction at flashing termination. Back edge of flashing and end dam turned up to receive AWB.
3. For each type of exposed finish.
    a. Trim and Metal Closures: 12 incheslong and in required profile. Include fasteners and other exposed accessories.
    b. Other Accessories: 12-inch-long Samples for each type of other accessory.

F. Certificates: Stating that zinc-tin alloy-coated stainless-steel, and aluminum has been given - specified finish. Coating formulator's approvals as specified.

G. Sealants: Submit in conformance with Section 07 92 00 - Joint Sealants.

H. Painted Finishes: Comply with requirements of Section 05 05 13 - Shop Applied Coatings for Metal

I. Sample Warranty.

J. Delegated-Design Submittal: Provide analysis data and calculations for the work of this Section signed and sealed by the qualified professional engineer responsible for their preparation. Submittals may or may not be returned, and will not bear stamp of approval.

K. Pre-Construction Adhesion Tests: See QUALITY ASSURANCE below. Submit results in format which allows comparison with manufacturer's published values.

1.5 QUALITY ASSURANCE

A. Subcontractor: Subcontract sheet metal associated with roofing as a part of the roofing contract for undivided responsibility.

B. Full approval of roofing manufacturer required for attachments to or penetrations in roofing systems. Obtain approvals as required for installation of work under this Section. Notify Resident Engineer and Architect of deviations from documents is required to obtain approval from roofing manufacturer prior to installation.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 10 years experience in similar glazed wall systems in providing engineering services of the kind indicated.

D. Mockup: See Section 01 43 39 - Mockups.

E. Preconstruction Field Adhesion Testing: Before installing Foil-Faced flashing on existing masonry, field test its adhesion to the substrate:
1. Locate test area(s) where indicated or, if not indicated, as directed by Resident Engineer.
2. Conduct field tests for each application for each type of substrate involved.
3. Notify Resident Engineer seven days in advance of dates and times when test areas are to prepared and tested.
4. Arrange for tests to take place with flashing manufacturer's technical representative present.
5. Acceptability of Foil-Faced Flashing adhesion to existing masonry shall be based on mutual agreement between flashing manufacturer and Resident Engineer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 JOB CONDITIONS

A. Substrates: Delay installation of flashing and trim until substrate construction, blocking and other support construction is complete and ready to receive sheet metal.

1.8 WARRANTY

A. Flashing and Sheet Metal work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend warranty period to 10 years from acceptance of facility by the Government.

1.9 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

A. The publications listed below for a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Sheet Metal & Air Conditioning Contractors National Association (SMACNA):

1. Architectural Sheet Metal Manual,

C. American Society for Testing and Materials (ASTM):

1.	A167-99(R 2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
2.	A653/A653M-07	Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
3.	B32-04	Solder Metal
4.	B209-07	Aluminum and Aluminum-Alloy Sheet and Plate
5.	B370-03	Copper Sheet and Strip for Building Construction
6.	D412-06	Vulcanized Rubber and Thermoplastic Elastomers-Tension
7.	D1187-97 (R2002)	Asphalt Base Emulsions for Use as Protective Coatings for Metal
8.	D1784-07	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
9.	D3656-07	Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
10.	D4586-07	Asphalt Roof Cement, Asbestos Free

D. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):

1. ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. Architectural Sheet Metal Manual.

F. National Roofing Contractors Association (NRCA):

1. The NRCA Roofing and Waterproofing Manual

G. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-505-88 Metal Finishes Manual

H. American Architectural Manufacturers Association (AAMA):

1. 2605-98 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

I. Factory Mutual (FM):

1. 49 Perimeter Flashing.

J. Federal Specification (Fed. Spec):

1. A-A-1925A Shield, Expansion; (Nail Anchors)
2. UU-B-790A Building Paper, Vegetable Fiber

K. International Building Code (IBC):

1. 2006 Edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet; coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin) to a thickness of 20 microns, with factory-applied gray preweathering.
1. Thickness: 0.015" thick, minimum.

B. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
1. Zinc-Tin Alloy-Coated Stainless Steel: ASTM B32, 100 percent tin.

C. Aluminum Sheet: ASTM B209, alloy 3003-H14. Except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
1. Thickness: 0.063" thick, minimum.
2. Finish: Fluoropolymer (PVDF) finish in conformance with Section 05 05 13 - Shop Applied Coatings for Metal.

D. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than 7 percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30° C (-20° F).
1. At locations that metal flashing transition with AWB, in cavity wall construction, the flexible sheet flashing material between AWB and sheet metal drainage flashing, shall be provided by Section 07 27 30 - Air Weather Barrier (AWB) in lieu of Nonreinforced, Elastomeric Sheeting.

E. Foil-Faced Flashing: Self-adhering modified bituminous sheet, 45 mils thick composed of bituminous compound laminated to of cross-laminated polyethylene film with aluminum foil surface. Furnished in roll form with release paper. Provide where shown at window openings at Dixie Building.
1. Basis of Design: HE200AM, Metal Clad Weather Barrier by Henry.

F. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m² (6 lbs/100 sf).

G. Bituminous Paint: ASTM D1187, Type I.

H. Fasteners:

1. Use stainless steel fasteners for stainless steel, zinc-tin alloy-coated stainless steel, and aluminum alloy flashing.
2. Rivets: Not less than 3 mm (1/8 inch) diameter.
3. Expansion Shields: Fed Spec A-A-1925A.

I. Sealant:

1. Typical: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations; except sealant used at lap joints.
2. Butyl Sealant: High solids, non-skinning, non-drying, butyl rubber based sealant.
   a. Adhesion: Excellent adhesion to anodized aluminum, PVDF coatings (Kynar),
   b. Comply with QUALITY CONTROL in Section 07 92 00.
   c. Will not deteriorate metal substrate.
   d. Solids: 85% minimum,
   e. Staining: No deterioration to painted surface to galvalume, galvanized, and PVDF.
   f. Corrosion: No darkening Etching or salt deposits on metal.
   g. Heat Aging: No cracking , ASTM C792, C661, D2240
   h. Water Penetration: No water leakage, ASTM E1646.

J. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

K. Roof Cement: ASTM D4586.

L. Miscellaneous Materials: Provide materials and types of welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

2.2 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows. Metal thicknesses specified in this Section are base metal thickness without specified coating, thickness specified is the minimum thickness.

B. Concealed Locations (Built into Construction):

1. Zinc-tin alloy-coated stainless steel: 0.015 inch thick.
2. Aluminum thickness: 0.063 inch thick, minimum.

C. Exposed Locations:

1. Zinc-tin alloy-coated stainless steel: 0.015 inch.
2. Aluminum thickness: 0.063 inch thick, minimum.

2.3 FABRICATION, GENERAL

A. General: Shop-fabricate items in accordance with SMACNA and NRCA standards and methods modified as required to conform to details shown on drawings, unless otherwise approved by Architect. If SMACNA and NRCA standards disagree follow the more stringent requirement.

1. Provide end dams and back stops for through wall or partial through wall flashing. Lock metal at corners and solder, braze or weld the metal to create water tight joint at corners.
2. Accurately form shapes and profiles to sizes and dimensions indicated on drawings. Verify field dimensions where critical for satisfactory fit.
3. Make all lines, angles, edges and moldings straight, sharp and true; reinforce as required for rigidity and strength.
4. Form all sheet metal exposed on exterior to be weatherproof with seams overlapping in the direction of water flow.
5. Fabricate with minimum number of joints and seams finished neatly in true straight lines.
6. Form all exterior sheet metal with allowances for thermal expansion and contraction.
7. Form free from waves and buckles.

B. Jointing:

1. Stainless steel, except expansion and contraction joints, 6" Lap With 5 Complete Transverse Rows of Butyl Sealant (RFI 5227.1)
2. Jointing of zinc-tin alloy-coated stainless steel over 0.018 inch thick shall be done by lapping, 6" Lap With 5 Complete Transverse Rows of Butyl Sealant (RFI 5227.1)
3. Joints shall conform to following requirements:
   a. Flat-lock joints shall finish not less than 3/4 inch wide.
   b. Lap joints subject to stress shall finish not less than 1 inch wide and shall be 6" Laps With 5 Complete Transverse Rows of Butyl Sealant (RFI 5227.1)
   c. Slip Joints: Use butt seam with back-up plate details similar to NRCA (The NCRA Roofing and Waterproofing Manual, 5th Edition, includes 2003 and 2006 updates) details SM-3, SM-8, SM-17C; except provide three parallel lines of sealant for each line of sealant shown. Place the additional lines of sealant about 1 inch outward of sealant lines shown in details. Back-up plates shall be 12 inch width and center on joint.
      1) Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.
      2) Use Non-Skinning Butyl Sealant at unsoldered joints. Butyl Sealant shall be concealed from view and UV light.
4. Flat and lap joints shall be made, shingle style, in direction of flow.
5. Edges of nonreinforced elastomeric sheeting shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant recommended by the manufacturer.
6. Soldering:
   a. Treat in accordance with metal producer's recommendations; sheet metal required to be soldered.
   b. Completely remove acid and flux after soldering is completed.

C. Thermal Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for zinc-tin alloy-coated stainless steel at intervals not exceeding 24 feet and meeting PERFORMANCE REQUIREMENTS.
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 10 feet for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
   a. Unsoldered Contraction Joints: Use butt seam with back-up plate details similar to NRCA (The NCRA Roofing and Waterproofing Manual, 5th Edition, includes 2003 and 2006 updates) details SM-3, SM-8, SM-17C; except provide three parallel lines of sealant for each line of sealant shown. Place the additional lines of sealant

about 1 inch outward of sealant lines shown in details. Back-up plates shall be 12 inch width and center on joint.
1) Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.
2) Use Non-Skinning Butyl Sealant at unsoldered joints. Sealant shall be concealed from view and UV light.

6. Fabricate joint covers of same thickness material as sheet metal served.

D. Cleats: Design to meet Performance Requirements, but not less than the following:

1. Fabricate cleats to secure flashings and sheet metal work over 12 inches wide and where specified.
2. Provide cleats for maximum spacing of 12 inch centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 2 inch wide strip. Form end with not less than 3/4 inch wide loose lock to item for anchorage. Form other end of length to receive nails/fastener free of item to be anchored and end edge to be folded over and cover screw heads.

E. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.024 inch thick zinc-tin alloy-coated stainless steel, 0.063" inch thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 10 feet maximum lengths with not less than 3/4 inch loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4 inch).
6. Fabricate anchor edge maximum width of 3 inches or of sufficient width to provide adequate bearing area to insure a rigid installation using 0.031 inch thick zinc-tin alloy-coated stainless steel, 0.12 inch thick aluminum.

F. Drips:

1. Form drips, with hemmed edge, at lower edge of sheet metal counter-flashings (cap flashings), fascias, by folding edge back 1/2 inch and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

G. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 2-1/2 inch to form dam, unless otherwise specified or shown otherwise. Coordinate height of turned up concealed edges as recommended by Section 07 27 30 - Air Weather Barrier (AWB).
2. Finish exposed edges of flashing with a 1/4 inch hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 1/4 inch minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC 2006.

2.4 FINISH

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:
1. Zinc-tin alloy-coated stainless steel:
   a. Exposed to Public View: Provide Fluoropolymer (PVDF) finish in compliance with Section 05 05 13 - Shop Applied Coatings for Metal.
      1) Color: Match clear anodized aluminum.
   b. Not Exposed to Public View: Mill Finish
2. Aluminum: Provide Fluoropolymer (PVDF) finish in compliance with Section 05 05 13 - Shop Applied Coatings for Metal.
   a. Color: Custom color as selected by Architect.

2.5 THROUGH-WALL FLASHINGS AND PARTIAL THROUGH WALL FLASHING

A. Through-Wall Flashings at Brick Veneers: Provided by Section 04 05 23 - Masonry Accessories.

B. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. ~~Install a sheet having 1/16 inch deep transverse channels spaced four to every 1 inch, or ribbed diagonal pattern, or having other deformation unless specified otherwise.~~

Install Flat Metal Flashing In Lieu of Corrugated (RFI 5227)

1. Fabricate in not less than 8 feet lengths; 10 feet maximum lengths.
2. Fabricate so keying nests at overlaps.

C. For Masonry Work When Concealed Except for Drip:

1. Zinc-tin alloy-coated stainless steel
2. Form an integral dam at least 2-1/2 inch high at back edge.
3. Form exposed portions of flashing with drip, approximately 1/4 inch projection beyond wall face.

D. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 3/16 inch high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.
4. Form end dams at least 3/16 inch high and solder water tight to dam at back edge.

E. For Flashing at Architectural Precast Concrete Panels.

1. Use plane flat sheet of zinc-tin alloy-coated stainless steel.
2. Form exposed portions with drip as specified or receiver.

F. Glazed Aluminum Curtain Wall and Louver Sill Flashing, and Lintel Flashing:

1. Material: Aluminum, painted to match color specified for system providing flashing.
2. Fabricate flashing at ends with folded corners to turn up 3/16 inch in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.

4. Form exposed portion with drip as specified or receiver.

G. Door Sill Flashing:

1. Where concealed, 0.018 inch thick zinc-tin alloy-coated stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.024 inch zinc-tin alloy-coated stainless steel.
3. Fabricate flashing at ends to turn up 3/16 inch in first vertical masonry joint beyond masonry opening with folded corners.

2.6 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.

1. Use zinc-tin alloy-coated stainless steel, thickness specified unless specified otherwise.
2. When flashing is over 10 inches in vertical height or horizontal width 0.018 inch zinc-tin alloy-coated stainless steel.
3. Use zinc-tin alloy-coated stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use either zinc-tin alloy-coated stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 8 inch nor more than 16 inch.

C. Fabricate roof flange not less than 4 inches wide unless shown otherwise. When base flashing length exceeds 8 feet form flange edge with 1/2 inch hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing (other than engine exhaust or flue stack):

1. Fabricate roof flange not less than 4 inches beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 1/2 inch and solder to flange and sleeve seam to make watertight.
3. At low pipes 8 inch to 18 inch above roof:

   a. Form top of sleeve to turn down into the pipe at least 1 inch.
   b. Allow for loose fit around and into the pipe.

4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:

   a. Extend sleeve up not less than 12 inch above roofing.
   b. Allow for loose fit around pipe.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Material: Zinc-tin alloy-coated stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 4 inches with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 8 feet and not more than 10 feet.

3. Manufactured assemblies may be used.
4. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
5. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. Two-Piece Counterflashing:

1. Receiver:
   a. Typical Receiver: Detail “A” on page SM-13 of The NRCA, Roofing and Waterproofing Manual with following clarifications:
      1) Height of upturned edge within wall cavity shall be a minimum of 4 inches high and secured through substrate to blocking with stainless steel screws. Screws to be within 1/2 inch of top edge. . AWB, specified in Section 07 27 30 - Air Weather Barrier (AWB), shall lap shingle style over up-turned edge and form watertight seal. Where up-turned edge is exposed to view at interior, upturn edge a minimum of ½ inch.
      2) Provide OPTIONAL 2” WIDE CLIP Approx. 30” (750 mm) O.C. 2 fasteners per clip indicated in Detail “A” on page SM-13.
   b. Receiver at Concrete Wall and Precast Concrete Panel: Detail “C” on page SM-14, of The NRCA, Roofing and Waterproofing Manual with following clarifications:
      1) At penetrations for fasteners provide horizontally slotted holes to permit 2 times the independent thermal movement of precast concrete panels. Center fasteners in opening when installing.
      2) Provide the “OPTIONAL: SEALANT OR ELASTOMERIC TAPE” indicated in Detail “C” on page SM-14.
      3) Provide OPTIONAL 2” WIDE CLIP Approx. 30” (750 mm) O.C. 2 fasteners per clip indicated in Detail “C” on page SM-14.
2. Counter-flashing:
   a. Upper edge designed to snap lock into receiver.
   b. Provide optional clip at bottom of counterflashing as required to meet performance requirements, but not less than 30 inches on center with two fasteners per clip.
3. Provide factory mitered and sealed corners, connector clips, joint covers, anchor clips, compressible secondary seal, and other accessories necessary for proper installation.

D. Surface Mounted Counterflashing:

1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 2-1/2 inches with top 3/4 inch bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 16 inch centers between end holes.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 16 inch centers between upper and lower edge.

E. Pipe Counterflashing:

1. Form flashing for watertight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 3/4 inch deep.
2. Fabricate 4 inch over lap at end.
3. Fabricate draw band of same metal as counter flashing. 0.015 inch thick stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 1 inch inside vent pipe.

F. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, over lapping base flashing.

2.8 GRAVEL STOPS

A. Gravel Stop: Specified elsewhere.

2.9 BITUMEN STOPS

A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.

B. Fabricate with 3/4 inch vertical legs and 3 inch horizontal legs.

C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.10 RE-CLADDING

A. Re-clad the following items with zinc-tin alloy-coated stainless-steel sheet.
1. Turret roof: Match existing construction method. Increase fastener spacing as required for wind.
a. Remove existing metal if needed to determine adequacy or spacing of substrate. Advise Construction Manager if substrate is not adequate
b. Provide separator sheet where installing new metal over existing metal. Make water-tight.

2.11 REGLETS

A. Fabricate reglets of following materials:
1. Stainless steel, not less than 0.015 inch thick.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 3/4 deep, nor more than 1 inch deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 3/8 inch, 45 degree snap lock.

2.12 INSULATED EXPANSION JOINT COVERS

A. Expansion Joint Covers: Specified elsewhere.

2.13 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.

B. Fabricate collar with roof flange 0.047 inch minimum thick black iron or galvanized steel sheet.

1. Fabricate inside diameter of collar 4 inches larger than the outside diameter of the item penetration the roofing.
2. Extend collar height from structural roof deck to not less than 14 inches above roof surface.
3. Fabricate collar roof flange not less than 4 inches wide.
4. Option: Collar may be of steel tubing 0.125 inch minimum wall thickness, with not less than four, 2 inch by 4 inch by 0.125 inch thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.

C. Fabricate sleeve base flashing with roof flange of zinc-tin alloy-coated stainless steel.

1. Fabricate sleeve roof flange not less than 4 inches wide.
2. Extend sleeve around collar up to top of collar.
3. Flange bottom of sleeve out not less than 1/24 inch and soldered to 4 inch wide flange to make watertight.
4. Fabricate interior diameter 2 inch greater than collar.

D. Fabricate hood counter flashing from same material and thickness as sleeve.

1. Fabricate the same as pipe counter flashing except allow not less than 4 inch lap below top of sleeve and to form vent space minimum of 4 inch wide.
2. Hem bottom edge of hood 1/2 inch.
3. Provide a 2 inch deep drawband.

E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

2.14 SCUPPERS

A. Scuppers Below Roof Structure and Involving Plumbing Piping: Specified elsewhere.

B. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.

C. Provide flange at top on through wall scupper to extend to top of base flashing.

D. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.

E. Fabricate not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.

F. Fabricate exterior wall flange for through wall scupper not less than 25 mm (1 inch) wide on top and sides with edges hemmed.

G. Fabricate gravel stop bar of 25 mm x 25 mm (1 inch by 1 inch) angle strip soldered to bottom of scupper.

H. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.

I. Solder joints watertight.

2.15 TURRET

A. Shop Fabricate to maximum extent possible.

B. Metal Type: As indicated on Drawings.

C. Metal Finish: As indicated on Drawings.

D. Seams: Fabricate with watertight seams and in conformance with SMACNA seam details indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and installation conditions. Substrates and conditions to be suitable for long term use under conditions expected for the Project. Do not install flashing and sheet metal work until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.2 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Confine direct screwing of sheet metal to strips 12 inch or less wide. Screw flashing along one edge only. Space screws not over 4 inches on center unless specified otherwise.
7. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 3 inch on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
8. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
9. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
10. Secure individual cleats with two screws and bend end tab over screw heads. Lock other end of cleat into hemmed edge.

11. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
12. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
13. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:

    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.

14. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
15. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
16. Bitumen Stops:

    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.
17. Secure flashing per approved shop drawings and to meet wind load requirements while maintaining the integrity of the flashing systems.

3.3 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1-1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
    a. Through-wall flashing at copings provided by Section 07 72 00 specified elsewhere.
8. Lap end joints at least two corrugations, but not less than 6 inches. Seal laps with 6 transverse rows of butyl sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.

11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Soldering Zinc-Tin Alloy-Coated Stainless-Steel Sheets: Remove pre-weather wash coat around edges to be soldered with lacquer thinner. To facilitate soldering, it is recommended that the edges of sheets to be joined be pre-tinned. Use pure tin solder with rosin recommended by tin alloy-coated stainless-steel sheet manufacturer. Flux residues must be neutralized with soda water and removed. Use soldering irons only. Do not use abrasives in preparing the surface for solder.
15. Continue flashing around columns:

    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 3 inch wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 1 1/2 inch.

16. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with other trades.

17. Manufactured Units: Install in compliance with manufacturer's written installation instructions and to meet requirements of QUALITY ASSURANCE.

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1-1/2 inch).

D. Flashing at Cavity Wall Construction: Specified in Division 4.

E. Flashing at Veneer Walls: Specified in Division 4.

F. Lintel Flashing when not part of shelf angle flashing:

1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
2. Turn ends up 25 mm (1 inch) and fold corners to form dam and extend end to face of wall.
3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Turned Up Edges of Flashing and End Dams at Vertical Face of AWB. Set metal flashing firmly against AWB. AWB transition membrane shall be installed shingle style over top edge of metal flashing and sealed in conformance with Section 07 27 30 - Air Weather Barrier (AWB).

H. Curtain Wall and Window Sill Flashing: Detail as shown on drawings and as follows:

1. Install flashing to extend beyond ends of sill abut AWB at vertical face of adjacent wall cladding system.

2. Turn back edge up to terminate under curtain wall frame and as detailed
3. Turn ends up 2-1/2 inch, unless detailed otherwise, and fold corners to form dam and extend to face of wall.
4. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (10 feet). Provide slip joint as described above. Lock and solder corner joints at corners.
5. Coordinate installation with AWB.

I. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over waterproof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

J. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.4 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and secure with screws through flanges into wood blocking over bituminous roofing.
4. Secure flange with screws through roofing into wood blocking with screws spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over fastener heads. Lock other end into the seam.
5. Metal base flashing shall not replace locations requiring Liquid Flashing specified in Section 07 52 16 - Styrene-Butadiene-Styrene (SBS) Modified Bituminous Roofing.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (10 feet). Provide slip joint as described above. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

D. Coordinate installation with AWB.

3.5 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 6 inch.
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 6 inch. Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counter-flashing: Provide where shown on drawings. Two-Piece Counter-flashing shall be used unless indicated otherwise on drawings or approved by Resident Engineer.

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.

    a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:

        1) Locate fasteners in masonry mortar joints.
        2) Use screws to sheet metal or wood.

    b. Fill joint at top with sealant and in conformance with requirements of Section 07 92 00 - Joint Sealants, bond breaker required.

4. Where flashing or hood is mounted on pipe.

    a. Secure with draw band tight against pipe.
    b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.

    c. Fill joint at top with sealant and in conformance with requirements of Section 07 92 00 - Joint Sealants, bond breaker required.

C. Two-Piece Counter-flashing: Typical counter flashing.

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.

2. Install welded corner pieces per manufacturer’s instructions.
3. Surface applied type receiver:
    a. Secure to face construction in accordance, with manufacturer’s instructions and apply sealant or elastomeric tape behind receiver per detail referenced above.

b. Fill joint at top with sealant and in conformance with requirements of Section 07 92 00 - Joint Sealants, bond breaker required.

4. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

5. At precast concrete panels center fasteners in slotted holes to allow for thermal movement of precast panels.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counterflashing is a component of other flashing install as shown.

3.6 FOIL-FACED FLASHING

A. Install Foil-Faced Flashing to provide a watertight installation.

B. Application Over Existing Masonry: Where adhesion of foil-faced flashing applied directly to existing masonry is determined to be acceptable as a result of pre-construction adhesion testing (see QUALITY ASSURANCE in PART 1 above), apply Foil-Faced Flashing directly over existing masonry. Where direct application is determined to be unacceptable, provide a parge coating, as specified in Section 04 05 13, Masonry Mortaring, over existing masonry and apply foil-faced flashing over the cured parge coating.

3.7 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:

1. Coordinate reglets for anchorage into concrete with formwork construction.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.8 GRAVEL STOPS

A. Gravel Stops: Specified elsewhere.

B. Scuppers:

1. Install scupper with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
2. Set scupper at roof water line and fasten to wood blocking.
3. Use sealant to seal joint with fascia gravel stops at ends.
4. Coordinate to lap over conductor head and to discharge water into conductor head.

3.9 METAL COPINGS

A. Specified elsewhere.

3.10 EXPANSION JOINT COVERS

A. Specified elsewhere.

3.11 ENGINE EXHAUST PIPE OR STACK FLASHING

A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.

B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.

C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:

1. Install insect screen to fit between bottom edge of hood and side of sleeve.
2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

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SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies roof hatches; equipment supports; and roof curbs.

1.2 RELATED WORK

A. Self-drilling Metal structural Fasteners: Section 05 05 23 - Metal Fastening.

B. Alternating Tread Devices: Section 05 51 00 - Metal Stairs.

C. Wood blocking for roof curbs: Section 06 10 00 - Rough Carpentry.

D. Color and texture of finish: Section 09 06 00 - Schedule for Finishes. Sealant material and installation: Section 07 92 00 - Joint Sealants.

E. Roofing: Section 07 52 16 - Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing.

F. General insulation: Section 07 21 29 - Sprayed Polyurethane Foam Insulation & Air/Vapor Barrier System. Rigid insulation for roofing: Section 03 52 00 - Lightweight Concrete Roof Insulation.

G. MEP roof Curbs: Divisions 22, 23, 26, 27.

1.3 PERFORMANCE REQUIREMENTS

A. Provide Roof Specialties to form part of the specified roof assemblies capable to resist the following loads:
   1. SBS Roof: Comply with “PERFORMANCE REQUIREMENTS” as specified in Section 07 52 16 - Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing.
   2. Roof Curbs shall be designed and provided to transfer positive and negative live loads and dead loads of materials supported by roof curb to the building structure in conformance with Section 01 83 16.13 - Exterior Wind Enclosure Requirements.

1.4 QUALITY CONTROL

A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.

B. Each accessory type shall be the same and be made by the same manufacturer.

C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm x 100 mm (4 inch x 4 inch), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.

C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

D. Manufacturer's Literature and Data: Each item specified.

E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

1.	RR-G-1602D	Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

C. American Society for Testing and Material (ASTM):

1.	A653/A653M-02	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
2.	B209/209M-02	Aluminum and Aluminum Alloy-Sheet and Plate
3.	B221/221M-02	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
4.	C612-00	Mineral Fiber Block and Board Thermal Insulation
5.	D1187-97	Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):

1.	AMP 500 Series	Metal Finishes Manual

E. American Architectural Manufacturers Association (AAMA):

1.	605-98	High Performance Organic Coatings on Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

D. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.

2.2 ROOF HATCH (SCUTTLE)

A. Fabricate from aluminum with mill finish.

B. Curb and Cover:

1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
5. Make top of curb12 inches above roof membrane.
6. Form cover to lap curb and cap flashing.
7. Size opening as shown.

C. Hardware:

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
2. Provide pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Covers shall automatically lock in the open position at not less than 70 degrees.
5. Provide weatherstripping at cover closure.
6. Galvanize all hardware items.

D. Assembly:

1. Completely shop assemble roof scuttle.
2. Fully weld all joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.

E. Accessories:

1. Roof Hatch Cover Handrail: Provide 1 -1/2” outside diameter aluminum handrail secured to interior face of roof hatch cover, and aligned with stair railing below to create an extension of stair handrail of metal stair. Construction Manager shall coordinate location and angle of roof hatch handrail with metal stair handrail provided in future bid package to align with stair handrail below roof hatch.
   a. Handrail Material: Match handrails performance requirements specified in Section 05 51 00 - Metal Stairs.
   b. Maintain watertight construction of roof hatch.
2. Others: As required for a complete installation.

F. Integral Safety Railing: Provide for each hatch.
1. Types and sizes as needed for hatch types

2. Performance Requirements: Comply with the following for roof and floor opening protection and safe ingress/egress through hatch:
   a. OSHA 29 CFR 1910.23.
   b. OSHA 29 CFR 1910.27.
3. Brackets for posts bolted on hatch curb above counter-flashing to preclude need of additional seals by roofing trade.
4. Factory applied powder coat finish; Safety Yellow.
5. 4-post configuration mounted to hatch curb.
6. Self-closing gate.
7. Manufacturers and models offered to comply with the requirements include, but are not necessarily limited to, the following:
   a. Bil-Guard™ Hatch Rail System by Bilco. Pultruded fiberglass reinforced polymer pipe railing. Aluminum hinges, stainless steel torsion rod and fasteners, and hot dip galvanized brackets ¼" thick.
   b. "Safety Railing" by Babcock Davis. 1-1/4 inch ID schedule 40 pipe; vinyl end caps; galvanized per ASTM A53; stainless steel gate hardware.
   c. "Safety Railing" by Nystrom. 1-1/4 inch ID schedule 40 pipe; vinyl end caps; galvanized per ASTM A53; stainless steel gate hardware.
   d. "STH" by JL Industries. 1-5/8 inch OD ASTM A53 grade B seamed galvanized steel pipe.
   e. "SafePro" by SafePro L.P. 1-1/2 inch steel tubing; ASTM A500.

2.3 EQUIPMENT SUPPORTS

A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.

B. Form exterior curb with integral base

C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).

D. Fabricate curb with a minimum height of 12 inches above roof surface.

E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.

F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

2.4 FINISH

A. In accordance with NAAMM Amp 500 Series.

B. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof specialties where shown.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, Thermal Insulation and Section 03 52 00 - Lightweight Concrete Roof Insulation. .

D. Comply with Section 07 92 00, Joint Sealants to install sealants where manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturer’s recommendations.

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

3.4 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:
1. Copings and custom pilaster caps.
a. Membrane flashing under coping and pilaster caps.

B. Field Measure to verify sizes required for coping and pilaster caps.

C. Work Specified Elsewhere, but Provided Under this Section:
1. Roof expansion Joint Covers: Provide in conformance with Section 07 95 13 - Expansion Joint Cover Assemblies.

1.2 RELATED WORK

A. Wind Loads: Section 01 83 16.13 - Exterior Wind Enclosure Requirements.

B. Roof curb supports: Section 06 10 00 - Rough Carpentry.

C. Execution: Section 01 73 00.

D. Exterior Wind Enclosure Requirements: Section 01 83 16.13.

E. Precast Architectural Concrete: Section 03 45 00.

F. Air Weather Barrier (AWB): Section 07 27 30.

G. Manufactured Insulated Wall Panels: Section 07 42 15.

H. Manufactured Metal Siding: 07 46 15.

I. Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing: Section 07 52 16.

J. Color and texture of finish: Section 09 06 00, Schedule for Finishes

K. Sealant material and installation: Section 07 92 00, Joint Sealants.

L. Rigid insulation for roofing: Section 03 52 00, Lightweight Concrete Roof Insulation

1.3 DESIGN/PERFORMANCE REQUIREMENTS

A. SPRI Wind Design Standard: Manufacture and install copings, roof-edge flashings, and fascia systems that have been tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressures: 121 pounds per square foot, minimum. Meet or exceed the requirements of Section 01 83 16.13 - Exterior Wind Enclosure Requirements.

B. Roof accessories shall not have waves, warps, buckles, oil-canning, fastening stresses or distortion.

C. Thermal Movements: Provide roof accessories that allows for thermal movements from ambient and surface temperature changes
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Provide a watertight transition to adjacent expansion joints and cladding systems.

1.4 QUALITY CONTROL

A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.

B. Each accessory type shall be the same and be made by the same manufacturer.

C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

D. All metal roof edges shall meet requirements of IBC 2006, including expansion joint covers.

E. Mockup: See Section 01 43 39 - Mockups.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples.

B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm x 100 mm (4 inch x 4 inch), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
1. Special Finish Samples: Submit 12 x 12 inch samples of each color referenced in Part 2 for selection by Architect.

C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

D. Product Data: Submit data for roof edge systems indicating compliance with windstorm requirement; see “Roof Edge Systems” under QUALITY ASSURANCE below.

E. Installation Guide for Edge of Roof Systems: The product manufacturer shall provide a written installation guide.

F. Painted Finishes: Comply with requirements of Section 05 05 13 - Shop Applied Coatings for Metal.

G. Manufacturer's Literature and Data: Each item specified.

H. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.6 WARRANTY

A. Work of this Section subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend warranty period to 10 years from acceptance of facility by the Government.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Material (ASTM):

1.	B209/209M-07	Aluminum and Aluminum Alloy-Sheet and Plate
2.	B221/221M-07	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
3.	C612-04	Mineral Fiber Block and Board Thermal Insulation
4.	D1187-97 (R2002)	Asphalt-Base Emulsions for Use as Protective Coatings for Metal

C. National Association of Architectural Metal Manufacturers (NAAMM):

1.	AMP 500-505-88	Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):

1.	605-98 and Panels.	High Performance Organic Coatings on Architectural Extrusions

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221/B221M.

B. Aluminum Sheet: ASTM B209/B209M.

C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

D. Insulation: ASTM C612, Class 1 or 2.

E. Asphalt Coating: ASTM D 1187, Type I, quick setting.

2.2 COPINGS AND PILASTER CAPS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

B. Pilaster Caps: Custom fabricated devices at Dixie Building. Same as copings except 4-sided devices with “hip” type configuration with equal height legs.

C. Fabricate of aluminum not less than0.063 thick

D. Terminations Other than at Metal Panel (Mp)Wall Systems: Turn outer edges down each face of wall and ends of coping, .

E. Terminations at Metal Panel (MP)Wall Systems: Turn outer edges out to form end dam. End dam to butt tight to substrate with AWB. AWB to seal end dam flashing watertight to AWB system.

F. Maximum lengths of 10 feet.

G. Widths: Custom.

H. Shop fabricate external and internal corners as one piece assemblies with not less than 12 inch leg lengths.

I. Provide 4 inch wide 0.032 inch thick watertight joint covers.

J. Provide anchor gutter bar of 0.032 inch thick with anchor holes formed for underside of joint.

K. Provide concealed guttered splice plate of 0.032 inch thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

L. Finish: Fluorocarbon in conformance with Section 05 05 13 - Shop Applied Coatings for Metal for all exposed and semi-exposed surfaces..

M. Fasteners: Shall be stainless steel screw type with a minimum pull-out resistance of 240 # as supplied by the manufacturer per substrate application. No exposed fasteners shall be permitted.

N. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer.

O. Membrane Flashing:
   1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
      a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
      b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
      c. Material shall be compatible with AWB.
   2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
      b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
      c. Henry Company; Blueskin PE200 HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.3 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS

A. Provide expansion joint Type EJR-1 as specified in Section 07 95 13 - Expansion Joint Cover Assemblies.

2.4 FINISH

A. Typical: Fluorocarbon Finish: in conformance with Section 05 05 13 - Shop Applied Coatings for Metal.

B. Special Finish at Dixie Building: Fluorocarbon finish with Limestone appearance.
1. Basis of Design: Cast Stone Premium or Limestone Premium by Metal Era.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric **silicone** sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof accessories where shown.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 03 52 00 - Lightweight Concrete Roof Insulation. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.

D. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

E. Aluminum Coping:

1. Provide Membrane Flashing under Coping: Install wrinkle free. Provide primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than fasteners for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less Than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days. At ends terminate with concealed end dams or concealed ends to match profile of coping. Do not extend membrane where it will contact exposed sealant joints, unless approved by Architect.

2. Install sections of coping with approximately 6 mm (1/4 inch) space between ends of sections.
3. Center joint gutter bar and covers at joints and securely lock in place.
4. When snap-on system is used insure front and back edges are locked in place.

F. Gravel Stops System with Fascia And Cant :

1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown.
2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
3. Offset joints in extruded aluminum members from galvanized steel cant joints.

G. Expansion Joint Covers:

1. Install to terminate base flashing 200 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
3. Use stainless steel screws when exposed.

4. Two piece assembly:

   a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
   d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).
   e. Moisture Barrier: Install to meet requirements in Part 2 above.
   f. Drainage Boot:
      1) Install flexible rubber gutter system in strict accordance with the manufacturer's typical details and instructions along with the advice of their qualified representative.
      2) Terminate drainage hose to plumbing vent pipe to maintain positive drainage. Final connection to drainage tubing to vent pipe shall be provided by Division 22.

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

C. Remove protective film or covering after installation is complete and prior to substantial completion.

3.3 ADJUSTING

A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

- - - E N D - - -

SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies mineral fiber and cementitious coverings to provide fire resistance to structural steel members. Include partially concrete encased steel beams in Dixie Building.

B. Section includes the fire proofing of trusses and calculating the required fireproofing on the truss base on UL requirements and calculating required fireproofing for the trusses.

1.2 RELATED WORK (Items not included in this Project Manual are available through Construction Manager upon request.)

A. Interstitial spaces: Section 01 11 10 - Summary of Work – General.

B. Testing: Section: 01 45 29 - Testing Laboratory Services.

C. Structural Steel: Section 05 12 00.

D. Steel Decking: Section 05 31 00.

E. Composite Metal Decking: Section 05 36 00.

F. Sprayed Polyurethane Foam Insulation & Air/Vapor Barrier System, Section 07 21 29.

G. Intumescent Fireproofing: Section 07 81 23.

1.3 PERFORMANCE REQUIREMENTS

A. PERFORMANCE REQUIREMENTS: Fireproofing to meet or exceed the following when applied in the thickness and density required to achieve the required fire-rating:

B. General:

1. Fire-Resistance Rating of Assemblies: As required by Code; ASTM E 119.
2. Deflection: No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3 m (10 ft.); ASTM E 759.
3. Corrosion-Resistance: No promotion of corrosion of steel; ASTM E937.
4. Bond Impact: No cracking or delamination; ASTM E 760.
5. Air Erosion: 0.27gm/m^2 (0.025 gm/ft^2); ASTM E 859/GSA.
6. Flame Spread Rating for Materials with Adhesive and Sealer to be Used: Not to exceed 25; ASTM E 84.
7. Smoke Developed Rating for Materials with Adhesive and Sealer to be Used: Not to exceed 50; ASTM E 84.
8. Fungi Resistance: Resistance to mold growth when inoculated with aspergillus niger (28 days for general application); ASTM G21.

9. Density: ASTM E 605, tested to provide densities not less than set forth in manufacturers literature and applicable UL rated assemblies; except not less than 15 pcf average density.
10. Impact Penetration: 6 cc max.; NFGS-07250 City of San Francisco.
11. Abrasion Resistance 22 cc max.; NFGS-07250 City of San Francisco.
12. Asbestos Content: Asbestos free.

C. Standard Density Fireproofing: For use at interior of building only and protected from damage by another system to at least 6'-0" above finished floor.
1. Compressive Strength: Not less than 36 kPa (5 lbf/in^2); ASTM E761.
2. Cohesion/Adhesion (Bond Strength): 9.57 kPa (200 lbf/ft^2); ASTM E 736

D. Medium Density Fireproofing:
1. Minimum Cement Content: 60% by weight
2. Dry Density: 22 pounds/cu. ft., ASTM E 605.
3. Hardness: 10 minimum, ASTM D 2240.
4. Compressive Strength: 100 psi minimum at 10% deformation, ASTM E 761.
5. Bond Strength: 2,000 psf, ASTM E 736.

E. High-Density Fireproofing:
1. Dry Density: 40 pounds/cu. ft., ASTM E 605.
2. Hardness: 40 minimum, ASTM D 2240.
3. Compressive Strength: 550 psi minimum at 10% deformation, ASTM E 761.
4. Bond Strength: 10,000 psf, ASTM E 736.

F. For beams and column sizes not included within the required UL fire resistance design numbers, the Contractor is responsible to adjust the thickness of sprayed protection material based on the equations listed in the UL Fire Resistance Directory.

G. Applied Fireproofing shall be an acceptable substrate for spray insulation specified in Section 07 21 29 - Sprayed Polyurethane Foam Insulation & Air/Vapor Barrier System, without decreasing the required fire resistant rating provided by the Applied Fireproofing; see RATING SCHEDULE below.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Manufacturer's complete and detailed application instructions and specifications.
2. Manufacturer's repair and patching instructions.

C. Shop Drawings: Structural framing plans indicating the following:
1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistance design designations; see "Fire-Resistance Ratings" under QUALITY ASSURANCE below.

b. Indicate “Restrained” and “Unrestrained” structure.
c. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
d. Steel Joists: See “Steel Joists” subpara. of “Fire-Resistance Ratings” under QUALITY ASSURANCE below.

3. Treatment of sprayed fire-resistive material after application.

D. Certificates:

1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.

a. List thickness and density of material required to meet fire ratings.
b. Accompanied by complete test report and test record.

2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

E. Miscellaneous:

1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
2. Manufacturer's written approval of completed installation.
3. Manufacturer's written approval of the applicators of fireproofing material.

F. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.

G. Calculations: Submit calculations for review by Resident Engineer of calculations used to determine the required thickness of fireproofing on truss members. Submittals, may or may not be returned, and will not bear stamp of approval. Calculations shall be signed an sealed by a professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 5 years experience in providing engineering services of the kind indicated.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver to jobsite in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.

B. Remove damaged containers from the site.

C. Store the materials off the ground, under cover, away from damp surfaces.

D. Keep dry until ready for use.

E. Remove materials that have been exposed to water before installation from the site.

1.6 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide designs indicated by designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.

B. Restraint: The structure for this Project shall be considered “unrestrained” as defined in ANSI/UL 263, Appendix C as determined by the Architect and his consulting structural engineer only. Opinions of manufacturer or their consultants not acceptable.

C. Exterior Products: Weatherability as listed in the UL Fire Resistance Index for exterior use.

D. Steel Joists: Design thicknesses for open web steel joists based on testing at a maximum allowable stress of 30 ksi. Designs based on stresses less than 30 ksi not acceptable.

E. Individual structural members can only use one fireproofing material to achieve the required fire rating. The use of dissimilar fire resistant materials on an individual element will nullify the fire resistance rating of the element.

F. Structural Steel Supporting Roof: The fire rating required of the structural steel frame at the roof shall not be reduced based upon the clear height of the frame above the floor for columns or beams connected to columns. If any portion of a structural bay can not be reduced based upon the clear height of the frame above the floor, the entire structural bay shall be fireproofed with no reduction in hourly rating permitted.

G. For beams and column sizes not included within the required UL fire resistance design numbers, the Contractor is responsible to adjust the thickness of sprayed protection material based on the equations listed in the UL Fire Resistance Directory.

H. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.

I. Manufacturer's approval of fireproofing applications.

J. Manufacturer's approval of completed installation.

K. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.

L. Testing: See Section 01 45 29 for testing furnished by Owner.

M. Mock-up: Before start of building fireproofing, provide full scale mock-up of fireproofing to establish acceptable quality, durability, and appearance of fireproofing. Mock-up to be one structural bay of not less than 900 sq. ft. and include all structural elements requiring fire protection, including metal deck, four columns and all associated beams or girders.
   1. Testing of mock-up performed under Section 01 45 29.
   2. Acceptable mock-up to be standard of quality for remaining work.
   3. Accepted work may remain in place. Unacceptable work to be removed and replaced until an acceptable level of fireproofing is achieved.

1.7 SEQUENCING/SCHEDULING

A. All trades making connections to members receiving fireproofing to install clips, hangers, and devices as required before installation of fireproofing. Construction Manager to coordinate this requirement with all bid packages.

B. Other trades to delay installing work which would prohibit application of fireproofing until fireproofing is completed. Construction Manager to coordinate this requirement with all bid packages.

C. Fireproofing must be installed and fully cured before overcoating with spray insulation specified in future work package. Construction Manager to coordinate this requirement with all bid packages.

1.8 APPLICABLE PUBLICATIONS (LATEST EDITION UNLESS OTHERWISE NOTED):

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. C841-03 Installation of Interior Lathing and Furring
2. C847-09 Metal Lath
3. E84-10 Surface Burning Characteristics of Building Materials
4. E119-09 Fire Tests of Building Construction and Materials
5. E605-93 (R2006) Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members
6. E736-00 (R2006) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
7. E759-92 (R2005) The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
8. E760-92 (R2005) Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
9. E761-92 (R2005) Compressive Strength of Fire-Resistive Material Applied to Structural Members
10. E859-93 (R2006) Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
11. E937-93 (R2005) Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
12. E1042-02 (R2008) Acoustically, Absorptive Materials Applied by Trowel or Spray.
13. G21-09 Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

1. Fire Resistance Directory Latest Edition including Supplements

2. 263 Fire Tests of Building Construction and Materials

3. 2079 Tests for Fire Resistance of Building Joint Systems.

Fire Resistance Directory,

D. Warnock Hersey (WH):

1. Certification Listings Latest Edition

E. Factory Mutual System (FM):

1. Approval Guide Latest Edition including Supplements

F. National Fire Protection Association (NFPA)

1. 101-2006: Life Safety Code

G. International Building Code (IBC):

1. 2006 Edition

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.
2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m^3 (15 1b/ft^3) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.
3. See PERFORMANCE REQUIREMENTS above.

2.2 ADHESIVE

A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.

B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

C. Sealant and adhesives used shall meet VOC requirements in conformance with Section 01 81 13 - Sustainable Design Requirements.

2.3 SEALER

A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.

B. Surface burning characteristics as specified for fireproofing material.

C. Fungus resistant.

D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m2 (1.7 pounds per square yard).

B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.

B. Verify hangers, inserts and clips are installed before the application of fireproofing material.

C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.

D. Verify concrete work on steel decking and concrete encased steel is completed.

E. Verify temperature and enclosure conditions are required by fireproofing material manufacturer.

F. For applications visible on completion of project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.2 PRE-APPLICATION TESTING

A. Before beginning work, test areas designated below receiving work of this Section for bond strength in accordance with ASTM E736.
   1. Areas which have painted surfaces.
   2. Areas which have received asbestos encapsulation under WP-9A.

3.3 APPLICATION

A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Application of Metal Lath:

1. Apply to beam and columns having painted or encapsulated surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 300 mm (12 inches) or more in width.
3. Apply to column flanges 400 mm (16 inches) or more in width.
4. Apply to beam or column web 400 mm (16 inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 300 mm (12 inch) center.
6. See design criteria section of the approved assemblies used.
7. Lap and tie lath member in accordance with ASTM C841.
8. Apply to steel members that are to receive any form of spray insulation.

D. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:

    a. Type I - 240 kg/m^3 (15 lb/ft^3).
    b. Type II - 350 kg/m^3 (22 lb/ft^3).

E. Specialty Systems: Provide specialty fireproofing to provide resistance to physical abuse for the areas specified below and other areas indicated on drawings. Provide metal lath where recommended by fireproofing manufacturer. Apply continuous coating over entire member(s).

1. Type I - Medium-Density System: Interior areas subject to physical abuse.
    a. Interior columns where fireproofing is exposed to view not otherwise protected by other materials.
    b. Framing in exterior walls not covered with sheathing or water-shedding membrane.
2. Type I - High-Density Systems: Interior and exterior areas.
    a. Framing exposed to weather or frequent wind-driven rain.
    b. Members in air plenums where adjacent to unducted louvers where members may get wet.
    c. Framing temporarily exposed to weather for:
        1) Periods longer than recommended by fireproofing manufacturer.
        2) Freeze/thaw conditions without protection after cure.
    d. Galvanized steel framing.
    e. Framing where exterior masonry on both sides steel members.

F. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.

3.4 FIELD TESTS

A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.

B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.

C. Access for Sprayed-On Fireproofing Field Tests: Construction Manager shall provide Resident Engineer and testing agency personnel access and use of motorized construction lifts to at no additional cost. The construction lifts shall be used by Resident Engineer and testing agency personnel to access areas of building structure they judge as requiring testing.

D. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.

E. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.

1. Test for cohesion/adhesion: ASTM E736.
2. Test for bond impact strength: ASTM E760.

3.5 PATCHING AND REPAIRING

A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.

B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.

1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
3. Hand mixing of material is not permitted.

C. Repair:

1. Respray all test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.6 SCHEDULE

A. Apply fireproofing material in interior structural steel members.

B. Type I: Interior and exterior

1. One hour fire rating.
2. Two hour fire rating.
3. Three hour fire rating.

C. Type II: Interior

1. One hour fire rating.
2. Two hour fire rating.

3.7 RATING SCHEDULE

A. Restraint: Members requiring fireproofing to be considered “unrestrained”; See “Restraint” subpara. of “Fire-Resistance Ratings” under QUALITY ASSURANCE in Part 1 above.

B. Roofs with metal deck shall be based on isocyanurate roof insulation being installed on deck, without a deck board.

C. For beams, trusses, and column sizes not included within the required UL fire resistance design numbers, the Contractor is responsible to adjust the thickness of sprayed protection material based on the equations listed below and in the UL Fire Resistance Directory.

Beam
T1=T2(W2/D2+0.6)/(W1/D1+0.6)

T = thickness of spray applied material
W= weight of beam per foot
D = perimeter of protection at the interface of the protection material
and the steel through which heat is being transferred to steel
1= refers to desired beam size and required material thickness
2= refers to given beam size and material thickness shown on the individual UL design.
W/D values are not less than 0.37
T1 not less than 3/8"
Applies to ratings of more than 1 hour of Unrestrained or Restrained Beam Ratings.

Column
X2=1.25(X1)(W1/D1)(D2/W2).

X2=thickness of coating of smaller WF section.
X1=thickness of coating used on the rated steel section
W2=weight per foot of smaller WF section
W1=weight per foot of the rated steel section
D2=perimeter of smaller steel section at interface with coating
D1=perimeter of the rated steel section at interface with coating

Round Cast Iron Columns
A/P = t(d-f) ÷ d
A = Cross sectional area of the column in square inches.
P = Heated perimeter in inches
d = Outside diameter of the column in inches.
f = Wall thickness of the column in inches.

H = R-0.20 ÷ 4.43(A/P)
R = Fire Resistance in hours.
H = Thickness of cementitious mixture in inches

D. Fireproofing Requirements by Construction Type for Each Structure:

As shown on next page.

Fireproofing Matrix								
Code Data	Building 1	Building 2	Building 3	Building 4	Building 5	Building 6	Building 7	Building 8
	In Patient	D&T	Out Patient			Trans Living	CEP	Research
Building Code	NFPA 101	NFPA 101	NFPA 101			NFPA 101	NFPA 101	NFPA 101
Main Use	I-2	I-2	B			I-2	S	B
Construction Type	II(222)	II(222)	II(222)			II(222)	II(222)	II (222)
High-Rise	Yes	Yes	Yes			No	No	No
Low-Rise	No	No	No			Yes	Yes	Yes
# Floors	4	5	7			4	4	4
Protected by Sprinklers	Yes	Yes	Yes			Yes	Yes	Yes
Construction	Steel Frame	Steel Frame	Steel Frame			Steel Frame	Concrete Frame	Concrete Frame

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E. Schedule of Minimum Fire--Resistance Ratings of Structural Elements (In Hours): In case of conflict with this abridged schedule and referenced building codes, provide the more stringent requirement.

NFPA 101 Structural Elements[a]	Construction	
	Type II (222)[b]	
Exterior Bearing Walls		
Supporting one or more floors, columns, or other bearing walls	2	
Supporting one floor only	2	
Supporting a roofs only	1	
Interior Bearing Walls		
Supporting one or more floors, columns, or other bearing walls	2	
Supporting one floor only	2	
Supporting a roofs only	1	
Columns		
Supporting more than one floor, columns, or other bearing walls	2	
Supporting one floor only	2	
Supporting a roofs only	1	
Beams Girders, Trusses and Arches.		
Supporting more than one floor, columns, or other bearing walls	2	
Supporting one floor only	2	
Supporting a roofs only	1	
Floor-Ceiling Assemblies	2	
Roof-Ceiling Assemblies	1	

a. See requirements of QUALITY ASSURANCE above.
b. Type II (222) is an NFPA construction type designation, and shall not be construed to be representing a Type II fireproofing material.

- E N D - - -

SECTION 07 81 23
INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

RFI 04040 CONFIRMS THAT THE EXISTING CAST IRON COLUMNS IN DIXIE ARE THE ONLY MEMBERS TO RECEIVE INTUMESCENT FP.

A. Section Includes:
1. Mastic and intumescent fire-resistive coatings (MIFRC) on steel surfaces where shown or specified. Extend coatings onto concrete surfaces where specified.
2. Interior MIFRC at Building #8, Research Building.
   a. Exposed cast iron columns using intumescent fireproofing.
3. Decorative finish over all intumescent fireproofing.
4. Patching as required due to work of other trades.
5. Section includes the fire proofing of trusses and calculating the required fireproofing on the truss base on UL requirements and calculating required fireproofing for the trusses.

B. Products Furnished but not Installed Under this Section:
1. Primer for Off-Site Intumescent Fireproofing: Furnish to Section 05 12 00 - Structural Steel Framing.
   a. For materials furnished include manufacturer's written instructions and recommendations required for work to meet specification.

C. Related Sections:
1. Testing: Section: 01 45 29 - Testing Laboratory Services.
2. Structural Steel: Section 05 12 00.
3. Steel Deck: Section 05 31 00.
4. Composite Metal Decking: Section 05 36 00.
5. Applied Fireproofing including partially concrete encased steel beams: Section 07 81 00.

1.2 REFERENCES (Latest editions unless otherwise indicated)

A. American Society for Testing and Materials (ASTM):

E 84 Test for Surface Burning Characteristics of Building Materials.

E 119 Methods of Fire Tests of Building Construction and Materials.

B. Underwriters Laboratories Inc. (UL):

Fire Resistance Directory

263 Fire Tests of Building Construction and Materials.

C. Steel Structures Painting Council (SSPC):
1. SSPC SP 1-00 (R2004) Solvent Cleaning
2. SSPC SP 2-00 (R2004) Hand Tool Cleaning
3. SSPC SP 3-00 (R2004) Power Tool Cleaning
4. SSPC-SP 6/NACE No. 3 (1/07) Commercial Blast Cleaning

1.3 PERFORMANCE REQUIREMENTS

A. Fireproofing to meet or exceed the following:
   1. Fire-Resistance Rating of Assemblies: As required by Code; ASTM E 119.
   2. Flame Spread Rating for Materials: Not to exceed 25; ASTM E 84.
   3. Asbestos Content: Asbestos free.

B. Exterior Exposure: Intumescent system with finish coat applied and cured shall be approved by manufacturer for exterior exposure for 180 days or more.

C. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Primers, Sealers, and Undercoaters: 200 g/L.
   4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   5. Fireproofing Coatings: 350 g/L.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:

B. Product Data: Submit manufacturer's literature fully describing fireproofing products and application conditions.

C. Samples: Submit complete selection of Decorative Finish and finish chips indicating color, texture and sheen, for selection and approval by the Architect.
   1. Samples of Decorative Finish for texture approval shall be applied over the proposed base coat(s).

D. Test Reports:
   1. Submit copies of fire test reports of fireproofing application to substrate materials required.
   2. Submit certified test reports of acceptable testing agencies which perform testing in accordance with ASTM E 119 and E 84.

E. Manufacturer's Instructions:
   1. Furnish manufacturer's printed material specifications and application instruction for each type of fireproofing.
   2. Furnish schedule of fireproofing thicknesses required for each item requiring same; see RATING SCHEDULE in Part 3.

F. Affidavits:
   1. Furnish manufacturer's certification that materials meet or exceed specification requirements.
   2. Furnish confirmation of compatibility between MIFRC and the substrate primer(s).
   3. Furnish applicators certification that Work has been completed as specified to meet fire-resistance ratings, thickness requirements, density requirements, and application requirements.

G. LEED Submittals:
   1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.

H. Calculations: Submit calculations for review by Resident Engineer of calculations used to determine the required thickness of fireproofing on truss members. Submittals, may or may not be returned, and will not bear stamp of approval. Calculations shall be signed an sealed by a professional engineer who is legally qualified to practice in the State of Louisiana and who has a minimum of 5 years experience in providing engineering services of the kind indicated.

1.5 QUALITY ASSURANCE

A. Applicator:
1. Experienced in applying MIFRC similar in material, design and extent to those indicated for this Project. Record of successful application of materials on two projects with similar quantities of fire proofing materials.
2. Licensed or approved by manufacturer of fireproofing materials.

B. Requirements of Regulatory Agencies: Comply with the following:
1. Building Code Requirements: Fire-resistance ratings of areas to receive fireproofing materials.
2. Underwriters' Laboratories, Inc.: Fire Hazard Classification.

C. Testing: See Section 01 45 29 for testing furnished by Owner.

D. Restraint: The structure for this Project shall be considered “unrestrained” as defined in ANSI/UL 263, Appendix C as determined by the Architect and his consulting structural engineer only. Opinions of manufacturer or their consultants not acceptable.

E. Steel Joists: Design thicknesses for open web steel joists based on testing at a allowable stress of 30 ksi. Designs based on stresses less than 30 ksi not acceptable.

F. Individual structural members can only use one fireproofing material to achieve the required fire rating. The use of dissimilar fire resistant materials on an individual element will nullify the fire resistance rating of the element.

G. For beam and column sizes not included within the required UL fire resistance design numbers, adjust the thickness of MIFRC based on the equations listed in the UL Fire Resistance Directory.

H. Application: Designated for "interior".

I. Mock-up: Before start of building fireproofing, provide full scale mock-up of fireproofing to establish acceptable quality, durability, and appearance of fireproofing.
1. Mock-up to include the following items where applicable:
   a. Column: One column, full height.
   b. Beam: One beam, full length, minimum 10 feet.
   c. Metal Deck: Minimum 100 square feet.
2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
3. Exposed fireproofing will be judge by Architect for “Aesthetic Finish” appearance.
4. Testing of mock-up performed under Section 01 45 29.
5. Acceptable mock-up to be standard of quality for remaining work.
6. Accepted work may remain in place. Unacceptable work to be removed and replaced until an acceptable level of fireproofing is achieved.
7. Do not proceed in other areas until mockup has been approved.
8. Keep approved installation area open for observation as criteria for MIFRC.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened containers bearing name of manufacturer and product identification.

B. Store materials off ground, under cover, in dry area at a temperature between 33 and 105 degrees F unless otherwise permitted or restricted by manufacturer.

C. Discard materials which have come into contact with contaminants prior to actual use.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not apply fireproofing when conditions are outside the parameters listed below:
   1. Temperature: See MATERIALS in Part 2 below except steel surfaces should be a minimum of 5 degrees F above the dew point.
   2. Relative Humidity:
      a. Intumescent Fireproofing: See MATERIALS in Part 2 below. Maintain throughout entire application and drying period.
      b. Decorative Finish Coat: See MATERIALS in Part 2 below. Maintain throughout entire application and drying period.

B. Protection:
   1. Protect from rain; maintain within specified environmental conditions during application and curing periods.
   2. Provide ventilation in area to receive fireproofing, introducing fresh air and exhausting air continuously during and after application until fireproofing dry to maintain non-toxic, unpolluted, safe working area.
   3. Provide temporary enclosures to prevent spray from contaminating air.
   4. Protect adjacent surfaces and equipment from damage from installation of fireproofing.

1.8 SEQUENCING/SCHEDULING

A. All trades making connections to members receiving fireproofing to install clips, hangers, and devices as required before installation of fireproofing.

B. Other trades to delay installing work which would prohibit application of fireproofing until fireproofing is completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specification based on thin film products by The Carboline Co., St. Louis, MO, 800 848-4645. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Albi Manufacturing, Division of StanChem Inc.
   2. Carboline Company.
   3. Isolatek International.
   4. AkzoNoble, International
   5. Firewise Supplies.

6. Other Manufacturers: As approved prior to bid. Submit application conditions. Verify below conditions and provide separate application conditions criteria.

Condition	Surface	Ambient	Humidity
Normal	Per manufacturer	Per manufacturer	10-70%
Minimum	50 degrees F	50 degrees F	10%
Maximum	Per manufacturer	Per manufacturer	75%

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. MIFRC: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat (Decorative Finish), and complying with indicated fire-resistance design.

B. Interior Intumescent Fireproofing: Basis of design is Thermo-Sorb by Carboline, a thin coat intumescent, thermally activated Intumescent coating for fireproofing steel, especially designed for minimum thickness and aesthetic applications.

1. Interior: Application conditions as follows:

Condition	Surface	Ambient	Humidity
Normal	60-85 degrees F	60-85 degrees F	0-85%
Minimum	40 degrees F	40 degrees F	0%
Maximum	90 degrees F	105 degrees F	85%

C. Exterior Intumescent Fireproofing: Basis of design is “Nullifire 605” by Carboline, a thin coat intumescent, thermally activated Intumescent coating for fireproofing steel, especially designed for minimum thickness and aesthetic applications.

1. Exterior:

Condition	Surface	Ambient	Humidity
Normal	60-85 degrees F	60-85 degrees F	0-80%
Minimum	33 degrees F	33 degrees F	0%
Maximum	90 degrees F	105 degrees F	80%

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Epoxy Substrate Primers: Primer shall be approved by manufacturer to allow primer on steel to be exposed to weather, for a period of not less than 365 days, before Intumescent fire-resistive coating is applied over the primer. The primers listed below are acceptable for specified Carboline systems. Other primers may be used, but the compatibility shall be confirmed by the fireproofing manufacturer before starting work. Chlorinated rubber or bituminous primers are prohibited.

1. Bare Steel:
   a. Carboguard 893SG.
2. Galvanized Steel:
   a. Carboguard 893SG. .
      1) Steel Preparation: Blast-cleaned to SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.

C. Substrate Primers for Interior On-Site Fireproofing: Provide as needed to comply with VOC and fireproofing requirements. Comply with all applicable environmental (temperature, humidity) restrictions.

1. Cast Iron: As recommended by fireproofing manufacturer.

a. Steel Preparation: Blast-cleaned to SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.

2. Concrete: As recommended by fireproofing manufacturer.

D. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

E. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

F. Sealer Coat: Product as recommended by manufacturer for application over Intumescent Fireproofing for proper application of coat.

G. Interior Topcoat (Decorative Finish): Suitable topcoat for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design. Basis of design is "Carboacrylic 3350 (semi-gloss) or Colorcoat (gloss)" by Carboline; a waterborne acrylic coating applied at 2.0 to 3.0 mils DFT; satin finish. Color(s) as selected by Architect from manufacturer's full line. Coating application conditions as follows:

Condition	Material	Surface	Ambient	Humidity
Normal	60-90 degrees F	65-85 degrees F	65-90 degrees F	10-80%
Minimum	50 degrees F	50 degrees F	50 degrees F	0%
Maximum	105 degrees F	130 degrees F	110 degrees F	85%

1. Other coating system as approved by both fireproofing manufacturer and Architect.

H. Exterior Topcoat (Decorative Finish): Suitable topcoat for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design. Basis of design is "Carbothane "133 LH"; an aliphatic acrylic-polyester polyurethane coating applied at 3.0 to 5.0 mils DFT per coat; satin finish. Color(s) as selected by Architect from manufacturer's full line. Coating application conditions as follows:

Condition	Material	Surface	Ambient	Humidity
Normal	65-85 degrees F	65-85 degrees F	65-85 degrees F	35-60%
Minimum	40 degrees F	40 degrees F	40 degrees F	0%
Maximum	100 degrees F	110 degrees F	110 degrees F	90%

1. Other coating system as approved by both fireproofing manufacturer and Architect.

2.4 Finish:

A. Match Architect's sample for color(s) and texture of finished MIFRC.

B. Interior Colors: ~~One coat required.~~
1. General: Unless otherwise noted, match Benjamin Moore, color number OC-65 – Chantilly Lace.

RFI 7967 clarified the decorative finish of intumescent top coat at existing columns.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive fireproofing before installation for defects or conditions adversely affecting bond, quality, and execution of the installation.
1. Do not proceed with installation work until unsatisfactory conditions are corrected.
2. Installation of fireproofing constitutes installer's acceptance of the substrates as satisfactory.

3. The primary responsibility for providing acceptable substrates are as follows:
   a. Metal Deck: By metal deck trade.
   b. Structural Steel: By the fireproofing trade.
   c. Cast Iron: By the fireproofing trade.

B. Condition of Surfaces to Receive Fireproofing:
   1. Surfaces to be firm, dry, clean, and free of paint, oily or waxy films.
   2. Ensure that clips, hangers, supports, sleeves, and other items required to penetrate the fireproofing are placed before installing fireproofing.

C. Verify that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.2 PRE-APPLICATION TESTING

A. Before beginning work, test areas designated below receiving work of this Section for bond strength in accordance with manufacturer's recommended test procedure to ensure completed system will not have negative effect to Performance Requirements due to loss of bond.
   1. Areas which have painted surfaces.
   2. Areas which have received asbestos encapsulation under WP-9A.

3.3 PREPARATION

A. Provide temporary enclosures for areas receiving work under this Section which may be damaged by rain, cold, wind, or other environmental conditions. Maintain until permanent enclosure in place or fireproofing is not subject to damage.

B. Fill voids and cracks in substrate, remove projections, and level offsets in locations where fireproofing is exposed to view as a finish material.

C. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which would affect bond of fireproofing.

D. Verify that primed surfaces, if any, on members to receive fireproofing are compatible with fireproofing materials and bond requirements.

E. Blast clean members to receive fireproofing to remove incompatible materials which would affect bond when scraping, brushing or washing will not remove the materials. Advise other trades of all cleaning operations which may have an adverse effect on the Work or which may present a health hazard; provide all required protection for the work, public, and workman.

F. Prime bare steel, cast iron, and designated concrete in accordance with manufacturer's recommendations.

G. Obtain Architect's and Resident Engineer's approval of mock-up before installing fireproofing; see QUALITY ASSURANCE in Part 1.

3.4 APPLICATION

A. Apply fireproofing in accordance with manufacturer's recommendation to comply with fire rating requirements. See RATING SCHEDULE below.

B. Apply fireproofing over substrate by airless spray unless Architect approves use of brush or roller. Build up to required thickness with as many passes or stages necessary to cover substrate with smooth coating of uniform thickness.

C. Decorative Finish: After fireproofing fully cured, apply decorative finish over fireproofing. Provide uniform coating, free of runs, sags, laps, or variation in color and sheen. Decorative finish not required where fireproofing is concealed from view. Structural members will be exposed to view at stair shaft locations.

D. Curing:
1. Temperature: Maintain temperatures at or above minimum required by manufacturer.
2. Ventilation: Where enclosed, maintain continuous air movement; provide fresh air and exhaust air until work completely dry and cured.

3.5 ADJUST AND CLEAN

A. Patching: Patch damage to this work caused by:
1. Other trades before fireproofing is covered up, or if exposed, before final inspection. Cost of repairs or damage due to work of other trades to be borne by trades responsible for damage.
2. Failure to provide adequate protection. Repair at no additional cost to Owner.

B. Protection:
1. Protect fireproofing which is less than 9 feet from floor level according to regulatory codes and local ordinances.
2. Protect applied fireproofing until permanent covering is installed, or where exposed, until final acceptance.

C. Clean-Up: Remove all excess material, droppings, equipment and debris related to this operation upon completion of work.

3.6 RATING SCHEDULE

A. See RATING SCHEDULE in Section 07 81 00, Applied Fireproofing.

B. Restraint: See “Restraint” under QUALITY ASSURANCE in PART 1 above. Members requiring fireproofing shall be considered unrestrained as defined in ANSI/UL 263, Appendix C.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

1. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction. Work includes, but not limited to, firestopping joints in the following:
   a. Openings between floor slab and curtain wall and other edge of slab fireproofing.
   b. Penetrations in concrete slabs.
   c. Penetrations in walls, partitions, or shafts.
   d. Expansion joints
   e. Walls and partitions abutting other materials including metal deck.
2. Design/Product selection.

B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

C. Firestopping Responsibility:
1. Edge of Slab or Roof to Exterior Wall Joints: By wall cladding or framing trade as component of their wall system.
   a. Cladding Systems: Curtain wall, precast concrete, and other systems where cladding does not cover the area requiring firestopping. Firestopping by wall cladding system.
2. Penetrations/Openings: By contractor requiring penetration and performed by firestopping specialist. Include the following:
   a. Through Penetrations: Including Division 21, 22, and 23 trades. Maximum number of firestopping specialists as follows:
      1) Division 21-23: One for each of the following trades; total 3 maximum.
         a) Fire Protection.
         b) Plumbing.
         c) HVAC.
   b. Divisions 26-28: One maximum.
3. All Other Interior Joints and Penetration Systems: Including head of wall joints and pneumatic tube work. Maximum one firestopping specialist.
4. Expansion Joints: Including walls and floors. Joint covers specified elsewhere; see “Related Sections” below.
5. Penetrations: The trade causing or requiring the penetration.
6. Multiple Use Penetrations: The trade utilizing the greatest amount of space.
   a. Cost of work shared by all users of penetration in direct proportion to each trade's use of space.
7. Others: The General Trades Contractor(s) designated by the Construction Manager.
   a. Terminations of rated construction; walls, partitions.

D. Framing Responsibility: See Section 09 22 16 Non-Structural Metal Framing:
1. Framing around the items listed below in fire-rated metal stud walls and partitions are specified to be provided under Section 09 22 16.
   a. Rectangular and oval duct.
   b. Cable trays.
2. Coordinate with Section 09 22 16 for locations and sizes of framed penetrations required.
3. Additional framing, if required for firestopping, shall be provided by Section 09 22 16 at additional cost borne by trade requiring additional framing.

E. Fire Ratings: The follow applies unless indicated otherwise on CODE SUMMARY DRAWING:
   1. All Buildings Except Building Except 08 (Research):
      a. Fire Rating at Occupied and Elevated Floor Structure: 2 hours.
      b. Fire rating at Interstitial Floor Structure: 2 hours.
      c. Fire Rating at Penthouse Floor Structure: 2 hours.
   2. Buildings 08 (Research):
      a. Fire Rating at Occupied and Elevated Floors Structure: 1 hour.
      b. Fire rating at Interstitial Floor Structure: 2 hours.

1.2 RELATED WORK

A. Construction Classifications: as Indicated on Drawings.

B. Patch existing penetrations in floor slab: Section 01 73 29 - Cutting, Patching & Sleeves.

C. Testing Laboratory Services: Section 01 45 29.

D. Steel Decking: Section 05 31 00.

E. Masonry: Division 4.

F. Sprayed Polyurethane Foam Insulation: Section 07 21 29.

G. Expansion Joint Cover Assemblies: Section 07 95 13.

H. Sealants and application: Section 07 92 00, JOINT SEALANTS.

I. Spandrel Glass Insulation: Section 08 88 53 - Security Glazing.

J. Glazed Aluminum Curtain Walls: Section 08 44 13 and 08 44 13.3.

K. Gypsum board partitions: Division 9.

L. Plumbing, Fire Protection, HVAC: Divisions 20, 21, 22, & 23.

M. Electrical: Division 26, 27, & 28.

1.3 DEFINITIONS

A. Firestopping: An assembly to retain the integrity of time-rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases at penetrations and voids.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping in floors having void openings of 4 inches or more to be reinforced or covered to support the floor load requirements; all in a manner acceptable to the Resident Engineer.

B. Firestopping to accommodate differential deflection and movement between adjacent substrates without damage to substrates, firestopping, loss of firestopping performance, and without transfer of structural loads through firestopping design.

C. Firestopping shall be listed under FM, UL, or WH as indicated below for duration not less than required for the time rated construction assembly, and acceptable to governing codes and local authorities. Testing by other laboratories which do not require test specimens be installed under exact field conditions are not acceptable.
   1. Penetrations: Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m^2 (16 sq. in.) in overall cross sectional area.
   2. Joints:
      a. Curtain Wall/Floor Intersection: ASTM E 119 or ASTM E 2307.
      b. Joints in Smoke Barriers: Air leakage per UL 2079.
         1) L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
      c. Other Joints: ASTM 1966 or UL 2079.

D. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

E. Firestopping Systems at Level 2 Floor Slab: Water-resistant after drying or curing and unaffected by 100 percent humidity, condensation or transient water exposure.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers' literature, data, and installation instructions for types of firestopping and smoke stopping used.
   1. Copies of tests and other product data verifying conformance with specified performance characteristics.
   2. Complete description of assemblies and installation methods.

C. List of FM, UL, or WH classification number of systems installed.

D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

E. Shop Drawings:
   1. Show proposed details of installation, reinforcing, and anchorage.
   2. Details shall reflect actual job conditions for unusual conditions or conditions not covered by manufacturer's standard details.
   3. Manufacturer's product data sheets may be submitted instead of shop drawings if submittal includes all required information.

F. LEED Submittals:

   1. Product Data for Credit IEQ 4.3: For sealers, documentation including printed statement of VOC content.
   2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

1.6 QUALITY ASSURANCE

A. Approved Laboratory: FM, UL, or WH or other approved laboratory tested products will be acceptable, except tests which do not require test specimens be installed under exact field conditions are not acceptable.

B. Untested Systems: For those firestop applications that exist for which no FM, UL, or WH or other approved laboratory tested system is available through any manufacturer, submit a manufacturer's engineering judgment derived from similar UL system designs to local authorities having jurisdiction for their review and approval prior to installation.

C. Installer: Currently listed by FCIA as FM 4991 Approved Firestop Contractor. www.fcia.org/fm4991.htm.

D. Manufacturer's Representative: A representative to be on-site during initial installation of firestop systems and train appropriate contractor personnel in proper selection and installation procedures.
1. Perform training to comply with manufacturer's published recommendations.
2. Representative required for each firestopping manufacturer utilized.

E. Job Mockups: After all approvals have been obtained, each firestopping contractor shall provide job Mockup of typical joints. Mockups subject to inspection specified under Section 01 45 29 - Testing Laboratory Services, including repairs. Accepted mockups to remain as an acceptable standard of workmanship and can be part of completed Work

F. Requirements of Regulatory Agencies: Comply with the applicable requirements for fire separations and penetrations including the following:
1. IBC.
2. NFPA 70.
3. NFPA 101.

1.7 DELIVERY AND STORAGE

A. Deliver materials to site in original sealed and labeled containers bearing manufacturer's name, product identification, date of manufacture, color designation, and instructions for storage.

B. Store in a location providing protection from damage and exposure to the elements and as required by required by manufacturer.

1.8 WARRANTY

A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

1.9 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. E 119 Fire Tests of Building Construction and Materials
2. E84 Surface Burning Characteristics of Building Materials
3. E814 Fire Tests of Through-Penetration Fire Stops
4. E 1966 Test Method for Fire-Resistant Joint Systems
5. E2174 Standard Practice for On-Site Inspection of Installed Fire Stops
6. E 2307 Test Method for Determining fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.

C. National Fire Protection Association (NFPA):

1. 70 National Electric Code, latest edition
2. 101 Code for Safety to Life from Fire in Buildings and Structures (Life Safety Code).

D. Underwriters Laboratories, Inc. (UL):

1. Annual Issue Building Materials Directory
2. Annual Issue Fire Resistance Directory
3. UL 1479 Fire Tests of Through-Penetration Firestops
4. UL 2079 Tests for Fire Resistance of Building Joint Systems Fire Resistance Directory

E. Firestop Contractors International Association (FCIA)

F. Factory Mutual System (FM):

1. 4991 Approval Standard for Approval of Firestop Contractors.

G. Warnock Hersey (WH):

1. Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Design/Product Selection: Contractor responsible for selection of products and tested designs which fulfill the firestopping requirements of this Section.
1. Firestopping at spandrel conditions to be compatible with the exterior wall construction and thermal insulation specified elsewhere. Such firestopping subject to approval of Architect and manufacturers of abutting materials.
   a. Insulated pipe: The fire-rating classification must not require removal of the insulation.

B. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.

C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

D. Firestop sealants used for firestopping or smoke sealing shall have following properties:

1. Contain no flammable or toxic solvents.
2. Have no dangerous or flammable out gassing during the drying or curing of products.
3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. Contain halogens which may be released upon heating.
5. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:

1. Classified for use with the particular type of penetrating material used.
2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

F. Materials:
1. Asbestos free.
2. Use only waterborne or neutral cure products, with no carcinogens, and no halogens.

G. Sealant and adhesives used shall meet VOC requirements in conformance with Section 01 81 13 - Sustainable Design Requirements.

H. Firestopping Materials at Interior Partition to Exterior Wall Construction: See Details on drawings.
1. Fire Tape: Intumescent wrap type strip, highly flexible elastomeric strip, designed for fire stopping non-metallic material that penetrates fire rated construction. At terminations of fire rated interior partition to exterior wall construction strips shall be full height and width of partition. The exterior wall deflects independent of the interior partition and composite wrap strip shall fill void.
   a. Void Space Width Perpendicular to Face of Exterior Wall:
      1) Floor to Floor Height of 13’-6” or Less: Provide Composite Wrap to fill a width of 3/4".
      2) Floor to Floor Height Greater than 13’-6”: Provide Composite Wrap to fill a width equal to the floor to floor height (in inches) divided by 240 and then add 1/4" to the value to determine the width of the joint in inches. [Eg. For 240 inches floor to floor height - Width = (240 inches/240) +1/4”= 1-1/4”].
   b. Basis of Design: Series SSW Intumescent Wrap Strips by Spec Seal Firestop Products.
2. Composite Wrap: Rigid fire resistant panel consisting of an intumescent layer bonded to a galvanized steel sheet reinforced with steel wire mesh covered with aluminum foil. Product designed to seal medium to large size openings with a variety of different penetrants in both fire-resistance rated floors and walls. Expands up to 15 times its thickness in a fire condition.
   a. Basis of Design: SpecSeal® Composite Sheet by Spec Seal Firestop Products.
3. Exposed Fire Caulk: One part neutral curing silicone sealant, designed and used in UL classified firestopping systems, Ozone and UV resistant, Chemical Resistant, excellent water resistant.
   a. Modulus: Plus 50% (minimum), and minus 50%.
   b. Color as selected by Architect from manufacturer’s full range of colors to match adjacent material.
   c. Basis of Design:
      1) Series SIL 300 by Spec Seal Firestop Products.

2) Dow 790 Sealant.
3) Dow 795 Sealant.

4. Mineral Wool: 4 pound density.
5. Metal Enclosure Material for Firestopping: 0.040" thick aluminum. Provide paint finish to match interior wall partition, unless indicated otherwise. Metal enclosure shall be full height of fire rated partition. With all edges fire caulked.

2.2 SMOKE STOPPING IN SMOKE RESISTANT PARTITIONS

A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS or other sealant approved by Architect. Sealant to meet UL 1479 for Air Leakage, ASTM C919, and ASTM C90 to maintain STC rating.
1. Color at concealed locations: Safety Yellow.

B. Use mineral fiber filler and bond breaker behind sealant.

C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. -At smoke partitions that are also fire rated, comply with requirements for FIRESTOP SYSTEMS and SMOKE BARRIERS.

F. Locations: As indicated on drawings and LIFE SAFTY PLANS.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

B. Examine substrates and conditions under which firestopping work is to be performed and notify Construction Manager in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

C. Installation of firestopping materials constitutes acceptance of substrate and conditions.

3.2 PREPARATION

A. Obtain manufacturer's instructions for firestopping installation and practices for installing crew.

B. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

C. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Provide firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Provide smoke stopping seals in smoke partitions.

D. Provide fire stopping at all holes or voids made by penetrations in fire rated construction.

E. Close openings or voids remaining from terminations of rated assemblies to other construction.
   1. Edge of slab to curtain wall.
   2. Top and bottom of walls and partitions to floor and roof structure.

F. All smoke barriers and rated corridor walls shall be firestopped with systems designed to maintain a fire rating equal to the rating of the wall, but not less than 1-hour. Smoke partitions (smoke tight, non-rated corridor walls) shall be sealed per sound rated construction requirements of Section 07 92 00, Paragraph 3.5.C, “Sound Rated Construction”.

G. Provide firestopping for conditions specified whether or not firestopping is indicated and, if indicated, whether such material is designed as insulation, safing, or otherwise. Insulation types incorrectly specified in contract documents shall not be installed in lieu of firestopping.

H. Penetrations - Provide Firestopping:
   1. Where penetrations including conduit, cable, wire, pipe, duct, electrical boxes, or other elements that pass through one or both outer surfaces of a fire rated wall or floor.
   2. High traffic openings (cable trays, openings for data cable, etc.) shall be firestopped using re-installable materials (Firestop Putty or Pillows) and shall be sized to provide 25% excess capacity for future growth.
   3. Unless specifically approved, all pipe and duct insulation must remain intact, undamaged and shall run continuously through walls and floors.
   4. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space, if any, between sleeve and wall opening.
   5. Gun grade sealants and putties shall be tooled into place to insure proper adhesion to penetrations and surrounding surfaces.
   6. Boxes, Electrical and Similar: Install putty pads to exterior surfaces of box. Wrap and seal over front edge to form gasket when covered with gypsum board.

I. Fire Rated Joints – Provide firestopping:
   1. Firestop systems for areas subject to movement from dynamic loading, thermal expansion, or building movement shall be tested per UL 2079 for 500 cycles at a minimum of 10 cycles per minute.
   2. Perimeter fire barrier systems shall have been fully tested at Underwriter’s Laboratories in their Intermediate Scale Multi-Story Apparatus using exterior wall systems similar to actual field conditions including the use of vision glass in the test specimen.
   3. Where exterior facing is continuous past a structural floor, and a space would otherwise remain open between the inner face of the wall construction and the perimeter edge of the structural floor, provide a perimeter fire barrier system designed to maintain a minimum 1-hour fire rating or that which is equal to the rating of the floor.
   4. Where an exterior wall of composite type construction is continuous past a structural floor/roof, and a space would otherwise remain open at the intersection of the floor/roof

and the exterior sheathing of the wall system, provide a perimeter fire barrier system designed to maintain a minimum 1-hour fire rating or that which is equal to the rating of the floor/roof.

5. Where the top edge of a fire-rated wall or full height partition (rated or non-rated) abuts the bottom of all floors or roof with or without fluted-type metal decking, provide a fire rated joint system that allows for the dynamic movement of the floor or roof deck with a minimum 1-hour fire rating or that which is equal to the rating of the wall. Mineral wool safing may not be used alone but only as a component of a UL tested firestop system. There shall be no drywall tape or joint compound installed in the joint opening prior to the installation of the fire rated joint assembly.
6. Gun grade sealants and putties shall be tooled into place to insure proper adhesion to penetrations and surrounding surfaces.

3.4 PENETRATION IDENTIFICATION

A. Identify each firestopping system with approved tag properly listing the following:
   1. UL System No.
   2. Firestopping product manufacturer.
   3. Company name.
   4. System installer.
   5. Installation date.

B. Placement: Place tags at locations approved by Resident Engineer; special attention required for locations exposed to public. In general, place tags so they are readily visible.
   1. Walls: Attach tags directly to penetrating item or immediately adjacent to penetration.
   2. Floors: Attach tags directly to penetrating item approximately 4 to 8 inches above floor. Where finish floor treatments or wall base materials are applied to penetrant, attach tag 2 to 4 inches above such treatments or materials.

C. Tag: Self-adhering device with release paper by Metalcraft, Mason City, IA, 800 437-5283, www.idplate.com, or approved equal. All required information to be pre-printed except System Installer and Date which may be hand-printed in indelible ink.

D. Soft Substrates: For penetrants which are difficult to obtain good permanent adherence to such as fabric-covered insulation or similar substrates, attach tag to substrate and wrap penetrant and tag with clear tape to maintain placement.

E. Where tags are applied to substrates scheduled to receive paint finish, provide temporary masking. Remove masking after paint finish is completed.

F. Firestopping Notice: At areas not exposed to public view, provide notice of wall penetrations with “RATED THROUGH-PENETRATION FIRESTOPPING SYSTEM - DO NOT DISTURB” message. Paint notice in red, 3/8-inch high stenciled letters.

3.5 FIELD QUALITY CONTROL

A. See Section 01 45 29 - Testing Laboratory Service, for inspections by independent testing agency.
   1. Repair or replace non-compliant fire stops at no increased cost to Owner.

3.6 CLEAN-UP AND ACCEPTANCE OF WORK

A. As work on each floor is completed, remove and dispose of masking materials; remove all excess sealing materials, litter, and debris; clean adjacent exposed surfaces of all soil and stain resulting from firestopping operations.

B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.

C. Clean up spills of liquid type materials.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Provide UL-classified systems for the conditions specified below. UL classified systems referenced are alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Untested Systems: See QUALITY ASSURANCE in Part 1 above.

C. Ratings: Criteria as defined by ANSI/UL 1479. Provide the following ratings for each system.
1. "F" Rating: Not less than the barrier rating.
2. "T" Rating: Not less than the barrier rating.
3. "L" Rating: As required by Code. UL 1479 only.

THROUGH PENETRATION FIRESTOP SYSTEM SCHEDULE						
	FLOOR PENETRATION SYSTEMS (Series)			WALL PENETRATION SYSTEMS (Series)		
TYPE OF PENETRANT	Concrete Floors up to 5 inches thick	Concrete Floors Over 5 inches thick	Framed Floors	Concrete or Masonry Walls up to 8 inches thick.	Concrete or Masonry Walls over 8 inches thick	Framed Walls
NO PENETRAT-ING ITEMS	C-AJ-0000 or F-A-0000 or Note 1	C-BJ-0000 or Note 1	Not Available	C-AJ-0000 or C-BJ -0000 or Note 1	Note 1	W-L-0000
METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-1000 or F-A-1000	C-BJ-1000 C-BK-1000 or F-B-1000	F-C-1000	C-AJ-1000 C-BJ-1000 or W-J-1000	C-BK-1000 or W-K-1000	W-L-1000
NON-METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-2000 or F-A-2000	C-BJ-2000 or F-B-2000	F-C-2000	C-AJ-2000 C-BJ-2000 or W-J-2000	Not Available	W-L-2000
ELECTRICAL CABLES	C-AJ-3000 or F-A-3000	C-BJ-3000 or F-B-3000	F-C-3000	C-AJ-3000 C-BJ-3000 or W-J-3000	Not Available	W-L-3000
CABLE TRAYS WITH ELECTRICAL CABLES	C-AJ-4000 or F-A-4000	C-BJ-4000	Not Available	C-AJ-4000 C-BJ-4000 or W-J-4000	W-K-4000	W-L-4000
INSULATED PIPES	C-AJ-5000 or F-A-5000	C-BJ-5000	F-C-5000	C-AJ-5000 or W-J-5000	Not Available	W-L-5000
MISCELLA-NEOUS ELECTRICAL PENETRANTS	C-AJ-6000 or F-A-6000	Not Available	Not Available	C-AJ-6000	Not Available	W-L-6000
METAL DUCT & MISCELL-ANEOUS MECHANICAL PENETRANTS	C-AJ-7000 Note 3	Not Available	F-C-7000 Note 3	C-AJ-7000 or W-J-7000 Note 3	Not Available	W-L-7000 Note 3
GROUPINGS OF PENETRA-TIONS	C-AJ-8000 or F-A-8000 Note 2	C-BJ-8000 Note 2	F-C-8000 Note 2	C-AJ-8000 C-BJ-8000 or W-J-8000 Note 2	Not Available	W-L-8000 Note 2

NOTES:
1. Seal opening using barrier's original construction.
2. If a Series 8000 system is not available, provide single-penetrants systems installed singly.
3. Where dampers used in penetrations, provide TPFS system approved by damper manufacturer.

3.8 JOINT FIRESTOP SYSTEM SCHEDULE

A. Provide UL-classified systems for the conditions specified below. UL classified systems referenced are alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Untested Systems: See QUALITY ASSURANCE in Part 1 above.

C. Ratings: Criteria as defined by UL 2079. Provide the following ratings for each system.
1. Assembly Rating: Not less than the barrier rating.
2. "L" Rating: Less than 1 CFM/Linear Foot of joint. Provide for systems indicated on Schedule below.

D. Joint Movement: Joints are either static ("S") or dynamic ("D"). Provide dynamic systems except where joints are designated as static on drawings or are patently obvious to be static joints.

JOINT FIRESTOP SYSTEM SCHEDULE								
			FLOOR JOINT SYSTEMS (Series)		WALL JOINT SYSTEMS (Series)			
NOMINAL JOINT WIDTH	RATING	JOINT MOVE-MENT	FLOOR-TO-FLOOR	FLOOR TO CURTAIN WALL	WALL-TO-WALL	FLOOR-TO-WALL	HEAD-OF-WALL	WALL-TO-WALL JOINTS AS CORNER GUARDS
UP TO 2 INCHES	Assembly: See "Ratings" above.	Static	FF-S--0000	Not Applicable	WW-S-0000	FW-S-0000	HW-S-0000	CG-S-0000
		Dynamic	FF-D-0000	See Note #1 below.	WW-D-0000	FW-D-0000	HW-D-0000	CG-D-0000
	"L" Rating							
OVER 2 INCHES UP TO 6 INCHES	Assembly: See "Ratings" above.	Static	FF-S--1000	Not Applicable	WW-S-1000	FW-S-1000	HW-S-1000	CG-S-1000
		Dynamic	FF-D-1000	See Note #1 below.	WW-D-1000	FW-D-1000	HW-D-1000	CG-D-1000
	"L" Rating							
OVER 6 INCHES UP TO 12 INCHES	Assembly: See "Ratings" above.	Static	FF-S--2000	Not Applicable	WW-S-2000	FW-S-2000	HW-S-2000	CG-S-2000
		Dynamic	FF-D-2000	Not Applicable	WW-D-2000	FW-D-2000	HW-D-2000	CG-D-2000
	"L" Rating							
OVER 12 INCHES UP TO 24 INCHES	Assembly: See "Ratings" above.	Static	FF-S--3000		WW-S-3000	FW-S-3000	HW-S-3000	CG-S-3000
		Dynamic	FF-D-3000		WW-D-3000	FW-D-3000	HW-D-3000	CG-D-3000
	"L" Rating							
OVER 24 INCHES	Assembly: See "Ratings" above.	Static	FF-S--4000		WW-S-4000	FW-S-4000	HW-S-4000	CG-S-4000
		Dynamic	FF-D-4000		WW-D-4000	FW-D-4000	HW-D-4000	CG-D-4000
	"L" Rating							

NOTES

1. FLOOR TO CURTAIN WALL;
   a. Precast Architectural Concrete: CW-D-2005 and use as silicone sealant material in conformance with tested assemble.
   b. Insulated-Core Metal Panels: CEN/WP 120-01
   c. Glazed Aluminum Curtain Walls: CW-D-1010.

- - - E N D - - -

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems, except where specifically provided by other trades in the Construction Documents.
2. Two-Stage Joints at Precast Architectural Concrete.
3. Two-Stage Joints at glazed aluminum curtain wall.
4. Work includes but not limited to, sealing joints in the following:
    a. Concrete slabs.
    b. Masonry.
    c. Expansion joints
    d. Frame perimeters abutting other materials; metal curtain wall, door frames, window, louver. Internal system sealants provided by component installer, unless indicated otherwise.
    e. Interior sealants.
    f. Trim exposed masonry flashing.
    g. 4th Floor Vivarium. See INSTALLATION in Part 3 below.
5. Preformed joint sealants.
6. Work shall meet the physical compliance requirements and intent of the following:
    a. AAALAC Handbook of Facilities Planning - Volume 2 Laboratory Animal Facilities.
        1) Work shall facilitate the Government's pursuit of AAALAC compliance certification.
    b. NRC Guide for the Care and Use of Laboratory Animals.

1.2 RELATED WORK

A. Execution Requirements: Section 01 73 00 – Execution.

B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.

C. Manufactured Metal Siding: Section 07 46 15.

D. Flashing and Sheet Metal: Section 07 60 00.

E. Firestopping: Section 07 84 00.

F. Hollow Metal Doors and Frames: Section 08 11 13.

G. Glazed Aluminum Curtain Walls: Section 08 44 13 and 08 44 13.3.

H. Resinous Flooring and Wall Covering: Section 09 67 25.

I. Painting: Section 09 91 00.

J. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 DEFINITIONS

A. "Sealant", "Joint Sealer", "Calk", "Caulk", "Calking", and "Caulking" are interchangeable terms for purposes of this contract.

1.4 QUALITY CONTROL

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint sealant installations with a record of successful in service performance. Applicators to be trained in accordance with the SWRI Applicator Training Manual.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Provide test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
   2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
   3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
   4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Field Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
   1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of non-elastomeric sealant and joint substrate indicated.
   3. Notify Resident Engineer seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

E. Manufacturers' Pre-Application Testing: Manufacturer of sealants to provide additional on-site testing by authorized personnel to assure materials are suitable for the application, have not suffered detrimental loss of shelf life, and will be fully covered by the Warranty in event of failure or staining of the sealed components.
   1. Method(s) of testing to be at manufacturer's option.
   2. Frequency: Provide testing as follows:
      a. Between 24 and 72 hours prior to initial application.
      b. Prior to use of each new shipment of materials.
      c. Not less than once a week for existing stored materials.
   3. Record Data: Manufacturer to submit log of testing, on company letterhead, for each test performed indicating, but not limited to, the following:
      a. Date.

b. Project identification.
c. Sealant identification including name, type, and batch number.
d. Test performance; acceptable, marginal, not acceptable.
e. Storage conditions.
f. Signature of person conducting test.

F. Defective Materials: Do not use sealant materials found by testing to be marginal or not acceptable. Tester to immediately notify Resident Engineer and Construction Manager. Construction Manager to immediately remove materials from site.

G. Manufacturers' Instruction: Manufacturer of sealants for exterior building enclosure to provide instruction to installers' foreman and mechanics, and Construction Manager on proper installation techniques required to achieve maximum life and weathertightness from the sealant installation. Special emphasis to be directed to practices required to avoid staining or other changes in appearances of sealed components such as granite in the completed work.

H. Compatibility: Sealants provided under this Section shall:
1. Be compatible with adjacent non-sealant substrates and materials.
2. Be the same material as adjacent sealant material unless otherwise directed by the Resident Engineer.

I. Defective Materials: Do not use sealant materials found by testing to be marginal or not acceptable. Tester to immediately notify Resident Engineer and Construction Manger. General Contractor to immediately remove materials from site. Do not use sealants after shelf life established by manufacturer has expired.

J. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 50 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

K. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.
2. After all approvals have been obtained, provide job Mockup of typical joints with sealant installed according to shop drawings. Mockup is to be standard of quality with respect to color, workmanship and tooling. Obtain approval of Architect.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:
1. Caulking compound.

2. Primers.
3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

E. Manufacturer's Certification: Sealant manufacturer shall certify that sealant submitted for use at Precast Architectural Concrete will not stain the Precast Architectural Concrete.

F. Pre-Construction Adhesion Tests: See QUALITY ASSURANCE below. Submit results in format which allows comparison with manufacturer's published values.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not proceed with installation of joint sealants under following conditions:
a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4° C (40° F).
b. Moisture: Do no work when moisture is present or when surfaces to be sealed are wet. Surfaces must be clean, dry, and frost free.

B. Joint-Width Conditions:
1. Do not proceed with installation of joint sealants where joint widths are less than or greater than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:
1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Store materials in a well ventilated space maintained at temperatures below 75 degrees F and above 40 degrees F unless more stringent controls required by manufacturer. Storage in truck trailers not acceptable unless trailer is equipped with suitable HVAC system. Temperatures above manufacturer's suggested limits are detrimental to sealant materials. Improper storage may result in rejection of materials; see QUALITY ASSURANCE.

1.8 DEFINITIONS

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY

A. Warranty exterior sealing against water penetration, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five years.
   1. Not stain or cause change in appearance to occur on sealed materials.

B. Conditions: Provide the following at no cost to Owner:
   1. Replace failed joints with new materials meeting the requirements of the Contract Documents; repair damage to adjacent construction caused by replacement.
   2. Replace stained materials with new materials meeting the requirements of the Contract Documents; repair damage to adjacent construction caused by replacement.
   3. Coverage:
   4. Manufacturer's warranty to provide primary coverage and will be looked to for initial relief from all claims made by the Owner.
   5. Contractor's warranty to provide secondary coverage to the extent that the manufacturer's warranty does not apply. The Contractor will be looked to for relief from all claims made by the Owner and not provided by the manufacturer.

C. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.10 APPLICABLE PUBLICATIONS (Latest edition unless otherwise noted)

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

1.	C509	Elastomeric Cellular Preformed Gasket and Sealing Material.
2.	C612	Mineral Fiber Block and Board Thermal Insulation.
3.	C661	Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
4.	C717	Standard Terminology of Building Seals and Sealants.
5.	C719	Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
6.	C834	Latex Sealants.
7.	C920	Elastomeric Joint Sealants.
8.	C919	Standard Practice for Use of Sealants in Acoustical Applications
9.	C1021	Laboratories Engaged in Testing of Building Sealants.
10.	C1135	Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
11.	C1193	Standard Guide for Use of Joint Sealants.
12.	C1330	Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
13.	D412	Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

14. D1056 Flexible Cellular Materials—Sponge or Expanded Rubber.
15. E84 Surface Burning Characteristics of Building Materials.

C. Association for Accreditation of Laboratory Animal Care International (AAALAC):
1. Handbook of Facilities Planning - Volume 2 Laboratory Animal Facilities

D. National Research Council (NRC):
1. Guide for the Care and Use of Laboratory Animals

E. Sealant, Waterproofing and Restoration Institute (SWRI).
1. The Professionals' Guide.
2. Applicator Training Manual.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Polyurethane And Polysulfide Sealants
1. S-1:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type M.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 20-40
2. S-2:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type M.
   c. Class 25.
   d. Grade P.
   e. Shore A hardness of 25-40.

3. S-3:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type S.
   c. Class 25, joint movement range of plus or minus 25 percent.
   d. Grade NS.
   e. Shore A hardness of 15-25.
   f. Minimum elongation of 700 percent.
4. S-4:
   a. ASTM C920 polyurethane or polysulfide.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 25-40.
5. S-5:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type S.
   c. Class 25.
   d. Grade P.
   e. Shore hardness of 15-45.

B. Silicone Sealants: Stain/bleed-resistant products to porous substrates, including limestone.
   1. S-6:
      a. ASTM C920, silicone, neutral cure.
      b. Type S.
      c. Class 100: Joint movement range of plus 100 percent to minus 50 percent.
      d. Grade NS.
      e. Shore A hardness of 15-20.
      f. Minimum elongation of 1200 percent.
   2. S-7:
      a. ASTM C920, silicone, neutral cure.
      b. Type S.
      c. Class 25.
      d. Grade NS.
      e. Shore A hardness of 25-30.
      f. Structural glazing application.
   3. S-8:
      a. ASTM C920, silicone, acetoxy cure.
      b. Type S.
      c. Class 25. Grade NS.
      d. Shore A hardness of 25-30, ASTM D 2240.
      e. Structural glazing application.
   4. S-9:
      a. ASTM C920 silicone.
      b. Type S.
      c. Class 25.
      d. Grade NS.
      e. Shore A hardness of 25-30.
      f. Non-yellowing, mildew resistant.
      g. Use: NT.
      h. FDA Regulation No. 21 CFR 177.2600.
      i. National Sanitation Standard 51.
      j. Mildew resistant.

C. Polyurethane Sealants
   1. S-10:
      a. ASTMC C920, coal tar extended fuel resistance polyurethane.
      b. Type M/S.
      c. Class 25.
      d. Grade P/NS.
      e. Shore A hardness of 15-20.
   2. S-11:
      a. ASTM C920 polyurethane.
      b. Type M/S.
      c. Class 25.
      d. Grade P/NS.
      e. Shore A hardness of 35 to 50.
   3. S-12:
      a. ASTM C920, polyurethane.
      b. Type M/S.
      c. Class 25, joint movement range of plus or minus 50 percent.
      d. Grade P/NS.
      e. Shore A hardness of 25 to 50.

D. Polysulfide and Polyurethane Sealants:

1. S-13: Sealant for Continuous Immersion: Provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion and have not failed in adhesion or cohesion when tested with substrates indicated for Project.
    a. ASTM C920, polyurethane or polysulfide.
    b. Type M.
    c. Class 25.
    d. Grade NS.
    e. Use: T or NT.
    f. ASTM C510 for “Stain and Color Change”: Not required.

E. Urethane Sealants:
1. S-14:
    a. ASTMC C920, Urethane Joint Sealant:
    b. Single component.
    c. Class: 50
    d. Grade: NS.

2.2 CAULKING COMPOUND

A. Butyl Sealant: High solids, non-skinning, non-drying, synthetic, butyl elastomer sealant.

B. C-1: ASTM C834, acrylic latex.

C. C-2: One component acoustical caulking, non-drying, non-hardening, synthetic rubber.

2.3 COLOR

A. Provide custom colors as selected by Architect to match adjacent materials.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Type B: Cylindrical flexible sealant backings composed of bi-cellular material. as defined in the terminology of C 717.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER

A. Mineral fiber board: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

A. Primer: Provide primer material made or recommended by the caulking or sealant manufacturer, for the conditions and substrates of the application and in conformance with tests results that have been submitted and approved.

B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES

A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

2.8 PREFORMED JOINT SEALANT

A. Preformed Extruded Silicone Joint Sealant: Sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
   1. End Dams: Provide extruded silicone end dams at ends of preformed Extruded Silicone Joint Sealants. End dams shall be 3 inches high unless indicated otherwise on drawings.
   2. Special Shapes: Provide special shapes indicated on drawings, and an as required to meet performance requirements.

B. Preformed Joint Sealant Performance Requirements:
   1. Minimum performance requirements for 1-1/2-inch silicone seal applied over 1/2-inch joint after 21 days cure:
      a. Properties tested in accordance with ASTM C1135:
         1) Ultimate strength: 40 psi.
         2) Ultimate elongation: 800 percent.
         3) Stress at 25 percent elongation: 3 psi and 1.5 pli
         4) Stress at 50 percent elongation: 5 psi and 2.5 pli.
         5) Stress at 50 percent compression: Less than 5 psi and 2.5 pli
      b. Moment capability: Plus 200 percent and minus 75 percent, tested in accordance with ASTM C719.

C. Preformed Joint Sealant Physical Properties:
   1. Hardness: 25-durometer hardness, Shore A, ASTM C661.
   2. ASTM D412:
      a. Tensile strength: 400 psi.
      b. Elongation: 400 percent.
   3. Tear strength, die B: 100 ppi, ASTM C624.

D. Preformed Joint Sealant Color: Provide custom color to match color of curtain wall and as approved by Architect.

E. Preformed Joint Bonding Sealant:
1. Type: Compatible Type S-6 silicone type as recommended and provided by silicone seal manufacturer. Acetoxy-cure silicone sealants are not acceptable.
2. Color: Match silicone seal.

2.9 ACCESSORIES

A. Weeps:
1. Tube Type (where indicated): Clear PVC tubing; 3/8 inch outside diameter by 1/4 inch inside diameter with RF within tubes.
2. RF Type (typical): Reticulated polyurethane foam, 30 ppi; type compatible with adjacent materials including sealants; thicknesses to match joint widths.

B. Weep Baffles: RF type specified above; provide within all tubes.

C. Miscellaneous: As required for complete installation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

A. Prepare joints in accordance with manufacturer's instructions and SWRI.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
a. Concrete.
b. Masonry.
c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required. PRIMER in Part 2 defines locations for primers.
1. Apply primer prior to installation of back-up rod or bond breaker tape.
2. Use brush or other approved means that will reach all parts of joints.
3. Apply full strength, undiluted in uniform coating over surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

A. General:
1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees F and 100 degrees F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise. Joints shall be dry tooled. Use of liquids in tooling joints is not permitted.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
11. Silicone sealants, except at inner seal of Two-Stage Joints, shall not be in contact with Air Weather Barrier (AWB) or other products that will change the color of the sealant.

B. Application:
1. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
2. Applications of sealing materials are noted on drawings, in this section or specified in other sections of these Specifications. Apply sealant over backing to uniform thickness in continuous beads, filling all joints and voids solid; superficial pointing with skim bead will not be accepted. After application, tool surface to achieve complete adhesion and contact.

C. Sound Rated Construction: Where partitions are of sound rated construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise. Firestopping fire-rated and smoke barrier construction is provided by Section 07 84 00 - Firestopping. Sealing penetrations in smoke resistant corridor partitions is provided by under this Section.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster joint reinforcing.
4. Openings: Apply a 1/4 inch, minimum, bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs. At sleeves and other penetrations apply sealant to both sides of partition penetrations.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.
6. After gypsum board is installed apply an additional sealant joint to edges of gypsum that will be concealed from view after finished materials are installed.
7. Sealant system shall be designed to maintain the indicated sound rating.

D. Two-Stage Joints: Provide two-stage sealant joints between curtain wall framing and adjacent exterior wall construction and between exterior storefront and adjacent exterior wall

construction; and provide two stage sealant joints between joints in precast architectural concrete panels and adjacent exterior wall construction.

1. Outer Seal: Silicone sealant with open-cell backer rod. Recess back from panel edge approximately 1/2 inch.
2. Inner Seal: Silicone sealant. Install at inner face of panel or as indicated on drawings. Provide at least ½ inch gap between face of inner seal and backer rod for outer seal. Provide color which contrasts with adjacent construction to aid visual inspection. Inner Joint shall cure before backer rod for outer seal is installed.
3. Joints: Miter joints to drain to exterior; make tight fit; all in accordance with manufacturer's recommendations.
4. Parapets: In addition to outer seal, provide sealant across cavity beginning at roof level and sloping downward at 45 degrees. Extend through both outer seals; weep as specified below.
5. Weep cavities of two-stage joints to drain/vent to exterior. Use tubing in sealant joint for weep cavity or other method recommend by contractor and approved by Resident Engineer.
    a. Provide weep joints to weep water from cavity in two stage joints where indicated on drawings but not less than the following locations:
        1) Bottom of a two-stage cavity above a change in cladding systems, including all glazed framing systems.
        2) At deflection joint in precast concrete panels and curtain wall system.
        3) Not less than one weep joint per floor level for a vertical sealant joint.

E. Cement Plaster: At all cement plaster applications, apply sealant at all intersecting members, terminations and butt joints of all accessories and trim to prevent water infiltration. Refer to drawings for further clarification of plaster installation.

F. Through Wall Flashing: This type flashing is designed to drain water from inside wall construction to the exterior.

1. Do not seal joint between flashing and superimposed materials unless documents require joint to be sealed.
    a. Provide weeps in sealant joint that allow water to drain to exterior after sealant is installed. Verify spacing and types of weeps with Resident Engineer. If not indicated on drawings the bid shall provide weeps not to exceed 5'-0" on center.
2. Masonry Flashing: Where sealant joint is in direct contact with flexible masonry flashing, trim flashing flush with face of masonry after sealant is installed and cured. This procedure is to prevent sealing required weeps.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply Preformed Joint Bonding Sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of Preformed Joint Bonding Sealant application, press Preformed Silicone-Sealant into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. 4th Floor Vivarium: Special attention required for these areas to assure that all penetrations through walls, floors, and ceilings are sealed to prevent harborage of vermin, germs and

bacteria and to prevent loss of differential room pressurization through unscheduled openings. Penetrations include, but not limited to, conduit, piping, receptacles, fasteners, cabling, ductwork, sprinklers, and light fixtures. Sealing responsibility based on substrate finish:

1. Resinous Flooring: Sealed under Section 09 67 25.
2. Resinous Wall Covering (Alternate): Sealed under Section 09 67 25.
3. Painted (Base bid walls and ceilings): Sealed under this Section.

3.6 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:
   1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS

A. General: Whether or not specifically indicated, apply sealant at all locations which normally need sealing to prevent passage of air, liquids, insects, or vermin and to reduce light or sound transmission. Include the following:
   1. Metal Coping: Where metal coping laps weatherseal portion of wall less than 4 inches, seal with sealant to prevent water from rising between coping and wall due to wind. Not required interior side of coping if roofing membrane extends full height of parapet and terminates on exterior side of wall.
   2. Vivarium Areas: Junctions and penetrations in all floor, wall, ceiling, and other enclosing work.
   3. Elsewhere indicated.
   4. As indicated below.

B. Default: For joint types not indicated below the bid price shall be based on Type S-6 sealant. Verify required sealant type with Architect prior to submitting SUBMITTALS for this Section.

C. Exterior Building Joints, Horizontal and Vertical: The joints below also apply to the conditions at the interior side of exterior wall system construction.
   1. Metal to metal: Type S-6.
   2. Glazed Aluminum Curtain Walls to adjacent wall system: S-6 with Two-Stage Joints.
   3. Metal to masonry, concrete, or stone: Type S-6.
   4. Precast concrete to precast concrete: S-6 with Two-Stage Joints.
   5. Masonry to masonry or stone: Type S-6.
   6. Stone to stone: Type S-6.
   7. Cast stone to cast stone: Type S-6.
   8. Threshold setting bed: Type S-6.
   9. Masonry expansion and control joints: Type S-6.
   10. Wood to masonry: Type S-1.
   11. Prefinished exterior door frame to interior metal or gypsum board: Type S-3.
   12. Exterior glazed framing systems to interior metal or gypsum board: Type S-6.
   13. Joints in cement plaster to receive elastomeric coating: Type S-14.

D. Horizontal Joints Below Grade: Type S-13.

E. Metal Reglets and Flashings:
   1. Flashings to wall: Type S-6.
   2. Metal to metal: Type S-6.

F. Metal Coping: Where metal coping laps weatherseal portion of wall, seal with sealant Type S-6 to prevent water from rising between coping and wall due to wind. Not required interior side of coping if roofing membrane extends full height of parapet and terminates on exterior side of wall, unless detailed otherwise on drawings.

G. Sanitary Joints:
   1. Walls to plumbing fixtures: Type S-9.
   2. Joints between ceramic tile and adjacent surface: Type S-9.
   3. Tile control and expansion joints: Type S-9.
      a. Does not apply to surfaces such as carpet that are not an acceptable substrate for sealant.
   4. Flooring: Seal intersection of flooring and penetrations with Type S-9 sealant; include fixtures, piping, and other conditions where base is not installed such as bathtub, shower receptors, and toilets. Verify compatibility of sealant with flooring materials prior to installation.

a. Exception: Penetrations in elevated slabs, including edge of slab firestopping shall comply with Section 07 84 00 – Firestopping.

5. Counter tops to walls: Type S-9.
6. Pipe penetrations: Type S-9.
7. Joints in food service areas: Type S-9.
8. Joints between medical equipment and adjacent surface: S-9.
   a. Does not apply to surfaces such as carpet that are not an acceptable substrate for sealant.

H. Horizontal Traffic Joints:
   1. Concrete Paving, Unit Pavers: Type S-11 or S-12.
   2. Garage/Parking Decks: Type S-10.

I. High Temperature Joints over 204° C (400° F):
   1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8.

J. Interior Joints: Interior joints in vertical surfaces and horizontal non-traffic surfaces. Joints requiring Sanitary Sealant supersede requirements below. Joints below do not apply to joints at interior side of exterior walls; except joints abutting the exterior wall system such as ceiling systems and casework.
   1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
   2. Perimeter of Interior Door frames, Interior Windows, Access Panels which Adjoin Concrete or Masonry Surfaces at Interior Partitions: Types C-1 and C-2. Apply before paint at walls to receive finish coat of paint. Apply sealant after wall fabric at wall surfaces scheduled to receive fabric wallcovering.
   3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
   4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1 and C-2.
   5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
   6. Exposed Acoustical Joint at Sound Rated Partitions: Type C-2.
      a. See Section 09 29 00 - Gypsum Board for sound sealants associated with gypsum board installation.
   7. Concealed Acoustic Sealant: Type S-4, C-1 and C-2.
   8. Joint/gap between masonry wall and acoustical ceiling wall molding system: Types C-1 and C-2.
   9. Joints between glass provided by All Glass Entrances and Storefronts; and adjacent finish material: Sealant to match sealant provided by Section 08 41 26 - Interior All-Glass Entrances and Storefronts.

K. Joints Below Grade: Type S-13.

L. Structural sealant internal to the curtain wall system: Provided by Section 08 40 10 - Glazed Framing Systems.

- - - E N D - - -

SECTION 07 92 05
SITE JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealant for:
   1. Concrete Paving Expansion Joints
   2. Expansion joints in Architectural site concrete walls.
   3. Expansion joints in Architectural site concrete paving.

B. Related Sections:
   1. Cast-In-Place Concrete (Site Structures): Section 03 30 01.
   2. Water and Stain Repellants: Section 07 19 15.
   3. Architectural Site Concrete: Section 32 13 15.

1.2 DEFINITIONS

A. Acceptance, Acceptable, or Accepted: Acceptance by the Architect in writing.

B. Excessive Compaction: Planting area soil or soil mix compaction greater than 75 percent of maximum dry density as determined by ASTM D 1557.

C. "Sealant", "Joint Sealer", "Calk", "Caulk", "Calking", and "Caulking" are interchangeable terms for purposes of this contract.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
   1. Sealant.
   2. Bond Breaker.
   3. Backer Rod.
   4. Joint Primers.

C. Samples:
   1. Applied Sealant Colors.
   2. Bond Breaker.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
   2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
   3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

D. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

E. Preconstruction Field Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
   1. Locate test joints where indicated or, if not indicated, as directed by Resident Engineer.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of nonelastomeric sealant and joint substrate indicated.
   3. Notify Resident Engineer seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

F. Manufacturers' Pre-Application Testing: Manufacturer of sealants used for stone caulking to provide additional on-site testing by authorized personnel to assure materials are suitable for the application, have not suffered detrimental loss of shelf life, and will be fully covered by the Warranty in event of failure or staining of the sealed components.
   1. Method(s) of testing to be at manufacturer's option.
   2. Frequency: Provide testing as follows:
      a. Between 24 and 72 hours prior to initial application.
      b. Prior to use of each new shipment of materials.
      c. Not less than once a week for existing stored materials.
      d. At any time when storage conditions have exceeded manufacturers recommended limits.
   3. Record Data: Manufacturer to submit log of testing, on company letterhead, for each test performed indicating, but not limited to, the following:
      a. Date.
      b. Project identification.
      c. Sealant identification including name, type, and batch number.
      d. Test performance; acceptable, marginal, not acceptable.
      e. Storage conditions.
      f. Signature of person conducting test.

G. Defective Materials: Do not use sealant materials found by testing to be marginal or not acceptable. Tester to immediately notify Resident Engineer and Construction Manager. Construction Manager to immediately remove materials from site.

H. Manufacturers' Instruction: Manufacturer of sealants for exterior building enclosure to provide instruction to installers' foreman and mechanics, and Construction Manager on proper installation techniques required to achieve maximum life and weathertightness from the sealant

installation. Special emphasis to be directed to practices required to avoid staining or other changes in appearances of sealed components such as granite in the completed work.

I. Compatibility: Sealants provided under this Section shall:
   1. Be compatible with adjacent non-sealant substrates and materials.
   2. Be the same material as adjacent sealant material unless otherwise directed by the Resident Engineer.

J. Defective Materials: Do not use sealant materials found by testing to be marginal or not acceptable. Tester to immediately notify Resident Engineer and General Contractor. General Contractor to immediately remove materials from site. Do not use sealants after shelf life established by manufacturer has expired.

1.5 SEQUENCING AND SCHEDULING

A. Joints on Walls to Receive Dampproofing: Install sealant after dampproofing has been applied and has cured.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4° C (40° F).
      b. Moisture: Do no work when moisture is present or when surfaces to be sealed are wet. Surfaces must be clean, dry, and frost free. When joint substrates are wet.

B. Joint-Width Conditions:
   1. Do not proceed with installation of joint sealants where joint widths are less than or greater then those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:
   1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 APPLICABLE PUBLICATIONS (LATEST EDITION UNLESS OTHERWISE NOTED):

A. American Society for Testing and Materials (ASTM): Latest edition unless otherwise noted.
   1. C661 Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
   2. C920 Elastomeric Joint Sealants.
   3. C1193 Standard Guide for Use of Joint Sealants.
   4. D412 Vulcanized Rubber and Thermoplastic Elastomers—Tension

B. Sealant, Waterproofing and Restoration Institute (SWRI).
   1. The Professionals' Guide
   2. Applicator Training Manual.

1.8 WARRANTY

A. General Description: In addition to manufacturer's warranties, warrant Work for a period of one year from date of Final Completion against defects in materials and workmanship.

B. Additional Items Covered: Warranty shall also cover repair of damage to other materials and workmanship resulting from defects in materials and workmanship.

C. Exceptions: Contractor shall not be held responsible for failures due to ordinary wear, abuse or neglect by others, vandalism, and other causes outside the Contractor's control.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sealant for Pedestrian Joints:
1. ASTM C 920, polyurethane.
2. Type: M.
3. Class: 25.
4. Grade: NS.
5. Use: T.
6. Shore A hardness ASTM C 661: Not less than 40.
7. Suitable for water immersion; compatible with bonding surfaces.
8. Color(s): As selected by Architect from manufacturer's full range; minimum 2 colors.

B. Sealant in Vehicular Concrete Paving:
1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 100/50: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Use: T, A, M and O.
6. Shore A hardness of 15-20.
7. Minimum elongation of 1200 percent.
8. Adhesion to Concrete, Minimum Peel Strength: 20 psi, per ASTM D412.
9. Color(s): As selected by Architect from manufacturer's full range; minimum 2 colors.

C. Sealant for Water Feature Joints
1. ASTM C 920, Silicone.
2. Type: S.
3. Class: 50.
4. Grade: NS.
5. Use: NT.
6. Suitable for water immersion; compatible with bonding surfaces.
7. Color: Black.

D. Backer Rod: Non-absorbent, non-staining and specifically recommended for this installation by the sealant manufacturer.

E. Expansion Joint Filler: See Section 32 13 15 – Architectural Site Concrete for pedestrian paving. See Section 32 05 23 for vehicular paving..

F. Joint Primers: Use only those primers which have been tested for durability on the surfaces to be sealed and are specifically recommended for this installation by the manufacturer of the sealant used.

G. Masking Tape: For masking around joints, provide an appropriate masking tape which will effectively prevent application of sealant on surfaces not scheduled to receive it, and which is removable without damage to substrate.

H. Bond Breakers: Use only those bond breakers which are specifically recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine site and verify that conditions are suitable to receive Work and that no defects or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.

B. Joint Size Verification: Verify that the required proportion of width of joint to depth of joint has been provided.

C. Dampproofing at Joints: On surfaces adjacent to joints to receive dampproofing, verify that dampproofing has been applied and returned into joints a minimum ½ inch, and has cured for at least 7 days.

D. Notification of Unsuitable Conditions: Before proceeding with Work, notify the Owner's Representative in writing of unsuitable conditions.

3.2 PREPARATION

A. Protection:
1. Use all appropriate precautions to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the work.
2. Provide barricades, fences or other barriers as necessary to protect existing conditions to remain from damage during construction.
3. Use all appropriate precaution to prevent excessive compaction of planting area soil and soil mixes within or adjacent to the areas of Work.
4. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
5. Submit written notification of conditions damaged during construction to the Owner's Representative immediately.

B. Preparation of Joint Surfaces:

C. Clean surfaces to be dry, sound, and free from dust, concrete residue and other materials which could weaken bond or conflict with sealant width and depth.
1. At open joints, remove dust by mechanically blown compressed air if required.
2. Remove oil, grease, loose or flaking materials when present; use sandblasting or wire brushing.

3. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.

3.3 INSTALLATION

A. Priming:
   1. Meet requirements of the manufacturer's current printed instructions.
   2. Meet requirements of ASTM C 1193, except where in conflict with manufacturer's current printed instructions.

B. Bond-Breaker Installation:
   1. Meet requirements of the manufacturer's current printed instructions.
   2. Provide bond-breaker where recommended by the manufacturer of the sealant, and where indicated by the Drawings.

C. Backer Rod Installation:
   1. Install backer rod where indicated on the Drawings.
   2. Do not install backer rod at paving – See "Expansion Joints" under Section 32 13 15 – Architectural Site Concrete.
   3. Use a blunt-surfaced tool of wood or plastic, having shoulders designed to ride on the adjacent finished surface and a protrusion of the required dimensions to assure uniform depth of backer-rod material below the sealant.
   4. Do not use a screwdriver or similar sharp-ended tool to install backer-rod material.
   5. Using the blunt-surfaced tool, smoothly and uniformly place the back-rod material to the depth required by the sealant manufacturer's current printed installation instructions, compressing the backer-rod material to no more than 25% and securing a positive fit.
   6. Avoid lengthwise stretching of the backer-rod material.
   7. Do not twist or braid back-rod stock.

D. Masking:
   1. Thoroughly and completely mask joints on exposed surfaces.
   2. Equipment: Apply sealant under pressure with power-actuated hand gun or manually-operated hand gun, or by other appropriate means.
      b. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.

E. Sealant Thickness: Meet requirements of the manufacturer's current printed instructions.

F. Tooling Sealant:
   1. Tool sealant to insure complete filling of the joint to eliminate air pockets and voids and to insure positive adhesive of the sealant with the bonding surfaces.
   2. Tool joints to the profile shown on the Drawings or if such profiles are not shown on the Drawings provide uniformly smooth joints with slightly concave surface.
   3. Do not use tooling agent unless specifically recommended in writing by the sealant manufacturer.

3.4 CLEANING

A. Sealant Residue: Before it hardens, clean sealant from adjacent surfaces as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.

- - - END OF SECTION - - -

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications.
2. Exterior wall expansion control systems.
3. Interior wall, floor, and ceiling expansion control systems.
4. Wall expansion joints transitioning to roof expansion joints.
5. Coordinating transitions in exterior expansion joints to provide weather tight joint at transitions between different types of exterior expansion joints.

1.2 RELATED WORK (Items not included in this Project Manual are available through Construction Manager upon request)

A. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.

B. Vapor Retarder: Section 07 26 10.

C. Air Weather Barrier (AWB): Section 07 27 30.

D. Roof Expansion Joint Cover Assemblies: Section 07 72 00, ROOF ACCESORIES.

E. Color of Elastomeric Inserts, Filler Strips, Exterior Wall Seals and Metal Finishes: Section 09 06 00, SCHEDULE FOR FINISHES

F. Steel Plate Expansion Joint Covers: Section 05 50 00, METAL FABRICATIONS.

1.3 DESIGN REQUIREMENTS

A. The Drawings show aesthetic design intent. Products provided must conform to design intent shown and performance levels specified. The drawings and specifications are complimentary regarding the aesthetic design intent.

B. Contractor is solely responsible for engineering design of the exterior expansion joint systems following the below listed architectural design criteria and performance criteria specified under PERFORMANCE REQUIREMENTS.
1. See “Engineer’s Seal/Signature” under SUBMITTALS below.
2. See Manufacturer’s Professional Engineer under Quality Assurance below

1.4 PERFORMANCE REQUIREMENTS

A. Water Resistance: Joint covers at exterior applications or interior spaces shall be watertight at the following conditions:
   1. All Exterior conditions
      a. Exception: Expansion joints at exterior precast concrete that are open to weather on both sides of walls, and other similar conditions do not need to be watertight. If the expansion joint transitions to a different condition; the expansion joint shall be watertight at the transaction between different conditions.
   2. Floors, including pavement joints at parking structures.
   3. Interior partitions up to nominal 4 inches above finish floor or top of wall base.

B. Fire Resistance: ASTM E 119.
   1. Floor: 2 hour rating for floor joint covers separating occupied spaces.
   2. Walls: Not less than rating of wall in which joint occurs.

C. Floor devices to present flush finished surface to wheeled traffic.
   1. All-Metal Plate Types:
      a. "Bump"; variation between top of curved plate and top of device not to exceed 1/8 inch when measured with straightedge.
      b. Exception: Surface Mounted expansion joint covers.

D. Floor Load Capabilities: Products to be suitable for intended use and traffic loads without permanent damage to joint cover or components of cover.
   1. Expansion Joint Covers at Interior of Hospital Patient Care Areas: Sustain moving or static wheel load from hospital bed of not less than 275 lbs per wheel with deflection not exceeding L/360. Joint cover must be capable of supporting 4 wheels simultaneously for a total load of 1,100 lbs with specified deflection limit.
   2. Surface Mounted Expansion Joint Covers at Central Energy Plant, Mechanical Rooms, and Parking Garages: Meet or exceed HS-20 per AASHTO's Standard Specifications for Highway Bridges AASHTO.

E. Fire-Resistance Ratings: Provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

F. Wind Loads: As specified in Section 01 83 16.13 - Exterior Wind Enclosure Requirements.

G. All metal roof edges shall meet requirements of IBC 2006, including expansion joint covers.

1.5 QUALITY ASSURANCE

A. Project Conditions:

   1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.
   2. Show recorded measurements on final shop drawings.

B. Single Source Responsibility:

1. Provide exterior expansion joints from one manufacturer, including expansion joints separating condition from unconditioned space.
2. Provide interior expansion joints at partitions, soffits, and ceilings from one manufacturer.

C. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

D. Exterior expansion joints and transition between exterior expansion joints shall be watertight.

E. Manufacturer’s Professional Engineer: A Professional Engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced has 5 years experience in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of exterior expansion joints that are similar to those indicated for this Project in material, design, and extent.

1.6 DELIVERY STORAGE AND HANDLING

A. Take care in handling of materials so as not to injure finished surface and components.

B. Store materials under cover in a dry and clean location off the ground.

C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

1.7 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Engineer’s Seal/Signature: Shop drawings and associated calculations required for structural design shall bear seal and signature of expansion joint manufacturer’s Professional Engineer. See Professional Engineer under Quality Assurance above, and “Structural Calculations" below.

C. Manufacturer's Literature and Data:

1. Submit copies of manufacturer's current literature and data for each item specified.
2. Clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for ultraviolet exposure.

D. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.

E. Shop Drawings:

1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.

a. Provide isometric details illustrating changes in expansion joints in direction and height. Include details on splicing joints including inner seal to maintain weather tightness of complete joint system.
b. Provide details showing transitions of exterior expansion joint cover systems.

2. Include description of materials and finishes and installation instructions.

F. Samples:

1. Samples: Submit for approval, minimum 12 inch long, for each type of device proposed. Samples to show all components required for expansion joint cover assembly.
2. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.
3. Samples of each type and color of flexible seal used in work.

G. Structural Calculations: Submit copies of structural calculations made by or for exterior expansion joints in connection with design exterior expansion joints, including connections and attachments. Submittals may or may not be returned, and will not bear stamp of approval. Base calculations on worst case conditions for all allowable variations, tolerances and connections. Perform calculations under direct supervision of manufacturer's Professional Engineer. . Calculations shall be signed and sealed.

H. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

I. Sealants: Submit shop drawings for sealants in compliance with Section 07 90 00 – Sealants.

1.8 APPLICABLE PUBLICATIONS

A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

1. E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences.
2. C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
3. C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
4. C661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
5. D395 Standard Test Methods for Rubber Property—Compression Set
6. D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
7. D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
8. D695 Standard Test Method for Compressive Properties of Rigid Plastics

9. D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
10. D1149 Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment
11. D2240 Standard Test Method for Fiber Cohesion in Roving, Sliver, and Top in Dynamic Tests
12. E1399 Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
13. G26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
14. G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

C. American Association of State Highway and Transportation Officials *(*AASHTO*):*

1. Standard Specifications for Highway Bridges, 17th Edition

D. Federal Specifications (Fed. Spec):

1. TT-P-645B Primer, Paint, Zinc-Molybdate, Alkyd Type

E. The National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500 Series Metal Finishes Manual.

F. National Fire Protection Association (NFPA):

1. 251-05 Tests of Fire Endurance of Building Construction and Materials

G. Underwriters Laboratories Inc. (UL):

1. 263-03 Fire Tests of Building Construction and Materials

1.9 WARRANTY:

A. Warranty exterior expansion joint systems against water penetration, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302 or 304.

B. Structural Steel Shapes: ASTM A36.

C. Steel Plate: ASTM A283, Grade C.

D. Rolled Steel Floor Plate: ASTM A786.

E. Aluminum: Alloys meeting ASTM B221

1. Extrusions: 6063-T5 and 6005-T5 alloys.
2. Plates: 6061-T6 alloy.
3. Sheet: 5052-H32 alloy.

F. Interior Sealant: Elastomeric sealant, unless indicated otherwise.

1. ASTM C920, polyurethane.
2. Type.
3. Class 25.
4. Grade P or NS.
5. Shore A hardness 25, unless specified otherwise.

G. Joint Bonding Sealant:
1. Provide Joint Bonding Sealant as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.

H. Exterior Sealant: Sealant Type S-6 or S-7 as specified in Section 07 92 00 Joint Sealants and as recommended by manufacturer.

I. Preformed Joint Sealant: Provide extruded silicone product complying with Preformed Joint Sealant specified in Section 07 92 00 Joint Sealants.

J. Thermoplastic Rubber:

1. ASTM C864.
2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.

K. Vinyl Invertor Sealant Waterstops: Manufacturers' standard shapes and grade.

L. Fire Barrier:

1. Designed for indicated or required dynamic structural movement without material degradation or fatigue.
2. Tested in maximum joint width condition as a component of an expansion joint cover assembly in accordance with UL 263 NFPA 251, or ASTM E119 and E814, including hose steam test at full-rated period.
3. Coverless applications shall maintain fire rating without joint cover system, or provide cover to maintain required rating at no additional cost to Owner.

M. Zinc-Molybdate Primer: Fed. Spec. TT-P-645.

N. Accessories:

1. Manufacturer's standard anchors, fasteners, set screws, spaces, flexible secondary water stops or seals and filler materials, drain tubes, adhesive and other accessories as indicated or required for complete installations.
2. Compatible with materials in contact.
3. Water stops.

2.2 FABRICATION

A. General:
1. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement. Each type of expansion joints cover shall be continuous with uniform appearance and joints butted tightly.
2. Deliver to job site ready for use and fabricated in as large sections and assemblies as practical. Assemblies identical to submitted and reviewed shop drawings, samples and certificates.
3. Furnish units in longest practicable lengths to minimize number of end joints. Provide mitered corners where joint changes directions or abuts other materials.
4. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
5. Fire Performance Characteristics:
    a. Provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ASTM E119 and E814, NFPA 251, or UL 263 including hose stream test at full-rated period.
    b. Fire rating: Not less than rating of adjacent floor or wall construction.
6. Fire Barrier Systems:
    a. Material to carry label of approved independent testing laboratory, and be subject to follow-up system for quality assurance.
    b. Include thermal insulation where necessary, in accordance with above tests, with factory cut miters and transitions.
    c. For joint widths up to and including 150 mm (6 inches), supply barrier in lengths up to 15000 mm (50 feet) to eliminate field splicing.
    d. For joint widths of seven inches and wider, supply barrier 3000 mm (10 foot) modules with overlapping ends for field splicing.
    e. For joints within enclosed spaces such as chase walls, include 1 mm (0.032 inch) thick galvanized steel cover where conventional expansion joint cover is not used.
7. Seal Strip factory - formed and bonded to metal frames and anchor members.
8. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.

2.3 INTERIOR EXPANSION JOINT COVER ASSEMBLIES

A. Floor-to-Floor Expansion Joint Cover Assemblies (EFF):

1. General: Frames on each side of joint designed to support expansion joint cover of design shown.
    a. Continuous frame designed to finish flush with adjacent floor of profile indicated with seating surface and raised floor rim to accommodate flooring.
    b. Provide concealed bolt and steel anchors for embedment in concrete.
    c. Designed for filler materials between raised rim of frame and edge of cover plate where shown.
    d. Exposed metal: Mill finished aluminum, unless indicated otherwise.
    e. Frame and cover plates.

1) Cover plates free of rattle due to traffic.
2) No gaps or budges occur on filler material during design movement of joint.
3) Provide manufacturer's continuous standard flexible vinyl water stop under floor joint cover assemblies.

f. Nominal Joint Width: Match width of expansion joints indicated on structural drawings.

g. Seismic Movement Capabilities: Expansion Joint cover shall be designed to allow normal expansion joint width to close to at least 50 percent of normal joint width and open to not less than 150 percent of nominal joint width, except Type EFF-B.

h. Floor edges of floor to wall expansion joint covers and floor to floor covers of same letter designation to align and be of same materials, appearance, and profile.

2. Type EFF-A: Interior flushline system with dual elastomeric seals:

a. Basis of Design: Model FDT series by MM Systems.
1) System may need to be modified to meet performance requirements.

b. Characteristics: See Drawings and as follows:
1) Base frame: Aluminum, mill Finish.
2) Support plate: Provide support plate with recess for flooring between elastomer insert seals. Provide recess in support plate as required for finished flooring material in recess to be coplanar with finished flooring on each side of expansion joint and top face of elastomeric inserts.
a) Material: Stainless steel and/or aluminum.
3) Cover centering bar: Provide combination centering bar and lifting device.
4) Dual Elastomeric Inserts: Exposed face of bellows shall be flat with no indentations.
a) Thermal Compression movement: One inch in compression and one inch in expansion for the expansion joint before the seals may disengage from the frame.

3. Type EFF-B: Interior flushline system with single elastomeric seals: Use at Level 1, only.

a. Basis of Design: Model FS-100-20H series by MM Systems.
1) System may need to be modified to meet performance requirements.

b. Characteristics: See Drawings and as follows:
1) Base frame: Extruded aluminum. Framed designed to be mechanically secured to concrete. Frame shall provide support plate for elastomeric insert.
2) Depth: 2-1/2 inches. Shim expansion joint so elastomeric inserts are coplanar with finished floor covering.
3) Elastomeric Inserts: Exposed face of bellows shall be flat with no indentations.
a) Width of Elastomeric Insert: 1-1/2”.
4) Movement Capabilities:
a) Nominal Joint Width: 1”.
b) Width in Thermal Compression: .75”
c) Width in Thermal Maximum 1.1875”.
d) Width in Seismic Maximum 1.25”.

4. Type EFF-C: Interior no bump floor covering system:

a. Basis of Design: Model PDS-500-50-1.5H by MM Systems.
   1) System may need to be modified to meet performance requirements.

b. Characteristics: See Drawings and as follows:
   1) Base frame: Aluminum, mill finish. Mechanically secured to concrete. Designed to create a ramp for centering pan to move up when sealant joint is fully compressed. Centering pan shall self-centered on center line of expansion joint as it moves up and down; and guided by cover centering bar. System is symmetrical on centerline of expansion joint.
   2) Centering Pan: Provide support plate with recess for setting finished flooring
      a) Exposed Material: Extruded aluminum, mill finish.
      b) Finished Flooring Setting Depth: 1", minimum.
   3) Centering bar assemble: Provide combination heavy duty centering bar and lifting device, with spring, at 24 inches on center.
   4) Top of expansion joint to be coplanar with finished face of floor covering.
   5) Sealant Joints: One each side of Center pan Assemble.
      a) Joint Width: ½ inch.
      b) Color: Custom color as selected by Architect to match flooring unless indicated otherwise on Finish Legend.

5. Type EFF-D: Not Used.

6. Type EFF-S: Surface Mounted Metal Cover Plate:

   a. Basis of Design: Model HSC-6 type, by MM Systems.
   b. Carrying Capacity: Meet or exceed HS-20 per AASHTO's Standard Specifications for Highway Bridges AASHTO.
   c. Characteristics: See Drawings and as follows:
   d. Hinged Cover Plate: Extruded aluminum incorporate an integral hinge allowing for vertical and lateral shear movement.
      1) Material: Aluminum, alloy 6005 -T5.
      2) Edges: Beveled.
      3) Thickness: 3/8".
      4) Shim Plate: Provide aluminum or stainless steel shim plate under cover plate on both sides of joint. Secure one side of plate to floor with shim plate below and align exposed edges of shim plate and cover plate. Side not secured to floor shall move freely with changes in width of expansion joint.
      5) Finish on Walking Surface: Slip resistant raised profile as part of aluminum extrusion.
      6) Underside of plate shall have continuous end cavities with integral high-density rubber damper that provides impact damping and sound deadening.
      7) Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.
   e. Rubber Gutter: Provide continuous reinforced 60-mil EPDM rubber. Provide flexible down spout and drain tubes as required. Sealed gutter water tight to expansion joint and concrete; and slope to drain.
      1) Basis of Design: Model HDLE (with bellows for drainage) by MM Systems.
   f. Bedding Compound: Provide elastomeric bedding compound to compensate for slight elevation changes of substrate along the length of the expansion joint.

B. Floor-to-Wall Expansion Joint Cover Assemblies (EFW):
   1. General:
      a. Exposed metal: Mill finished aluminum, unless indicated otherwise.

b. Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
c. Angle Cover Plates: Provide angle cover plates for joints to wall with countersunk flat-head exposed fasteners for securing to wall unless indicated otherwise.
d. Space fasteners as recommended by manufacturer.
e. Match cover of adjacent floor to floor cover.
f. Nominal Joint Width: Match width of expansion joints indicated on structural drawings.
g. Seismic Movement Capabilities:
   1) Flush expansion joint covers shall be designed to allow normal expansion joint width to close to at least 75 percent of normal joint width and open to not less than 125 percent of nominal joint width, except Type EFW-B,
   2) Surface mounted expansion joint covers shall be designed to allow normal expansion joint width to close to at least 50 percent of normal joint width and open to not less than 150 percent of nominal joint width.

2. Type EFF-A: Interior flushline system with dual elastomeric seals:

   a. Basis of Design: Model FDTE series by MM Systems.
      1) System may need to be modified to meet performance requirements.

   b. Characteristics: See Drawings and as follows:
      1) Base frame: Aluminum, mill Finish.
      2) Support plate: Provide support plate with recess for flooring between elastomeric insert seals and vertical face of support plate. Vertical face of support plate secures to partition. Provide recess in support plate as required for finished flooring material in recess to be coplanar with finished flooring and top face of edge strips.
         a) Material: Stainless steel and/or aluminum.
      3) Dual Elastomeric Inserts:
         a) Thermal Compression movement: One inch in compression and one inch in expansion for the expansion joint before the seals may disengage from the frame.
         b) Color: Color as selected by Architect to match flooring unless indicated otherwise on Finish Legend

3. Type EFW-B: Interior flushline system with single elastomeric seals: Use at Level 1, only. Use only against a concrete or CMU partitions/structure. At floor to drywall partitions use EFF-B specified above.

   a. Basis of Design: Model FSE-100-20H series by MM Systems.
      1) System may need to be modified to meet performance requirements.

   b. Characteristics: See Drawings and as follows:
      1) Base frame: Extruded aluminum. Framed designed to be mechanically secured to concrete. Frame shall provide support plate for elastomeric insert.
      2) Depth: 2-1/2 inches. Shim expansion joint so elastomeric inserts are coplanar with finished floor covering.
      3) Elastomeric Inserts: Exposed face of bellows shall be flat with no indentations.
         a) Width of Elastomeric Insert: 1-1/2”.
      4) Movement Capabilities:

a) Nominal Joint Width: 1".
b) Width in Thermal Compression: .75"
c) Width in Thermal Maximum 1.1875".
d) Seismic Max: 1.25"

4. Type EFW-C: Interior no bump floor covering system:

a. Basis of Design: Model PDSE-500-50-1.5H by MM Systems.
1) System may need to be modified to meet performance requirements.

b. Manufacturer's standard floor to corner unit to transition with Type EFF-C.
1) Base frame: Aluminum, mill finish. Mechanically secured to concrete. Designed to create a ramp for centering pan to move up when sealant joint is fully compressed. Centering pan shall remain centered on center line of expansion joint as it moves up and down; and guided by cover centering bar. System is symmetrical on centerline of expansion joint.
2) Pan Assemble: Extruded aluminum assemble.
a) Exposed Material: Extruded aluminum, mill finish.
b) Finished Flooring Setting Depth: 1", minimum.
3) Top of expansion joint assemble to be coplanar with finished face of floor covering.
4) Sealant Joints: One each side of pan assemble.
a) Joint Width: ½ inch.
b) Color: Custom color as selected by Architect to match flooring unless indicated otherwise on Finish Legend.

5. Type EFW-S: Surface Mounted Metal Cover Plate:

a. Basis of Design: Model HSC-C-6 type, by MM Systems.

b. Carrying Capacity: Meet or exceed HS-20 per AASHTO's Standard Specifications for Highway Bridges AASHTO.

c. Characteristics: See Drawings and as follows:
1) Exposed angle shaped frame. Vertical leg of frame secured to wall. Edge of cover set on floor shall have a beveled edge.
2) Hinged Cover Plate: Extruded aluminum incorporate an integral hinge allowing for vertical and lateral shear movement.
3) Material: Aluminum, alloy 6005 -T5.
4) Edges: Beveled.
5) Thickness: 3/8".
6) Extend cover to lap floor side of joint and to permit free movement on floor side.
a) On floor side of joint provide 1/8" thick x 3 inches wide x continuous aluminum or stainless steel shim plate under horizontal leg of expansion joint cover. Exposed edge of shim plate to align with edge of expansion joint cover when joint width is normal width.
7) Finish on Walking Surface: Slip resistant raised profile as part of aluminum extrusion.
8) Underside of plate shall have continuous end cavities with integral high-density rubber damper that provides impact damping and sound deadening
9) Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.

d. Inner Seal: Provide continuous elastomeric sheet sealed water tight to expansion joint and slope to drain.
e. Bedding Compound: Provide elastomeric bedding compound to compensate for slight elevation changes of substrate along the length of the expansion joint.

C. Interior Wall Expansion Joint Cover Assemblies (EWW):

1. General: Frames on each side of joint designed to support expansion joint cover of design shown.
   a. Exposed Metal: Clear anodized aluminum unless indicated otherwise.
   b. Nominal Joint Width: Match width of expansion joints indicated on structural drawings.
   c. Movement capabilities: Expansion Joint cover shall be designed to allow normal expansion joint width to close to at least 50 percent of normal joint width and open to not less than 150 percent of nominal joint width.

2. Type EWW-A: Flush mounted aluminum expansion joint cover at gypsum board partitions with vertical perimeter fins design to secure expansion joint side trim to wall and receive tape and spackling by Section 09 29 00 – Gypsum Board.

   a. Basis of Design: Model CRS series by MM Systems.
   b. Characteristics: See Drawings and as follows:
      1) Base and frame material: Extruded aluminum.
      2) Provide cover with centering bar in systems. Centering bar secures to cover plate and includes guides traveling in recess of side bar trim.
      3) Cover: "U" shaped extruded aluminum cover with flat face coplanar with finished wall surface. Cover secured to centering bar at 24" on center. Fastener head to be flat and flush with face of cover plate.
         a) Finish: Prime painted, unless indicated otherwise,
      4) Aluminum Side Trim: Extruded aluminum.
         a) Finish: Clear anodized aluminum.
      5) Exposed Fasteners: Stainless steel Philips Head or Robertson Head fasteners.
      6) Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.

3. Type EWW-B: For Use at Level 1, 2, and 3 only. At other levels use EWW-E.
4. Basis of Design:
   a. Level 1: Model HSC-C-6 type, by MM Systems. FSW-150 and FSWPL-150 by MM Systems.
   b. Level 2: Model HSC-C-6 type, by MM Systems. FSW-200 and FSWPL-300 by MM Systems. :
   c. Level 3: Model HSC-C-6 type, by MM Systems. FSW-250 and FSWPL-300 by MM Systems.
5. Base frame: Extruded aluminum. Framed designed to be mechanically secured to studs and designed to be finished with joint compound for Interior Gypsum Wallboard. Frame shall be notched to receive and hold elastomeric insert elastomeric insert, and flush with screed for joint compound.
   a. At corner conditions provide extrusion designed with concealed fastening at "U" channel shape to pocket edge of gypsum board at interior corner, and as detailed.
6. Elastomeric Inserts: Exposed face of bellows shall be flat with no indentations.
   a. Width of Elastomeric Insert at Level 1: 1-1/2".
   b. Width of Elastomeric Insert at Level 2: 2-1/2".

7. Movement Capabilities at Level 1:
   a. Nominal Joint Width: 1-1/2 inch.
   b. Thermal Minimum Joint Width: 1.125”
   c. Seismic Minimum Joint Width: 0.8125.
   d. Thermal Maximum Joint Width: 1.6875”.
   e. Seismic Maximum Joint Width: 1.75”.
8. Thermal Movement Capabilities at Level 2:
   a. Flush Wall: Nominal joint width is 2 inches with movement capabilities from 1-1/2 inch to 2-1/2 inches.
   b. Corner Wall: Nominal joint width is 21/2 inches with movement capabilities from 2 inch to 3 inches.
9. Thermal Movement Capabilities at Level 3:
   a. Flush Wall: Nominal joint width is 2-1/2 inches with movement capabilities from 1.875 inches to 3.0 inches.
   b. Corner Wall: Nominal joint width is 2-1/2 inches with movement capabilities from 2.25 inches to 3.5 inches.
10. Seismic Movement Capabilities at Level 3:
   a. Flush Wall: Nominal joint width is 2-1/2 inches with movement capabilities from 1.0625 inches to 3.185 inches.
   b. Corner Wall: Nominal joint width is 2-1/2 inches with movement capabilities from 1.5625 inches to 3.6875 inches.

11. Type EWW-C:
   a. Basis of Design: Model CRSI by MM Systems.
   b. Two piece extruded aluminum. Framed designed to be mechanically secured to wall and designed to be finished with joint compound for Interior Gypsum Wallboard.

12. Type EWW-C1: Match expansion joint Type EFF-C specified above.

13. Type EWW-D: Not used.

14. Type EWW-E:
   a. Basis of Design: Model VSW - 500 by MM Systems.
   b. Comply with details indicated on drawings.
   c. Base frame: Extruded aluminum. Framed designed to be mechanically secured to studs and designed to be finished with joint compound for Interior Gypsum Wallboard. Frame shall be notched to receive and hold elastomeric insert elastomeric insert flush with screed for joint compound.
      1) At corner conditions provide extrusion designed with concealed fastening at “U” channel shape to pocket edge of gypsum board at interior corner, and as detailed.
   d. Elastomeric Inserts: Exposed face of bellows shall be flat with 2 reveal.

15. Type EWW-S: Surface Mounted Metal Cover Plate:

   a. Characteristics: See Drawings and as follows:
      1) Concealed frame for fastening to wall on one sides of joint.
      2) Extend cover to lap each side of joint and to permit free movement on one side.
      3) Provide concealed attachment of cover t frame cover in close contact with adjacent finish wall surfaces.
         a) Use angle cover plates at intersection of walls.
      4) Use smooth surface cover plates matching floor plates.

5) Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.

D. Interior Ceiling Expansion Joint Cover Assemblies (ECC):

1. General: Frames on each side of joint designed to support expansion joint cover of design shown.
   a. Exposed Metal: Clear anodized aluminum unless indicated otherwise.
   b. Nominal Joint Width: Match width of expansion joints indicated on structural drawings.
   c. Movement capabilities: Expansion Joint cover shall be designed to allow normal expansion joint width to close to at least 50 percent of normal joint width and open to not less than 150 percent of nominal joint width.
2. ECC-A: Expansion joint cover assembly between acoustical ceiling grid system and acoustical ceiling grid system.
   a. Basis of Design: Model VSG-500 by MM Systems.
   b. Comply with details indicated on drawings.
   c. Base frame: Extruded aluminum. Framed designed to be concealed from view mechanically secured to vertical leg of ceiling grid “T” shape. Size extrusion to match ceiling grid provided by Division 9. Extrusion shall be notched to receive and hold elastomeric insert. The elastomeric insert and bottom ceiling grid are visually coplanar.
   d. Elastomeric Inserts: Exposed face of bellows shall be flat with 2 reveals.
      1) Color: Match color of Ceiling grid.
3. ECC-A2: Expansion joint cover assembly between acoustical ceiling grid system and gypsum board ceiling/soffit system.
   a. Basis of Design: Custom expansion joint cover using aluminum extrusion secured to wall that is part of model VSWL-500 by MM Systems and aluminum extrusion secured to ceiling grid in modelVSG-500 by MM Systems, with the elastomeric insert common to both the models.
   b. Comply with details indicated on drawings.
   c. Base frame: Extruded aluminum.
      1) Ceiling Grid Extrusion: Framed designed to be concealed from view mechanically secured to vertical leg of ceiling grid “T” shape. Size extrusion to match ceiling grid provided by Division 9. Extrusion shall be notched to receive and hold elastomeric insert. The elastomeric insert and bottom ceiling grid are visually coplanar.
      2) Wall Extrusion: Framed designed to be concealed from view mechanically secured metal stud framing above ceiling. Extrusion shall be notched to receive and hold elastomeric insert.
   d. Elastomeric Inserts: Exposed face of bellows shall be flat with 2 reveals.
      1) Color: Match color of Ceiling grid.
4. ECW-A: Expansion joint cover assembly between acoustical ceiling grid system and gypsum board partition.
   a. Meet requirements of Type ECC-A2, above.

2.4 EXTRIOR EXPANSION JOINTS

A. Exterior Wall Joint Assemblies:
   1. Variable movement with seal designed to prevent water and air infiltration.
   2. Expansion Joint Movement: Unless indicated otherwise expansion joints shall be designed for the following joint movements:
      a. Normal Width: 5 inch width.

b. Maximum Width of Expansion Joint: 7-1/2 inches.
c. Minimum Width of Expansion Joint: 2-1/2 inches.

3. Type EJW-1: Exterior walls.
   a. This type of expansion joint is typical for the following exterior wall expansion joints.
   b. Basis of Design: Model VSS by MM Systems Corporation.
   c. An exterior device presenting a flat surface, suitable for vertical and horizontal applications including exterior walls, ceilings, and soffits.
   d. Frame material: Extruded aluminum frames both sides of joint.
      1) Designed to receive flexible rubber primary seal on exposed face after installation of frame.
      2) Designed to receive continuous extruded secondary vinyl sheet seal.
      3) Anchor spaced at ends and not over 600 mm (24-inches).
   e. Extruded Rubber Primary Seal: Silicone, Santoprene, Elastoptrene, rubber, or neoprene seals (inner and outer).
      1) Color: Custom colors as selected by Architect to match adjacent wall cladding material.

Performance Requirements of Extruded Seals		
Physical Property	Test Method	Value
Tensile Strength	ASTM D412	1000 psi
Ultimate Elongation	ASTM D412	445%
Hardness, Shore A	ASTM D2240	67 +/- 3
Tear Strength @ 73oF (23oC)	ASTM D624	140 pli / 24.5 kN/m
Tear Strength @ 212oF (100oC)	ASTM D624	58 pli / 10.2 kN/m
Compression Set @ 168 hours	ASTM D395	25% @ 23°C/ 73°F
Compression Set @ 168 hours	ASTM D395	38% @ 100°C/ 212°F
Ozone Resistance	ASTM D1149	No Cracks
UV Resistance	ASTM D695	Very Good
Brittle Point	ASTM D746	-76°F (-60°C)

   f. Inner Seal: Continuous extruded elastomeric sheet.
   g. Variable movement extruded rubber primary seal designed to engage into and remain in aluminum frame, throughout movement of joint.
      1) Flush mounted seal minimum 3 mm (0.125 inch) thick with dual movement grooves designed for plus or minus 50 percent, movement of joint width.
      2) Recessed front face seal minimum 3 mm (0.125 inch) thick with no movement grooves, designed for plus or minus 50 percent movement of joint width.
   h. Provide factory heat welded transitions where directional changes occur to ensure a watertight system.
   i. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12 inches) and wider.
      1) Spaced as necessary to comply with wind load conditions.

2.5 GARAGE FLOOR EXPANSION JOINTS

A. Type EJP-1: Garage Floor Expansion Joint

1. Floor to Floor Conditions: Provide Expansion Joint Type EFF-S as specified above with drainage gutter.
2. Floor to Wall Conditions: Provide Expansion Joint Type EFW-S as specified above with drainage gutter.
3. Expansion Joint Width: 5 inches, unless indicated otherwise.
4. Movement Capability: Expansion joint to function from 50 percent to 150 percent of Expansion Joint Width.

2.6 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS

A. Fabricate in 10 foot lengths with fastener openings slotting for expansion not over 600 mm (24 inch) centers.

B. Provide four-way expansion, for joint widths shown.

C. Metal: Mill finish on aluminum.

D. Form waterstop or moisture seals of continuous sheets of neoprene, not less than 0.8 mm (0.032 inch) thick.

E. Fabricate corners as one piece assembly with mitered and welded joint and least dimension legs not less than 12 inches long.

F. Factory fabricate end caps and transitions to insure waterproof assembly.

G. Type EJR-1: Typical at roofs unless indicated otherwise
1. Basis of Design: Model WJL, by MM Systems Corporation.
2. Roof expansion joint system consists of combination extruded aluminum frame with integral adjustable counter flashing flange, and moisture seals; and an extruded aluminum cover.
3. Form cover from extruded aluminum 2 mm (0.078 inch) minimum thickness.
4. Expansion joint cover shall self- centered on center line of expansion joint as expansion joint size changes; and guided by stainless steel pivot bar with tension spring. Tension spring maintains aluminum cover centered and sealed to extruded aluminum base frame.
5. System is symmetrical on centerline of expansion joint.
6. Form frame assembly of not less than 2 mm (0.076 inch) aluminum except for flashing portion.
7. Proved continuous vinyl type gasket in frame to seal to underside of aluminum cover.
8. Provide compression gasket separating cover from curb at bearing.
9. Moisture barrier: Continuous elastomeric sheet, width of sheet to vary as required to promote drainage. Furnish and install moisture barrier to slope to drain. Where structure is not sloped, slope moisture barrier to drain to exterior wall and transition moisture barrier into moisture barrier at exterior wall system. Where structure is sloped to drain collect water in moisture barrier provide drain boot at low point and connect drainage tube into plumbing vent pipe. Coordinate connection with Division 22.
    a. Drainage Boot:
        1) Basis of design Model FGS by MM Systems Corporation.
        2) Drain Boot - preformed EPDM tapered boot assembly with pre-taped flange with adhesive for proper bonding to underside of moisture barrier.
        3) Drain Tube - clear PVC flexible tubing, length as required to for proper installation.
        4) Mounting Plates - 1/8” thick plate from aluminum alloy 6005 -T5 with anchor holes factory drilled at 18 inches on center.

5) Edge Sealant – contractor shall supply silicone sealant to seal outside edge on mounting plate. Provide sealant in conformance with Section 07 92 00 - Joint Sealants.
6) Accessories - Provide necessary assembly hardware required for complete installation.

10. Exposed Fasteners: Stainless steel or aluminum with neoprene washers.
11. Provide custom transitions as necessary to provide a complete watertight system.
12. Provide protective film or covering on exposed metal. Remove protective film or covering after installation is complete and prior to substantial completion.
13. Expansion Joint Movement:
    a. Normal Width: 2 inch width.
    b. Maximum Width of Expansion Joint: 3 inches.
    c. Minimum Width of Expansion Joint: 1 inch.
14. Conforms to ASTM E1399 for cycling joint.

2.7 FINISHES

A. Metal Finishes - General:

1. Apply finishes in factory after products are fabricated.
2. Protect finishes on exposed surfaces with protective covering before shipment.

B. Aluminum Finishes:

1. Finish: As specified in Section 09 06 00 - Schedule for Finishes.

2. Finish letters and numbers for anodized aluminum are in accordance with the NAAMM AMP 501, Aluminum Association's Designation System.

    a. Clear anodized finish: AA-C22A41, chemically etched medium matte, clear anodic coating, Class I Architectural, 0.7 - mil thick.

3. Fluorocarbon Finish: Provide in conformance with Section 05 05 13 -Shop Applied Coatings for Metal.
    a. Finish Expansion Joint at Metal Coping: Match Color of coping.
    b. Other Expansion Joint Colors: As specified in Section 09 06 00 - Schedule for Finishes.

C. Stainless Steel: NAAMM AMP 503, finish No. 2B.

D. Carbon Steel: NAAMM AMP 504, Galvanized 690.

E. Elastomeric Inserts:
1. Color: Custom colors as selected by Architect to match adjacent surface unless indicated otherwise in Finish Legend.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Manufacturer's representative shall make a thorough examination of surfaces receiving work of this section.

B. At Level 1 verify that vapor retarder on structural floor is installed on structural floor and a bellows is provided in vapor retarder to allow a movement of 1/2 inch in any direction.

C. Before starting installation, notify Prime Contractor of defects which would affect satisfactory completion of work.

3.2 PREPARATION

A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.

B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.

C. Provide templates to related trade for location of support and anchorage items.

3.3 INSTALLATION

A. Interior Floor Expansion Joints: Install after building space has been conditioned, including thermal temperature of structure, and concrete is cured long enough to allow installation of sheet flooring. See Section 09 65 16 – Resilient Sheet Flooring.
   1. Moisture Emission of Concrete: Rate not to exceed 3.0 lbs./1,000 sq. ft./24 hours. ASTM F 1869 prior to the installation of flooring.

B. Install in accordance with manufacturers installation instructions unless specified otherwise.

C. Provide anchorage devices and fasteners for securing expansion joint assemblies to in place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

D. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.

E. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.

F. Allow for thermal expansion and contraction of metal to avoid buckling.

G. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.

H. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer's instructions.

I. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.

J. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3- inches) from each ends, and, not more than 600 mm (24-inches) on centers.

K. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.

L. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.

M. Flush Metal Cover Plates:

1. Secure flexible filler between frames so that it will compress and expand.
2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

N. Waterstops:

1. Install in conjunction with floor joints and where shown, run continuously to prevent water damage to finish spaces.
2. Provide seal with frame to prevent water leakage.
3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.

O. Fire Barriers:

1. Install in compliance with tested assembly.
2. Install in floors and in fire rated walls.
3. Use fire barrier sealant or caulk supplied with system.

P. Sealants:

1. Install to prevent water and air infiltration.

Q. Vertical Exterior Extruded Thermoplastic Rubber.

1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with independent continuous PVC back seal.
2. Install primary seals retained in extruded aluminum side frames.

R. Installation of Extruded Thermoplastic Rubber or Seals:

1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-seal field splice joints to provide watertight joints using manufacturer's recommended procedures.

S. Installation of Preformed Elastomeric Sealant Joint:

1. Locate joint directly over joints in wall or floor substrates.

2. Full length shall be fastened to substrate using a construction adhesive.
3. Install flush or slightly below finish material.

3.4 ROOF EXPANSION JOINTS

A. Install in conformance with this section an “Expansion Joint Covers” In PART 3 of Section 07 72 00 - Roof Accessories.

3.5 PROTECTION

A. Take proper precautions to protect the expansion joint covers from damage after they are in place.

B. Cover floor joints with plywood where wheel traffic occurs.

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