SECTION 075400 THERMOPLASTIC

MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Welded seam single ply PVC roofing over rigid roof insulation.
B. Related Sections:
   1. Division 1 – Finish and Materials Legend, Designation
   2. Division 16-TBD – LEED Product Requirements and Volatile Organic Compound (VOC) Restrictions (If applicable)
   3. Division 18-TBD – Sustainable Design Requirements (if applicable)
   4. Division 7 – Thermal and Moisture Protection
   5. Section 07-84-00 – Firestopping
   6. Division 9 – Finishes
C. Cal Poly Project Manager to identify if this Project is pursuing certification under US Green Building Council "LEED" v4.
D. Comply with CAL-Green VOC requirements for single ply roof adhesives.
E. Comply with CAL-Green Appendix A5

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.
B. Performance Requirements:
   1. Provide a system of components which will meet FM wind uplift rating of FM1A-90 in accordance with Loss Prevention Data Sheets and Building Materials Approval Guide.
   2. Provide roofing system to comply with ANSI/SPRI Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems and ANSI/SPRI Standard Field Test Procedure for Determining The Withdrawal Resistance of Roofing Fasteners.
C. Fire Resistance Requirements:
   1. Class A.
   2. Test method: ASTM E108 and UL 790.
D. Fully Adhered Membrane on Concrete Deck.
   1. Furnish and install completed welded seam single ply sheet roofing assembly consisting of following layers indicated from top down:
      a. Fully adhered welded seam membrane.
      b. Fully adhered Densdeck roof board, 1/4 inch thick or as specified.
      c. Two layers of Polyisocyanurate roof insulation or as specified.
      d. Adhere insulation and roof board in low-rise foam.
      e. Vapor retarder
         1 Basis of Design: Sarnavap SA self-adhered vapor retarder.
         2 Or approved equal as required by membrane manufacturer
   2. Structural concrete deck.
E. No asphalt roofing permitted on new construction or renovations/replacements.

1.3 SUMMARY OF WORK

A. The work includes but is not limited to the installation of:
   1. Removal of Existing Roofing and Insulation
   2. Substrate Preparation

3. Roof Drains
4. Vapor Barrier
5. Wood Blocking
6. Fire Rated Wood Blocking (Where required)
7. Insulation
8. Separation Layers
9. Roof Membrane
10. Fasteners
11. Adhesive for Flashings
12. Roof Membrane Flashings
13. Walkway Protection
14. Metal Flashings
15. Sealants

1.4 SUBMITTALS

A. Product Data: Submit product data for each product.

B. Listed documentation from State Fire Marshal approved listing agency (i.e. UL, Intertek, FM) that clearly identifies the listed system that is being submitted.

C. Shop Drawings:
1. Submit details for this specific project indicating construction at all penetrations, terminations, and flashings.
2. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
3. Indicate vapor barrier placement and method of installation.
4. Outline of roof with roof size and elevations shown.
5. Walkway protection and perimeter warning tape dimensional layout identified (if applicable)
6. Technical acceptance by roofing manufacturer.

D. Samples for Verification: Of following products:
1. 12-by-12-inch square of welded seam single ply roofing membrane, of color selected, including T-shaped side and end lap seam.
2. 12-by-12-inch square of roof insulation.
3. 12-by-12-inch square of roof sheathing board.
4. 12-inch length of metal termination bars.
5. 6 fasteners of each type, length, and finish.

E. LEED Data: Refer to Sustainable Design Requirements for submittal requirements to achieve overall LEED v4.0 goals if applicable.

1.5 QUALITY ASSURANCE

A. General:
1. Obtain primary roofing materials from single manufacturer. Manufacturer's name shall appear on containers.
2. Provide secondary materials as required by manufacturer of primary materials.
3. Manufacturer's technical representative shall visit Project site to advise applicator of procedures and precautions for installation of roofing materials and upon completion of roofing to verify warranty requirements.

B. Owner reserves right to hire an independent roofing consultant to review submittals, procedures, and installation.

C. Installers Qualifications:
1. Approved, authorized, or licensed by roofing membrane manufacturer prior to execution of this Contract, and that is eligible to receive manufacturer' special warranty. Installer must

have documented experience on at least 5 projects using submitted roofing system and 10 years on projects of similar size and scope.

2. Foreman of field crew: 5 years minimum experience with roofing system and who is on the jobsite during roofing work.

D. Certifications: Manufacturer's Certification on manufacturer's letterhead:

1. Certify roof system design; penetration, transition, and perimeter details; and system specifications are appropriate and satisfactory for this particular project.
2. Certify products proposed for use comply with referenced standards; with listed documentation attached.
3. Certify materials ordered and supplied are compatible with each other, suited for locale and purpose intended and shipped in sufficient quantity to ensure proper timely installation.
4. Verify that the roofing system is manufactured directly by roofing system provider/supplier with the current formulation in use for past 20 years minimum to match the term of the warranty.
5. Certify roofing materials have express warranty of merchantability and fitness for particular purposes of this Project.
6. Certify manufacturer has reviewed Project and will issue warranty upon successful completion of installation.
7. Certify materials shipped to site meet membrane manufacturer's published performance standards and requirements of this Specification.
8. Membrane manufacturer's approval of insulation type and method of installation in writing.
9. Manufacturer's approval of installer.

E. Industry Standards: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.

1.6 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference prior to commencing work in accordance with Section 013119, 1.6. Coordinate with Cal Poly Project Manager to schedule with the appropriate campus Trade Shops to attend the roof deck tour.

E. Conduct tour of roof deck and review substrate surfaces to receive roofing and flashings. Report on substrate acceptability, possible problem areas, and recommended remedies. The meeting shall discuss all aspects of the project including, but not limited to:

1. Safety.
2. Review approved Submittals and Shop Drawings. If items are outstanding, discuss what additional information is required and when it will be provided.
3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review governing regulations and requirements for insurance and certificates if applicable.
6. Review temporary protection requirements for roofing during and after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the following requirements:

1. Store materials in weather protected environment, clear of ground and moisture.
2. Protect membrane from cuts, tears, punctures, and abrasions.
3. Protect light sensitive insulation from direct sunlight exposure.
4. Store materials (except membrane) between 60 degrees F and 80 degrees F. If exposed to lower temperatures, restore to proper temperature before using.
5. Stand roll materials as required by manufacturer.

6. Do not store materials on roof in such concentrations as to cause deck or structural membranes to be overloaded.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Proceed with roofing work only when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's requirements.
   1. Comply with more restrictive of following or manufacturer's written requirements under which products can be applied.
   2. Verify substrate is free of water, dew, and frost.
   3. Ambient temperature is above 0 degrees F.
   4. Open fires and spark producing equipment are not and will not be in application area until vapors have dissipated.
   5. Application areas must be well ventilated.

1.9 SEQUENCING

A. Do not install greater amount of insulation than can be covered by membrane in same day. Complete with night seals and appropriate tieoffs.

B. Sequence work to avoid traversing over completed areas in order to continue roofing operations.

C. Manufacturer is responsible for details and dimensions not shown on Drawings and shall furnish necessary details and field measurements to ensure roofing is covered by warranty. Coordinate with responsible trades to establish, verify and maintain field dimension and Project conditions.

1.10 WARRANTY

A. Comply with provisions of Section 017833 requirements.

B. **Manufacturer's Warranty**: Manufacturer's standard or customized form, without monetary limitation ("NDL"), and non-prorated for full replacement cost of completed installation in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Warranty includes membrane roofing, base flashings, fasteners, roofing accessories, walkways, and other components of the membrane roofing system.
   2. Warranty Period: 30 years from date of Substantial Completion.

C. **Applicator/Roofing Contractor Warranty**: In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner.
   1. Warranty Period: 30 years from date of Substantial Completion.

D. Provide material required for warranty including penetrations, terminations, flashings, sealants, roof sheathing board, expansion joints, vapor barriers, membrane, insulation, adhesives, and fasteners. Defects include (but are not limited to) unadhered membrane and flashings, moisture blisters, open seams, and weld scuffs.

PART 2 - PRODUCTS

2.1 MEMBRANE

A. Reinforced PVC Thermoplastic Membrane:
   1. Standard: ASTM D4434, Classification: Type II, Grade I
   2. Standard: ASTM D4434, Classification: Type III, fabric reinforced and fleece backed.
   3. Thickness: 0.070 inch (70 mils) minimum, exclusive of fleece backing.
   4. Size: 76 inches minimum wide by longest possible sheets as determined by Project conditions.
   5. Seams: Hot-air weldable.

6. Non-wicking fiberglass or polyester reinforced membrane.
7. Membrane remains pliable, weldable, and watertight throughout its useful life, minimum of warranty period.
8. At least 48 percent of membrane above scrim reinforcing or as specified.
9. Color: White to obtain EPA Energy Star rating for low sloped roofs.
10. White Membrane Solar Reflectance Values:
    a. Energy Star: U.S. Environmental Protection Agency certification, 78 percent or better, ASTM E903.
    b. Emissivity: 0.90 or better when tested per ASTM E408 and ASTM C1371.
    c. Solar Reflective Index (SRI) ASTM E1980 -- 100.
11. Products and Manufacturers:
    a. Sika Sarnafil, Johns Manville, or approved equal.
    b. Basis of Design: G410 – SA, Sika Sarnafil Roofing Systems.
    c. No "Private Label" or third-party membrane manufacturers will be approved as Substitutes.

2.2 INSULATION

A. Polyisocyanurate Insulation Materials:
1. Polyisocyanurate Insulation:
    a. Type: ASTM C1289, Class 1, Type II, Grade 2 (20 psi) complying with Green Guard Gold Certification.
    b. Zero ozone depletion potential (ODP) from blowing agent.
    c. Long Term Thermal Resistance (LTTR) R-value based on ASTM C1303: 5.7 per inch, regardless of published values complying with PIMA Quality Mark Certification.
    d. Thickness: R=40 average in multiple layers with joints offset.
    e. Facers: Both faces finished with fiberglass mat facers.
    f. Manufacturer: Approved by membrane manufacturer.
2. Roof Cover Board: 1/4 inch Dens-Deck Prime, or approved equal, or as specified.
3. Roof to provide positive roof drainage and slope to drains. Minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2% slope). Provide tapered polyisocyanurate insulation boards where crickets are shown or as required at edge strips and crickets for proper drainage.

2.3 ACCESSORIES

A. Base Flashing, Reglet, Stack Flashing, and Patching Materials:
1. Manufacturer's standard system compatible with and matching color of roof membrane.
2. Metal Clad Flashing: PVC clad sheet metal; SarnaClad or approved equal.
3. All flashing materials approved by manufacturer and covered by warranty.

B. Sealants, Adhesives, and Primers: As required by membrane manufacturer.
1. Provide single ply roof membrane adhesives complying with Cal-GREEN Table 5.504.4.1 - Adhesive VOC Limits (250 g/L max).
2. Provide single ply roof membrane sealants complying with Cal-GREEN Table 5.504.4.2 - Sealant VOC Limits (450 g/L).
3. Provide primers complying with Cal-GREEN Table 5.504.4.3 - VOC Content Limits for Architectural Coatings.

C. Insulation Adhesive or Fasteners:
1. Adhesive: Dual component, low-rise polyurethane foam adhesive, used to adhere insulation panels to the substrate as well to other insulation panels. Sarnacol 2163 by Sika Corporation-Roofing, Insta-Stik Professional Roofing Adhesive by Dow Chemical Corporation; Joliet, IL or equal as approved by roofing manufacturer and covered under warranty.

D. Vapor Barrier: Sarnavap SA self-adhered vapor retarder or equal as required by membrane manufacturer.

E. Roof Board: Glass Fiber Faced Gypsum, ASTM C1177; Type X; FM approved; silicone treated core with filled, heat-cured coating on one side.
   1. 4 feet by 8 feet.
   2. Thickness:
      a. 1/4 inch roof cover board for application over roof insulation as indicated.
      b. 5/8 inch Type X for use over metal deck.
      c. Provide 5/8 inch thickness Dens-Deck Prime for parapet wall studs with fully adhered membrane on parapet.
   3. Flame spread: 0.
   4. Acceptable Product: Dens-Deck Prime Roof Board, Georgia-Pacific Corporation, or approved equal.

F. Crossgrip Flexible PVC Walkway Mats:
   1. Heavily textured and profiled, rolled-out walkway protection mat.
   2. Used for walkway and protection from membrane from mechanical abuse.
   3. Thickness: 9/16 inch thick flexible PVC with heavily textured surface.
   4. Loose laid on top of completed roof assembly.

G. Perimeter Warning Tape: Designed for use on PVC membranes as a reflective, highly visible pressure sensitive tape used to draw attention to roof perimeters and potential hazardous areas. The tape is available in 2 inch wide rolls by 30 feet long and comes on a release liner for easy application. Perimeter Warning Tape exceeds reflectivity 3 requirements and Federal spec. L-S- 300, Class 1

H. Roof Drains: Retrofit roof drains are not to be installed. Coordinate with Project Manager and Cal Poly Plumbing Shop on acceptable roof drains to be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Material verification inspection by Cal Poly designee is required prior to installation. Material to match the listed system that is included in the reviewed submittal.

B. Ensure required fire treated wood blocking has been placed at proper elevations around perimeter of each roof level and at penetrations.

C. Verify work which penetrates deck has been completed.

D. Verify deck is clean and smooth, free of depressions, waves or projections, properly sloped to drains.

E. Verify roof openings and penetrating elements through roof are solidly set, and wood blocking, nailing strips, and reglets are in place.

F. Do not apply roofing materials to damp, frozen, dirty, dusty, or other deck surface conditions which are unacceptable to manufacturer and applicator.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Substrate is to be inspected by Cal Poly designee prior to installation of roof system.

D. Wood Nailers:

1. Install wood nailers, underlayment, membrane, and accessories in accordance with FM, UL, and manufacturer's requirements.
2. Install at roof perimeter and at base of penetrations over 18 inches long or in diameter.
3. Thickness equal to insulation or greater where indicated.

E. Vapor Retarder:
1. Prime the deck and adhere the vapor barrier directly over the concrete deck in accordance with roof manufacturer's requirements.
2. Lap and seal joints; offset endlaps.
3. Extend vapor retarder under blocking.

F. Insulation and Roof Cover Board:
1. Place 2 layers of insulation and offset joints in accordance with insulation manufacturer's instructions to achieve FM wind uplift rating.
2. Install insulation in parallel courses with end joint staggered and adjacent boards butted together with no joints greater 1/4 inch. Do not install cracked or broken boards.
3. Cut insulation to fit neatly to perimeter blocking and protrusions through roof.
4. Lay tapered boards to provide minimum 1/4 inch per foot slope drainage at crickets and other areas where structure has not provided slope to drains, gutters or roof edge.
5. Provide 1/4 inch roof cover board over insulation with joints offset from insulation joints or as specified.
6. Low Rise Foam Adhesive (Insulation and Roof Cover Board on Concrete Deck:
   a. Apply using manufacturer's approved equipment over properly installed and prepared substrates at rate according to manufacturer's requirements meeting FM wind uplift requirements and covered by roof membrane manufacturer's warranty.
   b. Clean vapor barrier prior to application of the insulation to ensure no excessive dirt or dust remains on substrate.
   c. Apply adhesive in a smooth, even coating with no gaps, globs, puddles or similar inconsistencies. Only areas that can be made completely watertight in the same day's operations shall be coated.
   d. For multiple layers of insulation spray adhesive or apply in beads over the base layer once fully secured and follow procedures above for attachment of each insulation layer.
   e. Installation Guidelines:
      1) Follow manufacturer's installation and environmental requirements.
      2) Adhesive shall not be applied to wet or damp surfaces.

3.3 INSTALLATION

A. General:
1. Do not apply roofing materials to surfaces which are unacceptable to manufacturer and installer.
2. Do not install greater amount of insulation than can be covered by membrane in same day.
3. Sequence work to avoid traversing over completed areas in order to continue roofing operations.
4. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.
5. Install night cut-off sealer and appropriate tieoffs at end of day's work.

B. Fully Adhered Membrane:
1. Install sheet according to ASTM D5036.
2. Unroll membrane over prepared substrate in approximate final position. Allow to relax.
3. Cut sheets to maximum length possible to minimize seams.
4. Overlap sheets at edges and ends as required by manufacturer.

5. Apply bonding adhesive to substrate as required by manufacturer. Do not apply adhesive with seam welding area.
6. Weld seams with hot air welder of type approved by manufacturer. Prime seams if necessary to achieve proper weld. Ensure that fastener plates and seams are located in accordance with manufacturer's requirements.
7. Overlap joints on sloped substrate in direction of drainage where possible.
8. Eliminate fishmouths, wrinkles, bubbles, or other type voids.
9. Heat weld membrane to adjoining surfaces.

C. Flashing and Accessories:
1. Install base flashing, terminations, and fascia trim as indicated and required by manufacturer. Use longest pieces practicable.
2. Install base flashing up vertical surfaces minimum 8 inches above edge strip unless otherwise noted. Fasten top of base flashing with devices and at locations and frequency as recommended by manufacturer.
3. Coordinate installation of base flashing with Division 7 - Thermal and Moisture Protection.
4. Bond base flashing to substrate in accordance with manufacturer's requirements to obtain water tight bond.
5. Take measures to ensure base flashing is not ridging where there is change of direction.
6. Fasten top of base flashing under metal counterflashing at manufacturer's recommended spacing.
7. Flash penetrations passing through membrane.

D. Walkway Mats:
1. Install walkway products in locations indicated.
2. Loose lay on substrate according to roofing system manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Request site attendance of roofing manufacturer technical representative during following stages of installation of roof assembly at a minimum:
1. As required per the manufacturer's requirements or waterproofing consultant.

B. Quality Control of Welded Seams - Check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane.

C. On-site evaluation of welded seams shall be made daily at locations as directed by the Owner's Representative or Manufacturer's representative. Take one inch wide cross-section samples of welded seams at least three times a day. Correct welds that display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

D. Install the new roof system in such a manner as to maintain watertight integrity on a daily basis. If water is allowed under the completed roof remove the roofing and dispose of all wet and damaged insulation and coverboards. Provide and reinstate new dry roofing materials once the roof deck has been allowed to dry.

E. Interim and Final Inspections - Upon completion of the installation and the delivery to Manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and Manufacturer's requirements, a warranty inspection shall be made by the manufacturers Specialist Technical Representative no personnel with a sales role/function within the company shall be permitted to inspect contractors work.

F. Manufacturer's Field Services:
1. Provide inspection to ascertain specified material and workmanship quality is being maintained and for purposes of warranty verification.

2. Perform final inspection after roof completion.
3. Field Reports: Submit summary of Project site observations, instructions and monitoring activities.

G. Site Tests and Inspections:
1. Inspect cooled seams with probe or similar device to ensure welds are consistent.
2. Correct defective seams.
3. Take 2 seam cuts daily; one in the morning before starting work and one again before starting work after lunch. Retain the sample cuts for roofing inspector verification.
4. The Contractor shall provide electrical and water connections at test locations as identified by the waterproofing consultant at no cost to the Owner.

H. Correct identified defects or irregularities.

3.5 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage membrane, flashing, or surrounding construction.

3.6 PROTECTION

A. Provide temporary roof protection as recommended by manufacturer in areas of anticipated roof traffic during remainder of construction.

B. Prevent traversing roof without temporary protection.

C. Remove protection when no longer needed.

END OF SECTION

SECTION 078400 FIRESTOPPING

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
1. Firestop devices and systems tested in accordance with ASTM E814 (ANSI/UL 1479) and listed in UL Fire Resistance Directory.
2. Fire-resistant construction joints.
3. Dynamic partition head, wall, and barrier details.
4. Fire safing at the edge of slab and curtain wall conditions.
5. Penetrations through fire-rated floors, walls, and shafts.
6. Duct and damper firestops.
7. Intumescent wraps and pads at receptacle boxes and recessed items within fire-rated walls.

B. Select adhesives, primers, and sealants meeting Cal-GREEN requirements.

C. Related Sections:
1. Section 000113 – Finish and Materials Legend, Designation
2. Section 016116 - Volatile Organic Compound (VOC) Restrictions
3. Section 018113 – Sustainable Design Requirements
4. Section 017329 - Cutting and Patching; Repair of openings with original materials.
5. Section 072100 – Thermal Insulation: Batt, mineral wool continuous, and EXP insulation types.
6. Section 072700 – Air Barriers
7. Section 075419 – Polyvinyl Chloride Roofing: Roof Insulation.
8. Section 078100 – Spray Applied Fireproofing.
9. Section 078123 - Intumescent Fireproofing.
10. Section 092900 – Gypsum Board: Acoustical Insulation, Mineral wool fire rated.
11. Section 092900 - Gypsum Board
12. Division 08 - Openings
13. Division 14 - Conveying Equipment
14. Division 21 – Fire Suppression.
15. Division 22 – Plumbing.
16. Division 23 – Heating, Ventilating, and Air Conditioning.
17. Division 25 - Integrated Automation
18. Division 26 – Electrical.
19. Division 27 – Communications
20. Division 28 - Electronic Safety and Security

1.2 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"

C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems"

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" which is updated annually.

1. UL Fire Resistance Directory:
    a. Firestop Devices (XHJI)
    b. Fire Resistance Ratings (BXRH)
    c. Through-Penetration Firestop Systems (XHEZ)
    d. Fill, Voids, or Cavity Material (XHHW)
    e. Forming Materials (XHKU)
    f. Joint Systems (XHBN)
    g. Perimeter Fire Containment Systems (XHDG)
2. Alternate Systems: "Omega Point Laboratories Directory" (updated annually).

E. Test Requirements: ASTM E 1966, "Standard Test Method for Fire Resistive Joint Systems"

F. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"

G. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops"

H. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials"

I. ASTM D6904, "Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry"

J. ASTM C 679, "Standard Test Method for Tack-Free Time of Elastomeric Sealants"

K. ASTM G21, "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi"

L. California Building Code

M. NFPA 101 - Life Safety Code

N. NFPA 70 - National Electric Code

O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives

P. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives

1.3 SYSTEM DESCRIPTION

A. General: Make firestop and smoke seal assembly selections that comply with UL Fire Resistance Directory, the Authority Having Jurisdiction, and applicable codes for:
   1. Materials, fabrication, and installation of firestops and smoke seals.
   2. Fire containment.
   3. Fire-resistant construction joints.
   4. Dynamic partition head details.
   5. Edge of slab and curtain wall conditions.
   6. Penetrations through fire-rated floors, walls, and shafts.
   7. Duct and damper firestops.
   8. Intumescent wraps and pads at receptacle boxes and recessed items within fire-rated walls.
   9. Coordinate with mechanical, electrical, and drywaller to provide a single manufacturer for all firestopping materials.

B. Firestop Voids and Openings in Following Locations:
   1. Duct, cable, cable tray, conduit, piping, and other penetrations through floor slabs (except on-grade slabs) and through fire-rated walls and partitions.
   2. Penetrations of vertical shafts, pipe chases, elevator shafts, and utility shafts.
   3. Openings between floor slab edges and exterior walls, including glass and aluminum curtain walls.
   4. Openings, gaps, and cracks at abutting fire-rated assemblies and components, such as wall-to-wall and wall-to-floor including overhead floor and roof decks.
   5. Blank openings into or through fire-rated floors and walls.
   6. Other locations indicated or scheduled.

C. Design Requirements:
   1. Insulated Piping and Duct Penetrations: Install firestop systems intended for use with the type of insulation on the penetrating item.
      a. Install firestop systems intended for use with the type of insulation on the penetrating item.
      b. If a compatible firestop system is unavailable, remove the insulation at the contact area with firestop material
      c. Coordinate with trades who installed insulation to ensure proper re-sealing of cut edges of insulation.
   2. Provide Products that Do Not Deteriorate when Exposed to Following Conditions:
      a. Plumbing and Wet-Pipe Sprinkler Systems: Moisture-resistant through-penetration firestop.
      b. Exposed to View:
         1) Flame-spread value of less than 25 and smoke-developed value of less than 450, ASTM E84.
         2) Compatible with applied finishes.

D. F and T Rating Requirements: Conform to F and T ratings, ASTM E 814 (ANSI/UL 1479).
   1. Comply with applicable codes and authority having jurisdiction.
   2. F Ratings: Equal to fire resistance rating of assembly being penetrated but not less than one hour.
   3. T Ratings: Equal to F ratings, except where a T rating for the firestop condition is specifically exempted by the applicable code.

E. Provide a W-rated fire/smoke stop system (Class 1) for wet areas and Telecom, IT, and

Electrical Rooms.

F. Testing Requirements:
   1. Utilize systems and materials tested and approved by UL or other nationally recognized independent testing agencies acceptable to the Authorities Having Jurisdiction.
   2. Determine fire ratings in accordance with ASTM E814 (ANSI/UL 1479), ASTM E 1966 (ANSI/UL 2079), and ASTM E 2307 for through penetration and joint firestops, ASTM E119 (UL263) for fire-rated assemblies, and as required by applicable codes and authority having jurisdiction. Testing laboratories approved by the Office of State Fire Marshal (OSFM): https://osfm.fire.ca.gov/media/rtlf4auu/approved-testing-laboratories.pdf

G. Large openings may be closed with the same type of construction as the adjacent floor, roof, and wall assembly.

H. Sealing around penetrations of fire-rated assemblies without an approved firestop system is not permitted. Methods and materials not permitted include but are not limited to:
   1. Joint compound at gypsum board assemblies.
   2. Mortar at masonry and concrete assemblies.
   3. Use of joint sealants.

I. Whenever finished firestop materials are scheduled to receive finish paint or other coatings, test the compatibility of firestop materials with coatings to be applied.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Submit manufacturer's certification stating:
   1. Each penetration of fire-rated walls and floor, partition heads, and the edge of slabs will be firestopped with a firestopping system tested by UL or other recognized testing agency for substrate and the penetrating item.
   2. Authorities having jurisdiction have approved firestopping systems for this project.
   3. Products and Classifications Schedule:
      a. Provide tabular form schedule for firestops, fire containment, and fire-resistant construction joints.
      b. Schedule to identify:
         1) Construction penetrated including fire resistance rating.
         2) Penetrating item.
         3) Products and manufacturers included in each system.
         4) Form material used.
         5) Firestop classification and description from UL or other nationally recognized independent testing agencies acceptable to the Authority Having Jurisdiction.
         6) Fire containment and fire-resistant construction joint description.
         7) F, T, and W ratings where applicable
      c. Update the schedule periodically to include addition and changes.

C. Informational Submittals: Submit the following:

1. Test Reports: Copy of UL or other acceptable testing agency report illustrating each system and device as tested and approved.
2. List of generic descriptions and product names and manufacturers included in each system including form material, containment system, gang assemblies, means of controlling size of annular space, and sealer, topcoat, or intumescent materials.
3. Certifications specified in this section.
4. Qualification Data: Manufacturer's and installer's qualification data.
5. Manufacturer's field reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with a minimum of five years' experience.

B. Firestop Manufacturer: Do not use firestop material produced by any manufacturer who will not agree to send a direct employee as a qualified technical representative to the project site, during the initial installation and when requested, for the purpose of training appropriate installer personnel in proper selection and installation procedures and for rendering advice concerning the proper installation of materials.

C. All Firestopping Products shall be manufactured by one company to ensure compatibility with tested and listed assemblies and systems. Firestopping products made by multiple companies shall not be permitted to be installed.

D. Engineering Analysis: Engineering Analysis or Engineering Judgments/EJs are not encouraged for tenant improvement projects and will not be accepted for new construction projects. If Engineering Analysis are submitted they may not be approved. The first course of action is to provide a listed or prescriptive code design. Engineering Analysis shall not be permitted without the Office of the State Fire Marshal or Deputy State Fire Marshal's approval, prior to permit issuance for the scope of work. An Alternate Materials and Methods Request (AMMR) will be required if a listed design is not available for a specific condition.

E. Installer Qualifications:

1. The General Contractor/Construction Manager shall coordinate with mechanical, plumbing, electrical, low-voltage, and rated assemblies to provide a single company for the installation of all firestopping materials
2. Company specializing in the installation of firestopping specified with experience on at least five projects of similar nature in the past three years.
3. Trained and approved by the manufacturer of firestop materials.
4. The installer shall be certified, licensed, FM Approved in accordance with FM 4991, or Certified by UL as a Qualified Contractor, or approved by Cal Poly and the AHJ, in addition to being certified by the firestopping manufacturer (not by distributor) as having been provided the necessary training to install firestop products per specified requirements.
5. The certified installer shall have in such person's possession their certification cards available at all times during installation and inspection. Any new certified installer shall be submitted for review and approval.
6. The firestopping installation shall be performed by one company, multiple

companies installing firestopping shall not be permitted.

F. Installer Responsibility: Select firestop, fire containment, and fire-resistant construction joint products from those indicated for each penetration.
   1. Obtain approval of authorities having jurisdiction for selected methods.
   2. Submit proposed methods along with proof of acceptance by the Authority Having Jurisdiction.

G. Regulatory Requirements: Ensure firestop, fire containment, and construction joint components comply with applicable portions of local, state, and federal codes, laws, and ordinances for flame spread and smoke-developed indices.

H. Certifications:
   1. Contractor's and installer's certification that products are installed in accordance with Contract Documents, based on inspection and testing specified as part of Field Quality Control.
   2. Manufacturer certification ensuring firestopping interface compatibility with other firestopping and systems
   3. Certificates of compliance from the Authority Having Jurisdiction indicating approval of firestops, fire containments, and construction joints.
   4. Certificate of inspection and acceptance by the Authority Having Jurisdiction of firestops, fire containments, and construction joints.

1.6 PRE-INSTALLATION CONFERENCE

A. Conduct a pre-installation conference in accordance with Section 013119.

B. Agenda: Include discussion and agreement upon acceptable:
   1. Product and classification schedule.
   2. Test firestop materials to confirm compatibility with adjacent materials and chemicals and solvents with which they may come into contact during construction.
   3. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
   4. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
   5. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.
   6. Coordinate with the firestop manufacturer during the pre-installation conference to ensure installation is completed per the required design.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 016000.
   1. Packing, Shipping, Handling, and Unloading: Deliver materials in the manufacturer's unopened containers with the manufacturer's name, product identification, lot number, UL labels or labels of other nationally recognized independent testing agencies, and mixing and installation instructions.

2. Storage and Protection: Store materials to prevent deterioration and damage due to moisture, temperature change, and contamination.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Comply with the manufacturer's temperature and humidity limitations before, during, and after installation.
   2. Do not install firestopping products when ambient or substrate temperatures are outside the limitations recommended by the manufacturer.
   3. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
   4. Comply with ventilation requirements.

2.0 SEQUENCING

B. Sequence Work properly with adjacent work to allow unobstructed access to all areas needing firestops and smoke seals.
   1. Identify penetrations and openings requiring firestops, smoke seals, fire containments, and construction joints.
   2. Schedule installation of firestopping after completion of work involving penetrating items, but prior to covering, concealing, and eliminating access to penetrations.
   3. Coordinate with work of other trades

C. Inspection: Request inspection of firestops by the Authority Having Jurisdiction and testing consultant before concealment.
   1. Sequence work to permit installation to be inspected and approved prior to being concealed.
   2. Ensure that subsequent openings and penetrations are reported, properly firestopped, and inspected.
   3. Required State Fire Marshal Inspection Milestones:
      a. Material Verification
      b. Substrate Inspection
      c. Assembly installation inspection (each layer)
      d. Final Inspection
      e. Other Inspection as required TBD (e.g. firestopping through penetrations) as applicable.

PART 2- PRODUCTS

2.1 FIRESTOPPING DEVICE AND SYSTEM MANUFACTURERS

A. Acceptable Manufacturers:
   1. Basis of Design: Hilti Corp., Tulsa, OK.
   2. Approved Equal

B. Substitutions: Product substitutions must comply with Section 012500. Approval must be obtained by the Design Team, Cal Poly Facilities Planning and Capital Projects department, and the Authority Having Jurisdiction for approved equivalent prior to installation.

2.2 PRODUCT DESCRIPTION

A.

1. Intumescent sealants: intumescent, water-based sealants. Fast drying, paintable, red in color. Sealant materials for use with non-combustible and combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles, and plastic pipe. Provides a W-rating once cured

2. Acrylic-Based Firestop Sealants: Single-part, water-based. Paintable, low shrinkage, low VOC sealant. Use firestop pipe penetrations (not for use with CPVC) and joints. Available in red, white, and grey colors.

3. Silicone Sealants: Flexible, Smoke, fume water, and UV resistant sealant. Halogen and solvent free. Meets Class 1 W-rating requirements. Use in mechanical, electrical, and plumbing applications to firestop through a fire-rated wall and floor assemblies

4. Self-Leveling Sealants: Products: Single part, self-leveling firestop silicone sealant. Gray in color. Meets Class 1 W-rating requirements. For use with floor penetrations UL Water leakage test.

5. Intumescent Composite Sheets: Intumescent sheet that fastens directly to the surface, #304 stainless steel, and nonmagnetic. For use with large wall and floor fire-rated assemblies.

6. Intumescent Collar: Factory-assembled steel collars lined with intumescent material sized to fit the specific outside diameter of the penetrating item, latch mechanism for closing, BS and UL compliant, and FM-approved firestop collar.

7. Intumescent Wrap Strips: Firestop wrap device that attaches to assembly around the combustible plastic pipe (closed and open piping systems) and can be continuously wrapped.

8. Intumescent Firestop Blocks: Intumescent, re-usable, Re-enterable non-hardening blocks with an embedded fiberglass mesh used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways. To be installed with the manufacturer's label intact on the block for ease of installation.

9. Intumescent Moldable Putty: Remains pliable, flexible, and easily re-enterable, non-toxic putty. Versatile putty for pipes, cables, cable trays, blank openings, and other penetrations.

10. Cast-In Place Device: A one-step cast-in firestop device for sealing combustible and non-combustible penetrations, ready-to-use out of the package, integrated

moisture, and smoke seal. Available in red or black.

a. Metal Deck Device: Cast-in firestop device that can work in composite W3 and W2 floor decks, does not require steel deck reinforcement or additional shoring, and tested in accordance with UL 1479, ASTM E 814, and ASTM G21.

11. Plugs: For blank openings made in a fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected.

12. Cable pathway devices: whenever single and/or bundled low-voltage cables penetrate fire-rated concrete, masonry, and drywall walls and floors, where frequent cable additions and changes may occur. The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The device shall be capable of being easily ganged together. The fire-rated cable management device shall consist of a bare metal housing and frame(s) to enable grounding for electrical continuity. The device shall provide airflow containment sufficient to achieve the L-Rating requirements of the barrier type.

    a. Round fire-rated cable management device: The device shall consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and an inner fabric smoke seal membrane. The device shall contain a smoke seal fabric membrane or intumescent firestop sufficient to achieve the L-Rating. Install the device per the manufacturer's published installation instructions.
    b. Rectangular fire-rated cable management device: The device shall consist of a rectangular galvanized steel sleeve with a symmetrical half-shell design for retrofit capabilities. The device shall consist of an inner and outer layer of brushes on both ends of the device sufficient to achieve the L-Rating. The device shall be capable of being easily ganged together using gang plates or floor grid systems with ganging clips. Install the device per the manufacturer's published installation instructions.

13. Pre-formed Head of Wall Device: One-piece, pre-formed, polyurethane foam-based, firestop seal for use with standard head-joint top tracks and slip-type head joints in fire-rated construction at top of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle over the top track.

14. Firestop Joint Spray: Tested in accordance with ASTM D6904, both sprayable and brushable, contains no halogens, solvents, or asbestos, mold, and mildew resistance rating of 1. For use of sealing wall and top-of-wall openings and joints, building perimeter gaps between floor slabs and exterior façades.

15. Edge of Slab Device: Pre-formed polyurethane foam-based material for use as part of a perimeter fire barrier between fire-resistance-rated floors and exterior wall assemblies.

B. Performance Criteria:
1. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

2. Pipe insulation shall not be removed, cut away, or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.
3. Fire-rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons, and changes will occur.
4. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data, and video cabling shall be provided with re-enterable products specifically designed for retrofit. Systems: Comply with the code for firestopping systems for each condition encountered.

C. **INS-07** Safing Insulation, Foil Faced:
1. General: Mineral fiber composition, foil faced.
2. Classification:
   a. ASTM C612, Class 1 or 2.
   b. ASTM C665: Type III, Class A.
3. Density and Thickness: Manufacturers recommended to achieve the indicated fire rating.
4. Combustion Characteristics: ASTM E136, noncombustible.
5. Fire rating: ASTM E84, flame spread 25 or less, and smoke development 10 or less.
6. Acceptable Products:
   a. Owens Corning Thermafiber: Thermafiber Safing Insulation.
   b. ROXUL SAFE, Rockwool.
   c. Or equal.

D. Accessories: Provide accessories required by the manufacturer, UL, or other testing agency, and classification for the specific application.
1. Sealant Primers: As instructed by the manufacturer.
2. Sealant Damming Materials:
   a. Non-combustible.
   b. Chemically compatible with sealant.
   c. Mineral fiberboard, mineral fiber matting, or fibrous fire safing.
3. Cleaning Solvents: As instructed by the manufacturer.
4. Labels:
   a. Provide a label for each firestop condition.
   b. Type information in non-fading ink on 20-pound (minimum) paper.
   c. Include the following information on each label:
      1) Manufacturer's name.

2) Product name.
3) Product type (sealant, putty, mortar, or other generic material description).
4) F-Rating.
5) W Rating.
6) T-Rating. State when not required for the condition.
7) Testing and listing agency filing numbers, such as UL System number.

E. Select adhesives, primers, and sealants meeting Cal-GREEN requirements.
1. Adhesives shall comply with VOC and chemical component limits of Cal-GREEN Table
5.504.4.1 Adhesive VOC Limit requirements.
2. Sealants and Sealant Primers shall comply with VOC and chemical component limits of Cal-GREEN Table 5.504.4.2 Sealant VOC Limit requirements.

2.3 CURTAIN WALL FIRE-STOPPING SYSTEMS

A. Deferred Submittals for Curtain Wall Fire Stopping Systems shall not be permitted.

1. Fire Retardant Sealants and Insulation:

a. Insulation: Approved semi-rigid curtain wall insulation and firesafing materials; coordinate with Section 072100 for materials to create a fire-rated assembly.

PART 3- EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with work when substrate conditions are acceptable.

B. Verify that permanent penetration items have been installed and that temporary penetrating items have been removed.

C. Verify that supports have been installed on both sides of penetrated construction as required by UL classifications.

D. Inspect and verify that surfaces and condition of openings have no defects that could interfere with the installation and performance of firestop materials.

E. Verify sleeves installed under plumbing, mechanical, and electrical work are properly installed.

3.2 PREPARATION

A. Clean surfaces of opening substrates free of dirt, oil, grease, debris, items not explicitly included in the listed assembly, and loose and harmful materials which may adversely affect the bond of materials to surfaces in accordance with manufacturer's recommendations.

B. Test surfaces which have been previously painted, sealed, and treated with other coatings and compounds to ensure compatibility with materials and proper bond capability.

C. Remove incompatible coatings and materials which may affect the firestop bond with surrounding surfaces.

D. Mask and protect adjacent surfaces from damage.

E. Prime surfaces as instructed by the manufacturer.

3.3 FIRESTOPPING INSTALLATION

A. General: Install in accordance with manufacturer's details, applicable codes, UL or other testing agency classification requirements, and approved schedule and shop drawings.
   1. Fire-resistant systems without UL or other testing agency classification requirements shall be approved by authorities having jurisdiction before installation.
   2. Install firestopping material in the manner required to achieve the F rating, W rating, and T rating required by UL classification, applicable codes, and authorities having jurisdiction.
   3. Install firestopping material with sufficient pressure to ensure uniform density and texture, and to ensure proper filling and sealing of openings to create a smoke seal.
   4. Install forms and supports to arrest liquid and flowable material leakage and retain materials in openings.
   5. Remove form materials after firestopping material has cured unless materials used are permitted or required to remain according to test classifications.

B. Through Penetration Firestopping Systems: Comply with classification design requirements. Separate cables not in conduit and maintain the required separation of penetrating items from edges of openings and from each other.
   1. Tool and trowel exposed surfaces to smooth finish, flush with surrounding surfaces unless otherwise required by test classification.
   2. Remove excess firestop material promptly as work progresses.

C. Through Penetration Firestopping:
   1. Securely attach device frames to supporting construction.
   2. Assembly component parts to ensure proper contact and sealing of gaps and openings around penetrating items.

D. Curtain Wall Fire Containment, Foil-Faced Safing Insulation:
   1. Fill voids between the curtain wall and edge of slabs at floors and roofs in accordance with the manufacturer's instructions. Do not leave voids in safing.
   2. Tape and seal tears and cuts in facing.
   3. Seal joints with the manufacturer's recommended sealant.
   4. Provide flexible fire-rated smoke seal tested and approved for dynamic movement.
   5. Create a fire-rated assembly with a listed design number.

E. Fire Resistant Construction Joints:
   1. Provide fire-resistant systems to match the fire rating of the adjacent construction.
   2. Provide fire-resistant systems at the following locations:
      a. Voids and gaps in fire-rated construction, including control joints and gaps at the top of fire-rated CMU walls.
      b. Fire-rated partition and metal deck flutes.
      c. Changes in partition material.
      d. Floor joints not requiring expansion joints.

e. Other locations indicated and required by applicable codes.

3.4 FIELD QUALITY CONTROL

A. Site Inspections: Comply with Division 01 requirements.

B. Inspection: The owner may engage and pay for the services of an independent testing consultant to perform a quality control inspection.

C. Do not conceal firestops, fire containments, and fire-resistant construction joints prior to required inspection by the Inspector of Record (IOR) and Authority Having Jurisdiction (AHJ)

D. Notify the Authority of Having Jurisdiction and designated inspectors of work released for inspection.

E. Manufacturer's Field Service: At the start of the installation, periodically as the Work progresses, and after completion, utilize the firestop material manufacturers' representative at the job site as necessary to advise on every phase of the Work.

F. The listed assembly and the manufacturer installation instructions shall be onsite and available during the installation to ensure and verify proper installation. Listed documentation and the manufacturer's installation instructions shall be provided by the Contractor or Subcontractor during inspections in accordance with 014100. Listed documentation provided shall be by the listing agency, not the manufacturer.

G. All firestopping installations must be performed in compliance with a tested and listed firestop system design. The tested and listed system specifically states the manufacturer and the exact products that may be used. There is NO substitution, as each product has different properties and these specific combinations and applications are what have passed testing.

H. Labels:
   1. Provide a label for each firestop/smoke seal condition.
   2. Securely fasten the label immediately adjacent to the firestopping condition to allow authorities having jurisdiction and the owner's inspection agency to readily identify and confirm the system.
   3. Wall partitions are required to have protected openings or penetrations permanently identified with signs or stenciling. Such identification shall be located in accessible concealed floor, floor-ceiling, or *attic* spaces:
      a. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall partition and
      b. Include lettering not less than 3 inches in height with a minimum 3/4-inch stroke in a contrasting color incorporating the suggested wording. "**Fire and/or smoke barrier-protect all openings**" or similar wording.

I. Inspection Requirements:
   1. Visually examine firestopping, fire containments, and fire-resistant construction joints to verify compliance with Contract Documents.
   2. Examine firestopping, fire containments, and fire-resistant construction joints for proper installation, adhesion, and curing appropriate for each material.
   3. Submit a written inspection report including the following information:
      a. Identify construction penetrated including fire resistance rating.

b. Identify penetrating items.
c. Identify products and manufacturers included in each system.
d. Identify the form material used.
e. Firestop classification and description from UL, FM, Warnock Hersey, or other independent testing agencies.
f. Fire containment and fire-resistant construction joint description.
g. F, T, and W ratings.
h. State whether firestop, fire containment, and fire-resistant construction joint is or is not in full compliance with testing agency classification, description, and manufacturer's requirements. If variations occur confirm acceptance of variation by the manufacturer and authority having jurisdiction.

J. Re-examine firestopping, fire containments, and fire-resistant construction joints immediately prior to concealment by other construction to ensure no damage has occurred since the initial inspection.

K. Correct unacceptable firestopping, fire containments, and fire-resistant construction joints, and provide additional inspection, to verify compliance with this Section, at no additional cost to the Owner.

3.5 REPAIRS AND MODIFICATIONS

A. Identify damaged and re-entered seals requiring repair and modification.

B. Remove loose and damaged materials.

C. If penetrating items are to be added, remove enough material to permit penetration by new elements, being careful not to damage the balance of the seal.

D. Repair holes, cracks, and damage in accordance with the manufacturer's instructions to ensure a complete smoke seal.

E. Use only materials approved by the manufacturer of the original seal as suitable for repair.

3.6 CLEANING

A. General:
1. Clean as instructed by the manufacturer. Do not use materials or methods which may damage the firestop or surrounding construction.
2. Remove stains and correct damage to adjacent surfaces.

3.7 PROTECTION

A. Protect material subject to traffic from damage.

END OF SECTION

07 63 00 - Sheet Metal Roofing Specialties

Roof penetrations of service utilities:
Preferred Manufacturer: LSC Corp.

Pipe Chase Housing:

Removable lid with gasket. Pipe seals for pipes from ¼-inch to 1½ -inches outside diameter. Housing with gasket to curb. 3-inch skirt protects leading edge of roof. Constructed of welded power coated aluminum and stainless-steel bolted connections. 2-inch flange out onto roof. Tower extension allows for space to mount disconnects and control boxes. Some models are equipped with hose bibb and knockouts for GFCI.

END OF SECTION 07 63 00 - Sheet Metal Roofing Specialties

SECTION 07 81 23
INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

1.02 DEFINITIONS

A. Intumescent coatings: Material or combination of fireproofing materials used to help retain the structural integrity of steel members by maintaining an effective thermal barrier to provide fire resistance rating as documented by listings from accredited test laboratories.

1.03 GENERAL DESCRIPTION OF THE WORK IN THIS SECTION

A. Intumescent coatings applied to primary and secondary structural steel members to provide specified fire resistance rating.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 01 40 00 – Quality Assurance
2. Section 03 30 00 – Cast-In-Place Concrete
3. Section 04 20 00 – Unit Masonry
4. Section 05 12 00 – Structural Steel Framing
5. Section 05 50 00 – Metal Fabrications
6. Section 07 81 16 – Cementitious Fireproofing
7. Section 07 80 00 – Firestopping
8. Section 09 20 00 – Plaster and Gypsum Board
9. Section 09 90 00 – Painting and Coatings

1.05 REFERENCES

A. Underwriters Laboratories Inc. (UL) Fire Resistance Directory

B. Test Requirements and Reference Standards:

1. ASTM E119,"Standard Test Methods for Fire Tests of Building Construction and Materials"
2. ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials"
3. ASTM D2240, "Standard Test Method for Rubber Property—Durometer Hardness"
4. ASTM D2794, "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)"
5. ASTM D4060, "Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser"
6. ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"
7. ASTM E329-09, "Standard Specification for Agencies Engaged in Construction Inspection and Testing"
8. National Fire Protection Association, NFPA 251
9. Underwriters Laboratories Inc. (UL) ANSI/UL263
10. Underwriters Laboratories of Canada (ULc) CAN/ULC S101-M
11. Association of the Wall and Ceiling Industry, AWCI Technical Manual 12-B, current edition.

C. Building codes: The most current edition of the Office of State Fire Marshal adopted California Building Code and California Fire Code.

D. Industry References:
1. Underwriters Laboratories (UL), www.ul.com
2. Underwriters Laboratories of Canada (ULC), www.ulc.ca
2. National Fireproofing Contractors Association (NFCA), www.nfca-online.org/
3. The Society for Protective Coatings (SSPC), www.sspc.org/
4. Association of the Wall and Ceiling Industry (AWCI), www.awci.org

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company responsible for the manufacture of fire protection materials with local direct technical employee(s) (as distinct from distributors or authorized agents) readily available at the project site. Intumescent coatings shall be manufactured under the follow-up services program of Underwriter's Laboratories (UL) or UL Canada (ULc) and bear the UL (and/or ULc) label (mark). Manufacturer's technical representative to be on site

during start of installation and be generally available on site as requested during the application process.

B. Installer Qualifications: Engage experienced Installer certified, licensed, or otherwise qualified by the intumescent coatings manufacturer as having the necessary training to install manufacturer's products, and otherwise have the experience and staff to properly perform the installation. Installer shall be trained by the intumescent coatings manufacturer's direct employee(s) (as distinct from distributors or authorized agents).

C. Installation: Verify steel members have been properly prepared, including the use of a compatible primer, and install intumescent coatings in accordance with manufacturer's written recommendations published in their product technical literature and/or provided by manufacturer.

D. Product Identification: Label packages (pail or bucket) with manufacturer name, product name, expiration date, UL or ULc label (mark).

E. Special Inspection: Owner to employ a qualified independent inspection and testing agency to perform field quality control testing services in accordance with NFCA 400 Field Quality Assurance Procedure, local building code and Authority Having Jurisdiction requirements.

F. Inspection and Testing Agency Qualifications: ASTM E329-09, "Standard Specification for Agencies Engaged in Construction Inspection and Testing" and NFCA 400 Field Quality Assurance Procedure.

G. Field Constructed Mockups: Prior to installing intumescent coatings, Installer shall apply products specified for exposed applications to demonstrate aesthetic qualities and workmanship. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Location: As indicated on drawings.
2. Extent of Mockups: Approximately 5 sq. ft. of surface for each product indicated.

Note to Specifier: *5 sq. ft. is a suggested minimum area and should be adjusted based on the scope of the project and/or a desire to completely coat one or more structural members that would be incorporated into the finished project.*

3. Notify architect one week in advance of the dates and times when mockups will be built.
4. Obtain architect's written acceptance of mockups before start of actual unit of work.
5. Retain and maintain mockups during construction in undisturbed condition as a standard for judging completed units of work.

a. Accepted mockups in undisturbed condition at time of substantial completion may become part of completed unit of work.

1.07 SUBMITTALS

A. Product data for each intumescent coating indicated on drawings and Finish Schedule.

B. Product certificates from manufacturer documenting intumescent coatings comply with specified requirements including those for fire test response characteristics and compatibility with adhesives, primers, and other surface coatings on substrates indicated to receive intumescent coatings.

C. Fire Resistance Rating Listings: UL, ULc, or other accredited testing agency indicating type and size of steel member to receive intumescent coatings and minimum dry thickness (mils) to achieve specified fire resistance rating.

D. Qualification Data: Installer to demonstrate capabilities and experience on completed projects which are comparable in size and scope by providing the following information:

1. Project location: City, State, and Country
2. Scope of work: project type, contract valuation
3. Completion date
4. Architect: firm and contact information
5. Owner: name and contact information

E. LEED Submittals:

1. Product Data for Credit EQ c4.2: Low emitting materials – Adhesives and sealants, documentation including printed statement of VOC content.
2. VOC content: <125 g/L
3. Meets requirements for LEED 4.1 rating system

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with manufacturer's labels intact and legible.

B. Install intumescent coatings prior to expiration date included on packaging. Properly discard expired product in accordance to local and federal regulations.

C. Store intumescent coatings protected from direct sunlight and maintained at a temperature as specified by the manufacturer. The product must not be frozen or

stored at freezing temperatures. Identify and label material damaged due to improper storage, remove from Project site and properly discard.

1.09 PROJECT CONDITIONS

A. Environmental Conditions:

1. Do not install Intumescent Coatings when ambient or substrate temperatures are, or prior to full cure will be, outside the manufacturer's recommended installation temperatures, unless temporary protection and heating/cooling is provided to maintain temperatures within the prescribed range for the period specified by the manufacturer.
2. Do not install intumescent coatings when relative humidity is outside the limits established by the manufacturer. Consult manufacturer to determine precautions that may be implemented to prevent condensation from forming on the steel during application of fireproofing.
3.

B. Ventilation: Ventilate areas where intumescent coatings will be installed by natural means or, where this is inadequate, forced air circulation during and after application until fireproofing dries / is cured thoroughly.

1.10 SEQUENCING

A. Sequence and coordinate application of intumescent coatings with related work specified in other Sections to comply with the following requirements:

1. Coordinate installation of intumescent coatings with other items of work that may interfere with proper installation of coatings.
2. Do not begin applying intumescent coatings until clips, hangers, supports, and other welded connections have been installed. Intumescent coatings manufacturer must approve in writing any clips, hangers, supports or connections that may installed over coating using mechanical or adhesive devices.
3. Provide temporary enclosures as necessary to prevent deterioration of intumescent coatings due to exposure to unfavorable environmental conditions as required by installation procedures and product performance capabilities as supplied by manufacturer. Exposure to exterior elements for any portion of construction cycle must be supported a verified burn test to ensure no degradation of fire properties.
4. Take appropriate steps to avoid abrasion and other damage to the applied intumescent coatings during construction operations.
5 Do not protect or conceal structural members to which intumescent coatings have been applied until each area has been inspected, tested, and corrections have been made to any deficient areas.

PART 2 - PRODUCTS

2.1 FIREPROOFING

A. Intumescent coatings: Factory mixed formulation consisting of a modified heavy bodied coating, with inorganic reinforcing fibers (non-asbestos) for spray application.

1. Basis of Design: Water-Based Product: Subject to compliance with requirements, provide the following; Hilti Fire Finish CFP-SP WB by Hilti, Inc.,. Or Approved Equal.

Physical Characteristics:

1. Surface Burning Characteristics of Building Materials, ASTM E 84 (UL 723, CAN/ULC-S102): Class A Rating.
    a. Flame Spread: 0
    b. Smoke Development <= 45
2. Durometer Hardness, ASTM D2240: >= 63 Shore D
3. Impact Resistance, ASTM D2794: >= 65 in-lb
4. Abrasion Resistance, ASTM D4060: <= 0.140 g/1000 cycles
5. Adhesion, ASTM D4541: >= 350 psi
6. VOC < 50 g/l as per CDPH Standard Method v 1.1-2010 or newer

2. Basis of Design: Solvent-Based Product: Subject to compliance with requirements, provide the following; Hilti All Weather High Build CFP-SP AWHB by Hilti, Inc.,. Or Approved Equal. Must be applied by a trained and approved applicator per manufacturer.

Physical Characteristics:

1. Surface Burning Characteristics of Building Materials, ASTM E 84 (UL 723, CAN/ULC-S102): Class A Rating.
    a. Flame Spread: 0
    b. Smoke Development: 10
2. Durometer Hardness, ASTM D2240: 39 Shore D
3. Impact Resistance, ASTM D2794: 15.9 in-lb
4. Abrasion Resistance, ASTM D4060: 255 g/1000 cycles
5. Adhesion, ASTM D4541: 280 psi
6. VOC < 125 g/l as per CDPH Standard Method v 1.2-2017

B. Accepted Substitute in accordance with Section 012500.

2.2 AUXILIARY FIREPROOFING MATERIALS

A. General: Provide auxiliary fireproofing materials that are compatible with intumescent coating products and substrates and are approved by UL or other accredited testing agencies acceptable to authorities having jurisdiction for use in the fire resistive designs indicated.

B. Substrate Primers: For use on each different substrate, provide primer that complies with the following requirements:

1. Primer approved in writing by manufacturer of intumescent coatings and applied in full compliance with the primer manufacturer's recommendations.
2. Primer to have been tested by manufacturer in fire conditions to ensure fire-performance of primer-intumescent system, and adhesion of the post-burn intumescent char to the primer. Documentation of such tests to be provided upon request.
3. Primer must be fully cured prior to installation of the intumescent coating.

C. Topcoats: Suitable for application over applied intumescent coatings; of type recommended in writing by intumescent coatings manufacturer for each fire resistance design. Topcoat to have been tested by manufacturer for compatibility in fire conditions with documentation of such tests to be provided upon request. Color of topcoat shall be as selected by the architect. Colors shall not be limited to manufacturer's standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cover other work subject to damage from fall out or overspray of intumescent coatings materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintaining adequate ambient conditions for temperature and ventilation.

B. Clean substrates of substances that could impair bond of fireproofing, including oil, grease, rolling compounds, incompatible primers, rust, and mill scale.

C. Prime substrates with an approved and compatible primer, unless an approved and compatible shop primer has been applied and is in satisfactory condition to

receive intumescent coatings. Primer must be fully cured prior to applying intumescent coatings.

D. Apply intumescent coatings: Protect intumescent coatings from rain, direct sunlight, high humidity, strong wind (with dirt, dust or sand) during the application, drying, and curing phases, unless test evidence allows otherwise. Do not apply an additional coat of intumescent coating until previous layer has fully cured.

E. For applications visible upon 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 that would telegraph through fire resistive products after application.

3.2 INSTALLATION, GENERAL

A. Coordinate application of intumescent coatings with other construction to allow for proper application and minimize need to repair damage.

B. Comply with intumescent coatings manufacturer's instructions for mixing materials, application procedures, and types of equipment used to convey and install products, as applicable to the particular conditions of installation and as required to achieve fire resistance ratings indicated.

C. Coat substrates with primer and allow proper cure time prior to applying intumescent coatings as recommended by intumescent coatings manufacturer for material and application indicated.

D. Apply intumescent coatings identical to mock-ups.

3.3 INSTALLING INTUMESCENT FIREPROOFING

A. Apply intumescent coatings in thicknesses required to achieve fire resistance ratings designated for each condition.

B. Provide a uniform finish complying with description indicated for type of material and matching finish approved for field erected mockup.

3.4 FIELD QUALITY CONTROL

A. Inspection and Testing Agency: Coordinate installation of fireproofing with owner’s independent inspection and testing agency.

B. Inspection & testing shall be in accordance with AWCI Technical Manual 12-B.

C. Testing agency will promptly report test results in writing to the installer and architect.

D. Remove and replace intumescent coatings where test results indicate that fireproofing does not comply with specified requirements for adhesion.

E. Apply additional intumescent coatings per manufacturer's directions where test results indicate that the thickness does not comply with specified requirements.

F. Additional Testing: Where intumescent coatings are removed and replaced or repaired, Owner's inspection and testing agency shall perform additional testing to determine compliance with specified requirements.

3.5 CLEANING, REPAIR, AND PROTECTION

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove product overspray and fall out from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Cure intumescent coatings per manufacturer's recommendations.

C. Protect intumescent coatings from damage during construction.

D Repair or replace work that was not properly protected from damage during construction in accordance with manufacturer's recommendations.

E. Ensure full curing of intumescent coating prior to application of an approved top coat.

END OF SECTION