PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, materials, tools, and equipment required and perform waterproofing work specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Perform work under this Section by specialty subcontractor regularly engaged in performance of type work required. Use workmen experienced in installation of specified products. Applicator to provide qualified, competent foreman present and in charge at all times work under this Section is performed.

B. Installer Guarantee: Furnish written guarantee for waterproofed under this Section against leakage for period of 2 years after acceptance, making good at his own expense leakage which may develop within guarantee period.

1.05 PRODUCT HANDLING

A. Protection: Protect waterproofing materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to Architect approval and at Contractor's expense.

PART 2 - PRODUCTS

2.01 COLD-APPLIED MEMBRANE WATERPROOFING

A. MANUFACTURERS: Polyguard Products, Inc., Ennis, Texas 75120-0755, phone: 800-541-4994, or approved equal.

B. Self-adhesive Membrane Waterproofing shall be Polyguard 650 Membrane, a 60 mil rubberized asphalt membrane consisting of a high density polyethylene film bonded to a layer of rubberized asphalt meeting or exceeding the following requirements:

C. Accessory Products
1. Substrate Conditioner: Shall be Polyguard 650 LT Liquid Adhesive or Polyguard ShurTac Water Based Liquid Adhesive.
2. Mastic: Shall be Polyguard 650 Mastic
3. Liquid Membrane: Shall be Polyguard LM-95.
4. Termination Bar: Shall be Polyguard Termination Bar

D. Prefabricated Perimeter Drainage Composite: Shall be Polyguard Total Flow System including Universal "T" Connectors and/or Outlet Connectors as needed for facilitate perimeter drainage.

2.02 UNDERSLAB WATERPROOFING SYSTEM

A. Underslab Waterproofing shall be Polyguard Underseal Underslab Waterproofing Barrier Membrane, a 84 mil rubberized asphalt membrane consisting of a strong sheet membrane with a facing of extremely high strength polyethylene backing laminated to a thick layer of proprietary stress absorbing / waterproofing formulation, with a top layer of nonwoven geotextile fabric:

B. Accessory Products
1. Fabric Tape: Shall be Polyguard Underseal Fabric Tape
2. Surface Primer: Shall be Polyguard 650 LT Liquid Adhesive or California Sealant
3. Liquid Membrane: Shall be Polyguard LM95

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 INSTALLATION OF WATERPROOFING IN GENERAL

A. Preparation: Prepare surfaces to receive waterproofing, strictly complying with manufacturer's recommendations. Deliver waterproofing materials to project site in original sealed containers with manufacturer's brand and name clearly identified.

B. Installation: Install waterproofing complying with manufacturer's recommendations, covering surfaces to prevent penetration of moisture.

3.03 INSTALLING COLD-APPLIED MEMBRANE WATERPROOFING

A. Priming: Apply primer to a cleaned, dust free surface. Apply by roller or spray. Apply Polyguard 650 LT Liquid Adhesive at the rate of 250-300 sq. ft. per gallon. Apply Polyguard ShurTac Water Based Liquid Adhesive at the rate of 350-400 per gallon. Allow to dry per manufacturer=s directions.

B. Membrane Installation - Vertical Surfaces
   1. All inside and outside corners shall be treated either with 12 inch wide membrane strip or by applying a 90 mil thick application of Polyguard LM-95. The 12 inch wide membrane should be centered over outside corners.
   2. Install a 3/4 inch, 45 degree angle cant of Polyguard LM 95 Liquid Membrane at all changes in plane including inside corners.
   3. Waterproofing membrane should be applied vertically in sections of 8 feet in length or less. On walls higher than 8 feet, apply two or more sections with the upper section overlapping the lower.
   4. Side laps should be a minimum of 2 2 inches and end laps should be a minimum of 6 inches.
   5. Use a hard roller to firmly press in the material as it is placed on the vertical surface.
   6. All terminations of the membrane should receive a bead of Polyguard 650 Mastic. The bead should be troweled to a flat surface approximately 1/8 inch thick by 3/4 inches wide. The mastic should be worked into cut edge terminations.
   7. Inadequately lapped seams and damaged areas should be patched with small sections of membrane. The patch should extend a least 6 inches in each direction beyond the defect.
   8. Fishmouths and severe wrinkles should be slit, flaps overlapped and repaired as above.
   9. Termination bar at top termination of field sheet. (optional)

3.04 INSTALLING UNDERSLAB WATERPROOFING

A. Installation shall be in accordance with manufacturer’s instructions and ASTM E 1634-98.

B. Membrane Installation - Horizontal Surfaces:
   1. Unroll waterproofing barrier membrane with longest dimension parallel with direction of pour.
   2. Place extremely high strength backing to the soil and fabric to the concrete.
   3. Lap waterproofing barrier membrane over footings and seal to foundation walls.
   4. Overlap side seams using the 4" edge trim seal. Clean polyethylene backing of waterproofing barrier membrane prior to application on the 4" edge seal with 30% Isopropyl Alcohol.
   5. End laps should be overlapped a minimum of 4" and addressed by applying a coat of liquid adhesive approximately 150-200 sq. ft. per gallon to fabric side of waterproofing barrier membrane and placing adjacent sheet on top. Roll to assure full adhesion.
   6. After application of end lap use liquid adhesive to prime seam and apply a 12" piece of fabric tape centered over seam to seal extend out 6” past side laps – roll with laminate roller.

7. If annular space of pipe through opening is ½" or less apply liquid adhesive to fabric side of membrane. Apply a 3/4" cant/fillet around pipe penetration extending onto fabric side of waterproofing barrier membrane and pipe a minimum of 3".
8. If annular space of pipe through opening exceeds ½" then a patch of fabric seal tape is required. Apply a heavy coat approximately 150 - 200 sq. ft. per gallon liquid adhesive onto the fabric side of the waterproofing barrier membrane extending 6" beyond pipe. Apply a patch 6" larger than pipe diameter. Press or roll patch firmly to obtain full adhesion to waterproofing barrier membrane. Apply another coat of liquid adhesive to the fabric side of the fabric tape patch and apply liquid membrane.
9. Steel reinforcements will be applied directly over the waterproofing barrier membrane. It is utmost important that reinforcement (rebar) chairs that are used are compatible with the system. Steel chairs and bolster be plastic dipped or have plastic caps.
10. Precaution should be taken to protect the waterproofing barrier membrane during placement of reinforcing or concrete. Visually inspect waterproofing barrier membrane prior to pouring of concrete for any punctures or damage to membrane which needs to be repaired. Patch any damaged areas by applying the liquid adhesive at a rate of 150-200 sq. ft. per gallon to fabric side of waterproofing barrier membrane and apply a patch of fabric tape.
11. Prior to slab pour all standing water must be removed from the membrane.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and application of liquid applied asphalt emulsion weather barrier.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E283-91 (1999) - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

G. ASTM E2178-01 - Standard Test Method for Air Permeance of Building Materials.

H. ASTM E2357 - 05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.
   2. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions at temperatures above 32ºF (0ºC), free from contact with cold or frozen surfaces.

C. Protect materials during handling and application to prevent damage or contamination.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not proceed with product application during rain or inclement weather.

C. Do not apply membrane when air or surface temperatures are below 30ºF (-1ºC).

D. Do not apply to frozen substrate.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. W.R. Meadows Air-Shield, W.R. Grace Perm-A-Barrier VP; or approved equal from Prosoco, Tremco or Carlisle.
   1. Coordinate with thru-wall membrane flashing product in 04 2000 for compatibility.

2.02 MATERIALS

A. Liquid Barrier System: Air-Shield™ LMP, One component, polymer modified, cold applied liquid vapor permeable membrane.
   1. Performance Based Specification: Air barrier membrane shall be water-based, that cures to form a tough, seamless, elastomeric membrane having the following characteristics:

a. Air Leakage ASTM E2357: < 0.04 cfm / ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
b. Air Permeability ASTM E2178: < 0.004 cfm/ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
c. Water Vapor Permeance ASTM E96 Method B: > 10 perms.
d. Elongation ASTM D412: 1300%.
e. Flexibility at -20° C ASTM C836 2" mandrel: Pass.
f. Flame Spread and Smoke Development, ASTM E84: Class A.
g. Installed Thickness: 45 mils dry, 60 mils wet.

2.03 ACCESSORIES

A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).
1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.

B. Joint Sealant: Single component, polyurethane joint sealant for exterior sheathing panels.
1. POURTHANE® NS by W. R. MEADOWS.

C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings and detailing.
1. AIR-SHIELD LIQUID FLASHING by W. R. MEADOWS.

D. Membrane Adhesive:
1. Solvent-Based Primer: MEL-PRIME VOC Compliant Solvent-Base Adhesive or Standard Solvent-Base Adhesive by W. R. MEADOWS.

E. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
1. POINTING MASTIC by W. R. MEADOWS.

F. Detailing Membrane: non-slump waterproofing material for joint detailing.
1. BEM by W. R. MEADOWS.

G. Concrete Repair Materials: general purpose patching materials.
1. MEADOW-PATCH™ 5 and MEADOW-PATCH 20 Concrete Repair Mortars by W. R. MEADOWS.

H. Sealant: Dow Corning 758 Silicone Weather Barrier Sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air/vapor barrier.

B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with cementitious patching mortar at least two hours before application.

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:
1. Panels are to be fastened according to sheathing panel manufacturer.
2. Fill all panel joint with detailing compound prior to full application.
3. Joints greater than 1/4" (6.3 mm) in exterior sheathing panels (drywall and glass-faced) should be filled with detailing compound and then taped with 4@ wide mesh tape as recommended by manufacturer.

3.03 APPLICATION OF SYSTEM

A. TRANSITION MEMBRANE
1. Prime surfaces to be covered in one working day with applicable primer.
2. Apply transition membrane with a minimum overlap of 75mm (3 in.) onto primed surface at all joints, columns, and beams as indicated in drawings.
3. Tie in to window and door openings, roofing systems, floor intersections, and dissimilar materials.
4. Roll membrane firmly into place.
5. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
6. Overlap subsequent courses of membrane a minimum of 2" (50mm) and ensure joints are fully adhered.
7. Seal all edges of transition membrane with detailing sealant.

B. BARRIER MEMBRANE
1. Apply membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft^2/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 45 mils dry.
7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.04 PROTECTION

A. Cover membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION

PART I GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
1. Rubberized-asphalt waterproofing membrane, reinforced.
2. Flashings and sealants.
3. Protection board
4. Root barrier
5. Molded-sheet drainage/water retention components.
6. Insulation.
7. Filter fabric.
8. Growing media.
9. Erosion Control Materials.
10. Roof ballast
11. Pavers.
12. Accessories.

B. Related Sections:

1. Section Section 03 3000 “Cast-in-Place Concrete”
   a) Strength/density: minimum 2,500 psi (17,235 kPa) compressive strength minimum 115 pcf (1842 kg/m^3) density
   b) Finish: Broom finish or equivalent similar to ICRI CSP 3 to 5. Steel troweled finish is not desirable.
   c) Concrete Hydration (Cure):
      1) Method of Cure: Water cure, wet coverings, paper sheets, plastic sheets or approved liquid curing compound (sodium silicate preferred).
      2) Duration of Cure/Dry:
         a) Structural Weight Concrete: recommend 28 days, minimum 14 days, prior to application of the membrane.
         b) Lightweight Structural Concrete: recommend 60 days, minimum 28 days, prior to application of membrane. Venting of the deck from the underside is recommended to facilitate drying.
         c) The above minimum cure/dry times are recommended based upon basic concrete fundamentals and experience. Depending on conditions (i.e., ambient temperature, humidity) the concrete may be dry enough to receive application of the membrane in less than the 14 day minimum recommendation. Consult Hydrotech for specifics when less than the minimum is desired.
   d) Refer to section 3.02 PREPARATION for additional deck types.
2. Section 07 9000 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
3. Division 07 Section “Sheet Metal Flashing and Trim” for metal flashing.

C. Contractor shall fully acquaint themselves with the existing site conditions and work area accessibility limitations.

1.03 REFERENCES

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

B. Canadian General Standards Board, CGSB-37.50-M89, Standard for Asphalt, Rubberized, Hot Applied, for Roofing and Waterproofing.

C. Underwriters Laboratories (UL) Class A.

D. ANSI/SPRI VR-1 2011 "Procedure for Investigating Resistance to Root Penetration on Vegetative Roofs".

E. International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) Scale.

1. ICRI 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

1.04 DEFINITIONS

A. Green Roof -- An area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from the natural ground by a man-made structure.

B. Extensive Green Roof -- Low maintenance landscaping consisting of shallow growing media depths (< 6 inches (152mm) with plant varieties restricted to primarily mosses, herbs and succulents capable of withstanding harsh growing conditions.

C. Intensive Green Roof -- Landscaping requiring regular maintenance, consisting of deeper growing media depths (> 6 inches (152mm) with a wider variety of plant species possible including shrubs and small trees.

D. Lawn Green Roof – Lawn oriented landscaping requiring at-grade lawn-oriented maintenance. Can include sodded or seeded turfgrasses or naturalized grasses with growing media depths > 8 inches (203mm).

E. Garden Roof® -- Patented system of drainage, water retention and root barrier components utilized in the construction of green roofs over Hydrotech's MM 6125® roofing membrane.

F. Steep Slope Green Roof -- Defined as a slope exceeding 3:12 pitch.

G. "C" Factor -- The runoff coefficient used in the Rational Method, "C" represents the portion of the storm rainfall that becomes runoff.

H. Curve Number (CN) -- A number that is used with Natural Resource Conservation Service (SCS) methods to convert rainfall depth into runoff volume. The Curve Number takes into account a site's soil type, plant cover, impervious cover, interception and surface storage.

1.05 SYSTEM DESCRIPTION

A. Furnish and install a completed Intensive Garden Roof® Assembly including roof substrate board, surface conditioner, Monolithic Membrane 6125®-FR and flashings, protection course, root barrier protection, Styrofoam™ brand insulation, water retention mat (if required), drainage/water retention component, filter fabric, lightweight engineered growing medium and vegetation.

1.06 ACTION SUBMITTALS

A. Make submittals in accordance with the requirements of Division 01 and as specified in this Section.

B. Product Data: Manufacturer's most current Product Data Sheets (PDS), Safety Data Sheets (SDS), and installation instructions for each product proposed for use on the project.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include the manufacturer's written instructions for evaluating, preparing, and treating substrates.

C. Shop Drawings: Submit Shop Drawings showing locations and extent of the waterproofing assemblies and details of all typical conditions. Include plans, sections, details, and attachments to other work. Clearly indicate and mark requested deviations from the design drawings. All shop drawings and shop drawings revisions shall be complete before conducting the Pre-Installation Conference and starting work of this section. Drawings should integrate the following specific systems.

1. Waterproofing System: Include drawings for flashing, counter flashing, copings, penetrations, vertical intersections, slope, expansion joints, control joints, cracks preparation, inside and outside corners, tie-ins with adjoining waterproofing, membrane terminations, and other project specific termination conditions.

2. Drainage System: Include drawings for drainage layers, filtration systems, drain bodies, and associated piping.

3. Vegetative Components: Include drawings for filtration layers, root protection, soil layers, dividers, rock, sod, and plantings.

4. Walkway System: Include drawings for gravel walkways, pavers systems, paver supports, paver jointing, and paver size.

D. Phasing Plan: Written execution process and plans depicting the phasing of the installation process. Contractor shall coordinate the phase plan with all trades. The phasing plan shall indicate when work for each trade will be performed for specific zones.

E. Samples: Provide 3 samples of each of the following.

1. 2 inch diameter hot rubberized asphalt sample.
2. 12 inch by 12 inch square of waterproofing reinforcing fabrics, uncured neoprene reinforcement, and protection course.

F. Material Test Reports:

1. Fire Response Properties

a) Flame Spread: Maximum ASTM E 84 flame-spread index of 25
b) Smoke Development: Maximum ASTM E 84 smoke-developed index of 450

c) Façade Fire Propagation: Provide an assembly that has passed the required testing of NFPA 285.

d) Provide Class A materials complying with ASTM E 108 or UL requirements for the application and slopes indicated. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Product test reports from a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing system formulations.

G. Material Certificates:

1. Where product data does not indicate material compatibility of independent products that form a system assembly; provide a written statement of material compatibility from the system assembly manufacturer. System assembly shall include:

a) Waterproofing system
b) Drainage system and plumbing drains
c) Filtrations system
d) Vegetative system

2. Written certification from the waterproofing manufacturer confirming compatibility with existing underlying coatings and/or substrate.

H. Proposed Means and Methods: Written explanation of what means and methods will be utilized for each phase of work including.

1. Preparation of concrete surface
2. Preparation of steel surfaces
3. Preparation of substrate board
4. Method and details for treatment of cracks and joints
5. Preparation of existing waterproofing surfaces
6. Preparation of existing surfaces to be tied into

I. Certification from an approved independent testing laboratory experienced in testing rubberized asphalt material, that the material meets the CGSB-37.50-M89 standard for rubberized asphalt membranes, including applicable ASTM procedures.

J. Certification that the roofing membrane has current validation by Underwriters Laboratories, or other approved independent validation service provider, of a minimum 40% recycled content (post-consumer).

K. Certification that the roof membrane assembly is currently Class A listed with Underwriters Laboratories.

L. Certification showing full time quality control of production facilities responsible for the manufacture of the rubberized asphalt and that each batch of material is tested to insure conformance with the manufacturers published physical properties.

M. Certification that the plant manufacturing the rubberized asphalt material has IS0 9001-2015 approval as evidenced by a copy of the official certificate.

N. Certification showing that all components of the green roof assembly are being supplied and warranted by a single-source manufacturer.

O. Certification that the extruded polystyrene insulation if used is free from CFC's.

P. Ballasting requirements for the specified loose laid extruded polystyrene insulation, and as referenced in part 1.09.K., shall be provided to include the following:

1. A written ballast review on membrane manufacturer’s letterhead outlining specific roof level ballasting requirements required to satisfy limited wind resistance warranty conditions.

2. Each roof level shall be individually evaluated and prepared during the design and prebid process

3. A final ballast review shall be submitted that reflects the designed conditions at the time of the project bid.

Q. Provide product data on all components of the green roof assembly.

R. Stormwater performance of the specific green roof assembly for the project shall be provided and include:

1. Composite Curve Number (CN)
2. Composite C factor
3. Total volume of water stored in the growing media
4. Total volume of water stored in the water retention/drainage element
5. Hydrograph of vegetated roof system showing stormwater release delay and stormwater volume reduction.

S. Evidence indicating that water is available at the roof level to ensure that the vegetation can receive sufficient moisture through proper maintenance of the green roof.

1.07 INFORMATION SUBMITTALS

A. Minutes of Pre-installation Meetings.

B. Qualification Data: Submit documentation of the required qualifications specified in part Quality Assurance of this Section.

C. Applicator Certification: Signed by the manufacturer certifying that the Installer is approved, authorized, or licensed by the manufacturer to install the specified systems and is eligible to receive the specified manufacturer's warranty.

D. Field Quality Control/Assurance Reports: Submit electronic copies of the contractor’s field quality control logs and reports, and quality assurance inspections and testing reports.

E. Project Specific Sample Warranty: Copy of special waterproofing manufacturers and applicator warranties stating obligations, remedies, limitations, and exclusions before starting waterproofing.

F. Maintenance Data:

1. Shall include in maintenance manuals specified in Division 01.

2. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of the waterproofing system.

1.08 QUALITY ASSURANCE

A. The Roofing/Waterproofing Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:

1. Certification or license by the membrane manufacturer as a locally based, authorized applicator of the product the installer intends to use, for a minimum of five (5) years.
2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.

B. The Green Roof Installing Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:

1. Certification or license by the green roof assembly supplier as a locally based, authorized applicator of the products the installer intends to use, for a minimum of five (5) years.

2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.

C. **Refer to Section 1.05 SYSTEM DESCRIPTION**. Include single-source for all components from the manufacturer.

D. The rubberized asphalt membrane product shall contain an inert filler and crumb rubber to enable the product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application respectively.

E. Membrane Manufacturer shall have available an in-house technical staff to assist the contractor, when necessary, in application of the products and final inspection of the assembly.

F. Membrane Manufacturer Qualifications: Manufacturer shall demonstrate qualifications to supply materials of this section by certifying the following:

1. Membrane Manufacturer shall show evidence that the specified rubberized asphalt has been manufactured by the same source for thirty five (35) years and successfully installed on a yearly basis for a minimum of thirty five (35) years on projects of similar scope and complexity.

2. Membrane Manufacturer shall not issue warranties for terms longer than they have been manufacturing their hot fluid rubberized asphalt membrane.

G. Testing Agency Qualifications

1. Testing Agency performing field testing and inspections shall be an Agency participating in the Manufacturer's Certified Inspection Program.
2. Testing Agency performing electronic leak detection shall be as specified in Section "Electronic Leak Detection."

H. Waterproofing Mockup: Apply waterproofing to 100 sq. ft. of the deck to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, and execution quality. Engineer will indicate the location of the mockup.

1. If Engineer determines mockups do not comply with requirements, remove and reapply the waterproofing until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at the time of Substantial Completion.

I. Quality Control Plan:

1. Manufacturer's Quality Control Procedures: Obtain documentation from the manufacturer indicating field inspections and testing that the manufacturer requires to be performed by the Contractor (Quality Control) or Testing and Inspection Agencies (Quality Assurance). Additionally, submit a written list of field inspections and testing that are recommended, but not required. Indicate how often the inspections and testing should be performed for both required and recommended field inspections and testing.

2. Contractors Quality Control Plan: Submit a written plan of field inspections to be performed by the Contractor on a routine basis. The quality control plan shall meet the requirements of

Part “Quality Control” below. Indicate how often the inspections will be performed, to what extent the inspections will be performed, and what individual will be responsible for performing each of the inspections.

3. At a minimum, the Contractor quality control plan shall address the following items and indicate the required frequency.

    a. Surface preparation acceptance criteria.
    b. Concrete moisture content acceptance criteria.
    c. Environmental and substrate monitoring of temperature, dew point temperature, and relative humidity.
    d. Application rate monitoring.
    e. Wet mil thickness testing.
    f. All quality control testing and inspections required by the waterproofing manufacturer.

J. Green Roof Supplier shall show evidence that the specified green roof assembly has been developed, marketed, supported and installed for a minimum of fifteen (15) years on projects of similar complexity.

K. Green Roof Supplier shall provide data and calculations, specific to the products being submitted, that verify that the green roof assembly specified meets the project criteria for storm water runoff volume and rate control.

1. Calculations shall be based on actual testing of supplier’s green roof components to be used for the project including but not limited to the regionally specific growing media formulation and water retention/drainage materials.

2. Calculations shall account for vegetated and un-vegetated portions of the roof as well as local climatic conditions including rainfall depth, intensity, duration, and timing.

L. Green Roof Supplier shall provide data demonstrating that the composite C-factor and Curve Number parameters for the specified green roof assembly are less than or equal to those factors used in the engineering design and analysis for the project’s drainage and storm water systems analysis.

M. Pre-Construction Conferences. The manufacturer will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the waterproofing and green roofing assemblies.

1. Contractor shall invite sub-contractors, representatives of authorities having jurisdiction, manufacturer's technical representative, Owner, Engineer, consultants, independent testing agency, and other concerned entities to participate in the preinstallation conference either in person or remotely by conference call. Notify participants at least 7 days before the conference.

2. Review project requirements of this section, including application phasing, protective measures, environmental limitations, forecasted weather conditions, substrate patching, joint/crack/penetration detailing, joint preparation, surface preparation, substrate condition and pretreatment, joint sealants, flashing, special details and sheet flashings, membrane reinforcement, priming, strip coating, application procedures, special finish requirements, minimum curing period, contractor’s quality control plan, testing and inspection procedures, and repair procedures.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and U.L. labels.

B. Materials and equipment shall be handled and stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60°F (15.5°C) and 80°F (26.6°C). If exposed to lower temperatures, restore materials to 60°F (15.5°C) minimum temperature before using. Store materials not in use on covered pallets. Maintain storage materials in a clean, dry condition, free of foreign materials and residue. Protect stored ultraviolet-sensitive materials from direct sunlight.

1. Damaged Material: Any materials that are found to be damaged or stored in any manner other than stated above will be rejected, removed, and replaced.

2. Expired Materials: Remove and replace materials that cannot be applied within their stated shelf life.

E. Keep roof substrate board dry before, during, and after installation. Outside storage shall be off ground and protected by a breathable waterproof covering. Roof substrate board shall be roofed the same day as installed.

F. Vegetation shall be handled and stored in accordance with the Hydrotech Intensive Garden Roof Plant Installation and Maintenance Guideline.

1.09 PROJECT CONDITIONS

A. Application of the membrane shall not commence nor proceed during inclement weather. All surfaces to receive the membrane shall be free of water, dew, frost, snow and ice.

B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).

C. Preparation and application of membrane shall be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. **Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.**

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges shall be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

G. Concrete Deck Surface Condition. **IMPORTANT - Refer to 1.02 RELATED SECTIONS.**

H. Deck Preparation; **refer to Section 3.02 Preparation**.

I. Deck slopes greater than 3 inches in 12 inches (approx. 15 degrees or 25%) shall be limited to extensive and lawn applications and require special installation considerations. **CONTACT Hydrotech for specifics.**

J. The project design professional shall design the roofing/waterproofing assembly to properly locate the dew point condition and determine the need and location for a vapor retarder to prevent excessive condensation contamination within the roofing/waterproofing assembly and/or delamination of the roofing/waterproofing membrane from the substrate.

K. The project design professional shall design the roofing/waterproofing assembly to remain in place withstanding the wind speeds and uplift pressures as determined for the roof sections of the project.

K. General Contractor shall assure that adequate protection is provided after installation of the membrane and plantings to prevent damage from subsequent trade traffic.

1.10 WARRANTY

A. Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Upon completion of the work, the contractor shall supply the owner with a single-source warranty of U.S. origin direct from the manufacturer.

B. Each warranty varies in scope and terms. **CONTACT Hydrotech for exact warranty terms and conditions to meet the specific project requirements.**

C. Warranties available from the manufacturer:

1. **Total System Warranties;** Manufacturer agrees to repair or replace materials that do not comply with requirements or that fail to remain serviceable due to materials or workmanship issues for a warranty period of 20 years from the date of Substantial Completion, with No-Dollar-Limit (NDL) coverage for the entire warranty period, covering both materials and application/repair labor. Covers components of the green roof assembly, including membrane, protection board, drainage panels, root barriers, flashing, insulation, Garden Roof® components, pavers and Checker Block® ballast units. Includes removal and replacement of the insulation, Garden Roof® components, pavers, Checker Block® ballast units and growing media (≤24 inches deep) when supplied by, installed, and maintained per Hydrotech's requirements and replacement of the Hydrotech supplied roof substrate board.

   a. Duration of Membrane/Flashing and replacement of Hydrotech supplied roof substrate board from date of installation (watertight condition):

      i. 20-year

   b. Duration of Insulation from date of purchase:

      i. 20-year

         a. 90% of original thermal value

   Note to specifier: A limited wind resistance warranty, to a maximum 70 mph gust wind speed, may also be available for the insulation. Contact Hydrotech DURING THE DESIGN PHASE for project specific ballasting assistance or guidelines

   c. Material Integrity of Garden Roof® Components from date of purchase:

      20-year

   d. Duration of Pavers and Checker Block® ballast units from date of purchase (will not crack, split or delaminate due to freeze-thaw):
      10-year

CONTACT HYDROTECH FOR EXACT WARRANTY TERMS AND CONDITIONS

D. Warranty does not include deterioration or failure of material due to unusual weather phenomena, failure of the substrate, formation of new substrate cracks exceeding the published limits of the material, movement exceeding the published movement capacity of the material, fire, vandalism, abuse, abuse during overburden installation, and maintenance equipment.

E. Perform any repair under this warranty at no additional cost.

PART II PRODUCTS

2.01 GENERAL

A. **Refer to Section 1.05 SYSTEM DESCRIPTION.** All components shall be obtained as a single-source from the membrane / green roof manufacturer to ensure total system compatibility and integrity.

Manufacturer: American Hydrotech, Inc.
541 North Fairbanks Court
Chicago, Illinois 60611-3318
800-877-6125 or 312-337-4998
FAX: 312-661-0731
Web Site: www.hydrotechusa.com

2.02 MATERIALS

A. Membrane

1. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the CGSB-37.50-M89 standard and other pertinent physical properties:

- American Hydrotech, Inc., Monolithic Membrane 6125®
(40% post-consumer recycled content)

PROPERTY	TEST METHOD	REQUIREMENT
Flash point	CGSB-37.50-M89 ASTM D-92	≥ 500°F* (260°C)
Penetration	CGSB-37.50-M89 ASTM D-5329	@ 77°F (25°C) max. 110 @ 122°F (50°C) max. 200
Flow	CGSB-37.50-M89 ASTM D-5329	@ 140°F (60°C) max. 3.0mm
Toughness	CGSB-37.50-M89	≥ 5.5 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	≥ 0.040
Water Vapor Permeability	CGSB-37.50-M89 ASTM E-96, Procedure E	≤ 1.7 ng/Pa.s.m^2 (0.027 perm)
Water Absorption	CGSB-37.50-M89	Gain in weight 0.35 g max. Loss in weight 0.18 g max.

Low Temperature Flexibility (-25°C)	CGSB-37.50-M89	No delamination, adhesion loss, or cracking
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration, flow or low temperature flexibility
Viscosity	CGSB-37.50-M89	2 - 15 seconds
Water Resistance (5 days/50°C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Softening Point	ASTM D-36	180°F (82°C)
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-5329	40% minimum
Bond to Concrete 0°F (-18°C)	ASTM D-5329	Pass
Resistance to Acid	ASTM D-896 Procedure 7.1 (N-8)	Pass - 50% Nitric Acid Pass - 50% Sulfuric Acid
Resistance to Hydrostatic Pressure	ASTM D-08.22 Draft 2	100 psi (equals 231 foot of head water)
Resistance to Salt Water (20% Sodium carbonate calcium chloride)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration
Resistance to Fertilizer (Undiluted 15/5/5, nitrogen/phosphorus/potash)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration
Resistance to Animal Waste	3-year exposure	No deterioration
Solids Content		100% - no solvents
Recycled Content	UL Validated	40% (post-consumer) (30% REACH compliant)
Shelf Life		10 years (sealed)

Specific Gravity	1.15 + .02

* Or alternatively not less than 25°C above the manufacturer's maximum recommended application temperature

B. Roof Substrate Board (if required)

1. Impact resistant, nonstructural, fiber-reinforced, gypsum panels made from 95% recycled content.
   - Securock Gypsum-Fiber Roof Board as marketed by American Hydrotech, Inc.

   a. Miscellaneous

      1. Fasteners and Plates
      - Provide size and type in accordance with Factory Mutual and/or applicable codes and to maintain structural integrity. Only 3 inch round metal plates shall be used.

      2. Adhesive
      - Provide adhesive compatible with roof substrate board and insulation to comply with Factory Mutual and/or applicable codes and to maintain structural integrity.

      3. Vapor Barrier
      - Provide suitable vapor retarder as required by design professional.

2. Other approved fire rated type "X" gypsum roof substrate board.

C. Conductive Primer: DETEC Tru-Ground conductive primer over substrate board prior to membrane installation for conducting electronic leak detection (ELD).

D. Surface Conditioner

1. Asphaltic surface conditioner for concrete surfaces only.
   - American Hydrotech, Inc., Surface Conditioner

E. Reinforcing

1. Spunbonded polyester fabric (standard duty) reinforcing sheet.
   - American Hydrotech, Inc., Flex Flash® F

2. 60-mil (1.5 mm) thick, uncured neoprene (heavy duty) reinforcing sheet.
   - American Hydrotech, Inc., Flex Flash® UN

F. Flashing

1. 60-mil (1.5 mm) thick, uncured neoprene sheet.
   - American Hydrotech, Inc., Flex Flash® UN

2. 157-mil (4 mm) thick, torch-grade, modified asphalt, reinforced flashing membrane.
   - American Hydrotech, Inc., Flex-Flash® MB

3. Two-component, liquid applied resin membrane flashing system.
   a. American Hydrotech, Inc., HydroSeal Resin

      - Minimum 100 total dry mils, cold applied, seamless fully reinforced PMMA or PUMA, self-terminating flashing or waterproofing resin that is reinforced and UV stable, specifically formulated for use on atypical and/or rigid roof penetrations.

   b. American Hydrotech, Inc., HydroSeal Matrix
      - acrylic resin with integral chopped polymer fiber reinforcement

   c. American Hydrotech, Inc., HydroSeal Flashing Accessories

- resin based primers, additives, reinforcing fleece, surfacing topcoats Adhesives/Sealant/Backer Rod

1. Contact adhesive to bond elastomeric flashing together.
   - American Hydrotech, Inc., Splicing Cement
2. Contact adhesive to bond elastomeric flashing to an approved substrate.
   - American Hydrotech, Inc., Bonding Adhesive
3. Sealant to seal elastomeric flashing seam edge.
   - American Hydrotech, Inc., Lap Sealant
4. Tape to bond laps of uncured neoprene flashings
   - American Hydrotech, Inc., Seam Tape
5. High-Temperature Resistant Cylindrical Backer Rod: ASTM D 5249 Type 1, extruded round, closed-cell, low-density cross-linked polyethylene foam, specially formulated to withstand temperatures in excess of 400°F (204°C), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

G. Separation/Root Barrier Protection Course 1. 160-mil (4 mm) thick polyester reinforced, modified asphalt sheet with granular surface with factory- and field-applied root growth regulator.

   - American Hydrotech, Inc., Hydroflex® RBII
   - American Hydrotech, Inc., SpinOut

2. Fiberglass reinforced rubberized asphalt protection sheet for areas with no vegetation.
   - American Hydrotech, Inc., Hydroflex® 30 ~~and Root Stop HD, or~~
   ~~- American Hydrotech, Inc., Hydroflex® 30 and Root Stop Bamboo~~
3. Pressure-sensitive polyethylene tape for Rootstop and Rootstop HD
   - American Hydrotech, Inc. Root Stop Tape

H. Termination Hardware: All termination bars and counterflashing, shall be fabricated from Stainless Steel Type 316 and fastened at **[8-inches (203 mm)]** on center. Termination bars shall be approximately 1 inch by 1/8 inch (25 mm by 3 mm). Counterflashing shall be **[0.0187 inch (0.476 mm)]** minimum. For conditions at stud wall the termination bar may be fastened at the stud spacing, but fastener spacing shall not exceed 16 inches (406 mm) on center. All fasteners, rivets, and anchors shall be fabricated from stainless steel. Refer to Section "Sheet Metal Flashing and Trim" for finish requirements for visually exposed elements.

I. Prefabricated Drainage Course 1. Composite drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric.

   - American Hydrotech, Inc., Hydrodrain® 990, with heavy duty polypropylene filter fabric, 30,000 psf compressive strength.

J. Insulation

1. Extruded polystyrene rigid board insulation for use above membrane.

   - Styrofoam™ brand insulation [TYPE] as manufactured by DuPont™, marketed by American Hydrotech, Inc.

   a. Insulation shall meet ASTM C-578, Type VI or VII.

b. Minimum compressive strength, ASTM D-1621, 40 or 60 psi

c. Maximum water absorption by volume per ASTM C-272, 0.3%

d. Water vapor permeance for 1" product per ASTM E-96, 0.8 perm (max.)

e. Insulation shall have an R value of 5.0°F ft^2 h/Btu/in. (0.88 K m^2/W) of thickness when tested at 75°F mean temperature in accordance with ASTM C-518

f. Product shall be free of CFC's

Product types available: Styrofoam™ brand, RoofMate; Ribbed RoofMate; PlazaMate; and High Load 100. Extruded polystyrene rigid board insulation for use as flat fill and tapered insulation below roof substrate board.

- Styrofoam™ brand insulation [TYPE] as manufactured by DuPont™, marketed by American Hydrotech, Inc.

a. Insulation shall meet ASTM C-578, Type IV.

b. Minimum compressive strength, ASTM D-1621, 25 psi (172.4 kPa)

c. Maximum water absorption by volume per ASTM D-2842, 0.7%

d. Water vapor permeance for 1" product per ASTM E-96, 1.1 perm (max.) (63 ng/Pa/s/m^2)

e. Insulation shall have an R value of 5.0°F ft^2 h/Btu/in. (0.88 K m^2/W) of thickness when tested at 75°F mean temperature in accordance with ASTM C-518

f. Product shall be free of CFC's

Product types available: Styrofoam™ brand, DeckMate Plus, DeckMate Plus FA, Tapered DeckMate Plus FA. Air Layer

1. Required air space over Styrofoam™ insulation when moisture mat is required shall be composed of a crush-proof core and non-woven filter fabric.
   - American Hydrotech, Inc., Hydrodrain® AL or Hydrodrain 300.

K. Water Retention Mat

1. Non-woven, synthetic fiber mat capable of retaining additional moisture for potential use by vegetation.
   - American Hydrotech, Inc., Moisture Mat

L. Drainage/Water Retention Component

1. A three-dimensional, molded recycled polypropylene core with drainage channels on the bottom side and water retention reservoirs and aeration holes on the top side. Non-woven geotextile fabrics are bonded to the top and bottom sides.
   - American Hydrotech, Inc., Gardendrain®
   a. Gardendrain GR25

2. Three-dimensional, molded panels of recycled polyethylene with drainage channels top and bottom sides and water retention reservoirs top side shall meet the following physical properties.
   - American Hydrotech, Inc., Gardendrain®
   b. Gardendrain GR30
   c. Gardendrain GR50

3. Expanded lightweight aggregate for use as fill material for drainage/water retention component as required.
- American Hydrotech, Inc., LiteTop® Lightweight Aggregate
a. 5/16" - 3/8" expanded, lightweight aggregate
    i. Gardendrain GR25 – Expanded aggregate not used.
    ii. Gardendrain GR30 – Expanded aggregate is an option where specified in the drawings and details. Fill at rate of 2 cubic yards per 1,000 SF.
    iii. Gardendrain GR50 – Expanded aggregate is required in standard Garden Roof applications. Fill at rate of 3 cubic yards per 1,000 SF.

M. Filter Fabric

1. Non-woven, polymeric, geotextile fabric.
- American Hydrotech, Inc., Systemfilter

N. Growing Media

1. Custom growing media mix capable of supporting vigorous growth of the specified vegetation, complying with the following specification.
- American Hydrotech, Inc., Intensive LiteTop® Growing Media

Property	**Intensive LiteTop Growing Media***
Grain Size Distribution (ASTM F1632 Method B)	
clay fraction (<0.002mm)	< 3%
silt fraction (0.075-0.002mm)	< 12%
passing #200 sieve (0.075mm)	< 15%
passing #60 sieve (0.25mm)	5 - 25 %
passing #18 sieve (1.0mm)	20 - 50 %
passing #10 sieve (2.0mm)	30 - 60%
passing 1/8-inch sieve	35 - 70 %
passing 1/4-inch sieve	60 - 95%
passing 3/8-inch sieve	95 - 100 %
Density (ASTM E2399)	
Initial Media Density	55 lbs – 75 lbs/cf
Maximum Media Density	76 lbs – 93 lbs/cf
Water/Air Management (ASTM E2399)	
saturated water capacity	> 40%
saturated air content	> 10%
total pore space	> 45%
Water Permeability	
Hydraulic Conductivity	> 10 in/hr
pH, Lime, and Salt Content	
pH (saturated paste)	6.0 – 8.0
EC salts content (water extract)	<3.0 mmhos/cm
Organics (LOI 550°C) (ASTM F1647	
Organic Matter content	6 – 12 %
Compost Fraction	

1) Meet or exceed USEPA Class A standard, 40 CFR 503.13, Tables 1 & 3 (chemical contaminants) and 40 CFR 503.32(a) (pathogens) and/or be permitted in the state of origin to produce Class A material.

2) Meet US Compost Council STA/TMECC criteria or equal for Class I or II stable, mature product.

*Values shall be adjusted due to availability of local materials or special project conditions related to plant selection and/or environmental conditions.

O. Erosion Control Materials (Edit to project requirements, consult Hydrotech)

1. Erosion Control Mat
   a. Biodegradable Erosion Control Matting: Composed of straw and/or coconut fiber stitched together with biodegradable thread forming top and bottom netting.
      - American Hydrotech, Inc., GardMat® LT
   b. Long Term Erosion Control Mat: Composed of polypropylene netting
      - American Hydrotech, Inc., GardMat® N
2. Heavy-Duty Anchors
   a. Plastic anchor disk with connected plastic stem and friction-fit plastic top disk used to fasten GardMat Erosion Control Mat or sedum carpet and tile.
      - American Hydrotech, Inc. Disk Anchors
3. Hydromulch
   a. Wood fiber-based hydromulch with natural-based tackifier for use in securing sedum cuttings on roof. Where hydromulching equipment is available and has access to roof; hydromulch shall be mixed with tackifier and applied as wet slurry to cutting installations.
4. Dry Hydromulch
   a. Wood fiber or straw-based hydromulch with integrally mixed guar-based tackifier. For use where hydromulching equipment and access is not possible. Dry hydromulch shall be applied in accordance with the Hydrotech Extensive Garden Roof® Plants Installation and Maintenance Guideline.

P. Filter Fabric

1. Water permeable polymeric fabric.
   -American Hydrotech, Inc., Stone Filter Fabric

Q. Hardscape / Roof Ballast

1. Pavers
   a. Ballast Pavers
      - American Hydrotech, Inc., Ballast Pavers, meeting the following physical properties:

PROPERTY	TEST METHOD	VALUES
Compressive Strength	ASTM C140	≥7,000 psi average min.
Flexural Strength	ASTM C293	≥600 psi average min.
Water Absorption	ASTM C140	Not greater than 5%
Freeze/Thaw	ASTM C67	≤1% loss/dry weight (50 cycles)

Centerload	-	Min. 1,750 lbs.

b. Architectural Finish Pavers
- American Hydrotech, Inc., Architectural Pavers, meeting the following physical properties:

PROPERTY	TEST METHOD	VALUES
Compressive Strength	ASTM C140	≥7,000 psi average min.
Flexural Strength	ASTM C293	≥600 psi average min.
Water Absorption	ASTM C140	Not greater than 5%
Freeze/Thaw	ASTM C67	≤1% loss/dry weight (50 Cycles)
Centerload	-	Min. 1,750 lbs.

2. Stone Ballast
Well screened and washed stone gravel meeting ASTM D-448-80, gradations #2, 4 or 5 as directed by DuPont™ and American Hydrotech, Inc.

3. Concrete Pour Topping

R. Miscellaneous

1. Metal Edging
Aluminum edging perforated to allow water flow as shown on plans and details.
- American Hydrotech, Inc. GardenEdge® Metal Edge Restraint; size as noted on plans and details.
- American Hydrotech, Inc. GardenEdge® Aluminum Leveling Strips: available to accommodate sloped/level roof surfaces.

2. Inspection Chambers
Aluminum and stainless steel over drain chambers perforated to allow water flow as shown on plans and details.
- American Hydrotech, Inc. GardenHatch® Inspection Chambers; size as noted on plans and details.

3. Prefabricated Concrete Curbing
High density, hydraulically pressed, prefabricated concrete curbing units as shown on plans and details.
- Hanover Architectural Products Rock Curb® as marketed by American Hydrotech, Inc. size as noted on plans and details.

4. Additional Ballast Units

a. Checker Block®: as manufactured by Hastings Pavement Co. LLC and as marketed exclusively by American Hydrotech, Inc. meeting the following properties:

i. Steel reinforced precast concrete

ii. Minimum 98 lbs per unit

iii. Nominally 24” x 24” x 4” deep

iv. Continuous and connected void spaces created by 16 truncated concrete pyramids joined by lower concrete connectors.

b. Stainless steel zip-ties as supplied by American Hydrotech, Inc.

c. Disk Anchors as supplied by American Hydrotech, Inc.

2.03 RELATED MATERIALS

A. Intensive plant materials (specified elsewhere) shall be as shown on plans.

B. Metal counterflashing shall be required to provide protection to vulnerable flashing materials from damage due to gardening activities.

PART III EXECUTION

3.01 INSPECTION

A. Examine substrates, areas, and conditions, with the Applicator present, for compliance with requirements and for other conditions affecting the performance of the waterproofing membrane. **Refer to American Hydrotech's Pre-Installation & Application Guidelines.**

1. For the record, prepare a written report, endorsed by Applicator, listing conditions detrimental to performance.

2. Verify that concrete has cured and aged for the minimum time period recommended in writing by the waterproofing manufacturer. Begin waterproofing application only after the minimum concrete curing and drying period recommended by the waterproofing manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.

3. Verify that the substrate is visibly dry and within the moisture limits recommended in writing by the manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

4. All high points, holes, aggregate popouts, ridges, rough surfaces, and other miscellaneous defects shall be corrected prior to the installation of the waterproofing system.

5. Contractor shall perform a survey to verify slab has slope to drain. Note any low spots that do not drain.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Application of waterproofing indicates acceptance of surfaces and conditions.

3.02 SUBSTRATE PREPARATION

A. A. Clean and prepare and treat substrate according to the manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. All surfaces must be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, form release agents and other surface contaminant.

1. Cast in-place concrete/Composite deck

   a. Poured in place concrete must be monolithic, smooth, free of voids, spalled areas, laitances, glaza, efflorescence, curing compounds, concrete hardeners, form release agents, honeycombs, and sharp protrusions. Remove remaining loose material and clean surfaces according to ASTM D 4258. Do not acid etch.

   b. Concrete to receive waterproofing membrane to have a uniform broomed finish of roughness equitant to ICRI CSP-4 profile.

   c. Refer to Section 1.02 of this specification, Division 3.

2. Metal Deck with roof substrate board

   a. Roof substrate board board shall be fire rated type "X" board attached to minimum 22 gauge steel decking with adequate structural support.

      1. Minimum 5/8 inch thick substrate board shall be used directly to metal deck.

      2. Minimum 1/2 inch thick substrate board shall be used over insulation.

   b. Flat fill and tapered roof insulation shall be installed in accordance with layout indicated on shop drawings and insulation board manufacturer's minimum requirements.

   c. Adequate number and type of fasteners and plates shall be used to comply with roof substrate and insulation board manufacturer's minimum requirements and applicable codes and to maintain structural integrity.

      1. Minimum of 10 fasteners and plates per full-size roof board shall be used.

   d. Appropriate roof adhesive shall be used in accordance with adhesive manufacturer requirements to comply with applicable codes and maintain structural integrity.

      1. Size and spacing of adhesive beads shall be as required by adhesive manufacturer.

   e. Roof substrate boards shall be installed such that all edge and end joints are supported by metal deck ribs and/or appropriate blocking.

   f. Roof substrate board end joints of adjacent lengths shall be staggered.

   g. Roof substrate board edges and ends shall be butt loosely in typical installations. Long, uninterrupted runs (greater than 200 feet) of roof substrate board may require slight gapping due to higher temperature gain. Gapping shall not exceed 3/16 inch and all such gaps shall be filled flush with the surface of the roof board with an appropriate sealant. **CONTACT Hydrotech for specifics.**

   h. Roof substrate board shall be cut to size using a sharp utility knife and straightedge. The surface of the roof substrate board shall be scored with the utility knife and the board bent up sharply towards the score cut. A keyhole-type drywall saw shall be used for penetration cutouts and radii. A low rpm circular saw shall be used for 5/8 inch thick roof board.

   i. Install DETEC Tru-Ground conductive primer over substrate board per manufacturer requirements, prior to membrane installation.

5. Metal Substrates: Metal substrates shall be prepared to the more stringent of the below minimum requirements and the waterproofing manufacturer's minimum surface preparation requirements.
    a. Remove grease, oil, paints, curing compounds, other penetrating contaminants, film-forming coatings, and other latencies from steel.
    b. Uncorroded Stainless Steel and Aluminum: Solvent clean to SSPC-SP1 "Solvent Cleaning"
    c. Steel: Abrasive blast clean steel to SSPC-SP6 "Commercial Blast Cleaning" minimum. Blast clean all surfaces using a sharp, angular abrasive to achieve a surface roughness of between 4 mils to 6 mils (100 µm to 150 µm).
    d. Uncorroded Galvanized Steel: Abrasive blast clean to SPC-SP 16 "Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
    e. Un-corroded Coated Steel: Abrasive blast clean to SSPC-SP7 "Brush-off Blast Cleaning" for existing coatings compatible with the waterproofing or SSPC-SP6 for existing coatings that are incompatible with the waterproofing or questionable compatibility.
    f. Prime cleaned and prepared substrates strictly following the manufacturer's written instructions, at the manufacturer's recommended rate, and allow the primer to dry. The primer must be overcoated within the manufacturer's publish open time/recoat window. Do not allow the primer to pool or become contaminated.

B. Substrate cleaning

1. Thoroughly sweep the substrate which is to receive the roof membrane.
2. Substrate must also be blown clean using an air compressor to remove any remaining loose debris.
3. Final check to determine if concrete has been properly cleaned is to apply a test patch of Monolithic Membrane 6125® to the surface and check its adhesion.

3.03 PREPARATION AT PENETRATIONS, CORNERS, AND TRANSITIONS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to the waterproofing manufacturer's written instructions and recommendations in CGSB-37.51 and ASTM D 6622.

B. Penetrations: Detail all penetrations with uncured neoprene or liquid-applied flashing according to the manufacturer's typical details. Terminate pipe and conduit penetrations detailed with uncured neoprene using a stainless-steel band.

C. Corners and Transitions: Reinforce all inside corners, outside corners, and substrate material transitions with uncured neoprene detailing that extend a minimum of 6 inches (150 mm) beyond the joint in each direction.

1. Inside Corners joints shall be detailed with 3/4-inch (20 mm) cants formed with built-up hot rubberized asphalt and covered with uncured neoprene sheeting embedded in hot rubberized asphalt. Monolithic reinforced hot rubberized asphalt waterproofing and protection course shall be terminated at the joint edges over the uncured neoprene layers.

2. Outside Corners shall be rounded by grinding for thick steel (non-cold formed steel) and concrete. The corner shall then be detailed with uncured neoprene sheeting embedded in hot rubberized asphalt. Monolithic reinforced hot rubberized asphalt waterproofing and protection course shall be terminated at the joint edges over the uncured neoprene layers.

D. Where adjacent pieces of uncured neoprene come within 6 inches (150 mm) of each other the detailing shall be done with a single larger piece of neoprene, unless otherwise approved by the Engineer.

3.04 PREPARATION OF JOINTS AND CRACKS

A. All details and flashings must be completed in accordance with the more stringent of the project documents requirements and manufacturer's installation requirements. All reinforcing strips shall extend a minimum of 6 inches (150 mm) beyond the joint/crack in each direction.

1. Non-moving cracks and joints up to 1/16 inch (1.6mm) in width do not require special detailing or treatment.

2. Non-moving cracks, joints, and penetration between 1/16 inch (1.6mm) and 1/4 inch (6.3mm) in width shall be detailed with an additional layer of reinforcing fabric embedded in hot rubberized asphalt. Fill joints and cracking with hot rubberized asphalt to rejection. Through cracks and joints may require an initial lift of semi-flowable-plastic cementitious grout to seal the crack/joint before filling the crack/joint with hot rubberized asphalt.

3. Non-moving cracks, joints, and penetration exceeding 1/4 inch (6.3mm) in width shall be detailed with uncured neoprene sheeting embedded in hot rubberized asphalt. Fill joints and cracking with hot rubberized asphalt to rejection.

4. Moving joints, moving cracks, and flexible penetrations shall be detailed with uncured neoprene sheeting embedded in hot rubberized asphalt. Fill joints and cracking with hot rubberized asphalt to rejection. Through cracks and joints may require an initial lift of joint sealant before filling the joint/crack with hot rubberized asphalt. Prefabricated boots embedded in hot rubberized asphalt for penetrations are acceptable. Joint movements for this detailing method shall be limited to [±25%] [±50%] movement normal to the joint/crack and [±5%] [±10%] shear movement.

B. Bellow Expansion Joints: Detail bellowed expansion joints, discontinuous deck-to-wall, discontinuous deck-to-deck joints, and discontinuous wall-to-wall joints as follows. Joint movements for detailing methods below shall be limited to [±25%] [±50%] movement normal to the joint/crack and [±5%] [±10%] shear movement.

1. Expansion joints less than 1/2-inch in maximum joint width: Bridge joints with flush mounted uncured neoprene sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot, rubberized asphalt. Monolithic reinforced hot rubberized asphalt waterproofing and protection course shall be installed over the uncured neoprene layer.

2. Expansion joints between 1/2-inch and 1-inches in maximum joint width: Bridge joints with flush mounted uncured neoprene sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot, rubberized asphalt. Coat

uncured neoprene with 125 mils of hot rubberized asphalt waterproofing and embed a second layer of uncured neoprene sheet extended a minimum of 12 inches (300 mm) on each side of the joint. Monolithic reinforced hot rubberized asphalt waterproofing and protection course shall be terminated at the joint edges over the uncured neoprene layers.

3. Expansion joints between 1 inch and 2 inches in maximum joint width: Install a new backer rod set in sealant or warm waterproofing membrane inside the joint. Bridge joints with bellowed uncured neoprene sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot, rubberized asphalt. Coat uncured neoprene with 125 mils of hot rubberized asphalt waterproofing and embed a second layer of uncured neoprene sheet extended a minimum of 12 inches (300 mm) on each side of joints. Monolithic reinforced hot rubberized asphalt waterproofing and protection course shall be terminated at the joint edges over the uncured neoprene layers.

4. Expansion joints greater than 2-inches in maximum joint width shall be detailed with a pre-engineer expansion joint system designed to be embedded in hot rubberized waterproofing. Refer to Section “Expansion Joint” for more information.

3.05 INSTALLATION

A. Surface conditioner application (to concrete substrates only)

1. Apply the surface conditioner only to concrete using a hand held sprayer evenly at a rate of 300 to 600 SF/gallon (7.4 - 14.7 m^2/L) depending on surface texture. Surface conditioner shall "tan" the surface, not blacken it.

2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application.

B. Membrane preparation

1. The membrane shall be heated in double jacketed, oil bath or hot air melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.

2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 350°F (176°C) and 375°F (190°C).

3. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before initial application and to review the Contractor’s application means and method to be used. Start application in presence of the manufacturer's technical representative.

C. Detailing/Flashing/Terminations

1. All detailing and flashing shall be done in accordance with the manufacturer's standard guideline details. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to the waterproofing manufacturer's written instructions and recommendations in CGSB-37.51 and ASTM D 6622. All waterproofing membrane terminations and transitions shall be detailed per the “Elastomeric Sheet Flashing Procedure” or the “Liquid Applied Flashing Procedure” below.

a. Elastomeric Sheet Flashing Installation

i. Install flashing sheets at the termination of the waterproofing membrane per the recommendations in CGSB-37.51 and the waterproofing system manufacturer's written instructions.

ii. Prime substrate with asphalt primer. Install uncured neoprene flashing sheet and adhere to deck and wall substrates in a layer of hot, rubberized asphalt. Uncured neoprene sheeting shall be included starting at the termination bar and extending down the wall to the lesser of at least 12 inches (300 mm) or until the uncured neoprene fulfills the corner condition reinforcement requirements.

iii. Install protection ply flashing sheet adhered to the substrate in a layer of hot, rubberized asphalt waterproofing.

iv. Extend flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above plaza deck pavers, topping slab, or grade line; unless otherwise detailed by the architectural drawings.

v. Install termination bar mechanically fasten/anchored at a maximum of 8 inches (200 mm) on center for all waterproofing terminations and transitions.

vi. Install sheet metal counter flashing covering the top 18 inches (450 mm) of the membrane to protect the membrane from ultraviolet exposure if it will be exposed to daylight.

b. Liquid Applied Flashing Installation

i. Install fully reinforced PMMA/PUMA flashing at UV-exposed terminations of the waterproofing membrane according to the waterproofing system manufacturer's written instructions.

ii. Prime substrates with manufacturers recommend primers for concrete, steel, and asphaltic surfaces.

iii. Extend liquid flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above plaza deck pavers, topping slab, or grade line.

iv. Broadcast and back roll sand aggregates into the flashing topcoat to create a wear-resistant and slip-resistant finish for wearing surfaces.

2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.

3. Roof substrate board joints shall be pre-detailed with membrane and fabric reinforcing prior to full fabric reinforced membrane application.

4. All liquid-applied, resin flashings shall be applied over properly completed membrane flashing details in accordance with the manufacturer’s standard guideline details.

D. Membrane Application

1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil minimum (approximately 2.3 mm), into which shall be fully embedded a layer of the spunbonded polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at an average thickness of 125 mil (approx. 3.2 mm). Total membrane thickness shall be 215 mils. Verify the wet film thickness of waterproofing every 100 sq. ft.

2. Overlap fabric reinforcing sheet a minimum of 2 inches with membrane between sheets.

4. Pre-detailing of joints between plywood and roof substrate board decks shall be required for warranties greater than 10 years.

5. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to the more stringent of heights indicated in the drawings or required by the manufacturer.

6. Bed protection ply in rubberized asphalt waterproofing while it is still hot. Ensure protection ply is fully bonded. Lap protection ply edges a minimum of 3 inches (75mm).

   a. Stagger protection ply end laps approximately 3 feet. Torch weld laps or bed lap edges in additional rubberized asphalt waterproofing.

7. Cure waterproofing according to the manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.

8. Pedestrian traffic over the membrane shall not be permitted until the application of the protection ply is performed and the asphalt membrane has cooled to ambient temperatures.

3.06 SEPARATION/PROTECTION COURSE INSTALLATION

A. Separation/Protection course shall be installed as follows:

1. Hydroflex® RBII protection/root barrier protection course shall be embedded into the membrane while it is still hot to insure a good bond.
   a. Adjoining sheet edges shall be overlapped 4” (100 mm) and sealed with a propane torch or additional MM 6125 membrane.
   b. SpinOut shall be applied to all sheet edges.

2. Hydroflex® 30 separation/protection course shall be embedded into the membrane while it is still hot to insure a good bond. Installation of a separation course shall be necessary in order to carry out the water test.
   a. Overlap adjoining sheet edges (dry) a minimum of 2"-3" (50.8 mm – 76.2 mm) to insure complete coverage

3.07 MEMBRANE QUALITY ASSURANCE TESTING

A. Testing Agency shall conduct quality assurance leak detection testing over the protection ply to verify a leak-free membrane has been achieved. Repair all detected leaks and re-test the area to verify the membrane has been repaired.

B. Contractor shall conduct quality assurance flood testing to verify a leak-free membrane has been achieved. Testing agency shall witness the testing. Repair all detected leaks and re-flood test the entire membrane to verify membrane has been repaired.

3.08 PROTECTION

A. Do not permit foot or vehicular traffic on the unprotected membrane.

B. Protect waterproofing from damage and wear during the remainder of the construction period.

C. Protect installed insulation and drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.09 MEMBRANE REPAIRS

A. Membrane Application Repairs

1. Membrane Contamination: All contaminated material must be completely removed, and all traces of the contaminant eliminated prior to the repair being made.

2. Outgassing Repair:

a) Cut away delaminated blistering and prepare the blister edge flush with the top of the waterproofing.

b) Heat the remaining waterproofing with a hand-held torch so that the membrane softens and melts. Extend heating 6 inches (150mm) onto well-bonded waterproofing. While the existing membrane is soft apply additional waterproofing to fill the blister cavity.

c) Bed new matching reinforcement into the waterproofing lapping at least 6 inches (150mm) with existing bedded reinforcement and topcoat with 125 mils of hot rubberized asphalt. Bed new protection ply patch into the waterproofing.

d) Verify the repair does not have outgassing issues by tap testing the final ambient temperature coating.

3. Uncured Neoprene Damage Repair:

a) Clean damaged uncured neoprene that has been installed with soap and water followed by wiping with a solvent cleaner.

b) Cut a patch of uncured neoprene that is 12 inch (300 mm) larger than the damaged area. Adhere the patch centered on the damaged area with the manufacturer’s splicing cement. Apply adhesive to both contact surfaces at a rate consistent with the manufacturer's recommendations and allowed to cure.

c) The patch should then be applied without stretching the uncured neoprene and then rolled with a hand roller to ensure complete contact and to force out any trapped air.

d) Bed repair in hot rubberized asphalt building a small cant at the edge of the repair to provide a smooth transition over the repair.

B. Membrane Damage Repairs

1. Protection Ply Removal: Heat the protection ply with a hand-held torch so that the membrane below the protection layer softens and melts. Remove the protection ply leaving the membrane on the substrate.

2. Membrane Breach Or Abrasion Damage: Remove the protection ply over the damaged area. Extend protection ply removal at least 6 inches beyond the area of damage in all directions.

a) Membrane With Reinforcement Damage: While the existing membrane is soft apply 90 mils of hot rubberized asphalt. Bed new matching reinforcement into waterproofing and topcoat with 125 mils of hot rubberized asphalt. Bed new protection ply patch into the waterproofing.

b) Membrane Without Reinforcement Damage: While the existing membrane is soft apply 125 mils of hot rubberized asphalt and bed new protection ply patch into the waterproofing.

3.10 PROTECTING AND CLEANING

A. Protect waterproofing and drainage layers from damage and wear during the remainder of construction activities. Do not allow drainage layers to become clogged with construction debris.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by the manufacturer of affected construction.

3.11 FIELD QUALITY CONTROL

A. Responsibilities

1. Manufacturer’s Responsibility:

a) Manufacturer’s field representation shall be responsible for periodically performing quality control reviews when required by Part 1 “Quality Assurance” in the Specification Section.

2. Contractor’s Responsibility:

a) Contractor is responsible for performing continuous field quality control during the progress of work including workmanship and materials furnished by his subcontractors and suppliers.

b) Contractor is responsible for maintaining logs of quality control inspections and testing performed in the field. Logs shall be submitted to the Owner, Architect, Engineer, Inspection and Testing agencies, and Manufacturer on a weekly basis.

B. Minimum Quality Control Requirements

1. The Contractor shall perform all manufacturer's recommended and required field quality control procedures to ensure proper preparation and application of the waterproofing system.

2. The Contractor shall coordinate with the Manufacturer to ensure the availability of a local qualified manufacturer representative throughout the duration of work.

3. The Contractor shall employ surface profile comparators in general conformance with ICRI 310 for concrete and ASTM D 4417 Method A for metal to verify the required surface profile has been achieved for all concrete and metal surfaces to receive waterproofing.

4. The Contractor shall perform testing for moisture in the concrete substrate by plastic sheet method according to ASTM D 4263.

5. The Contractor shall perform membrane field adhesion testing in general conformance with a modified version of ASTM C 794 "Adhesion-in-Peel" for each substrate to receive the membrane. Prime the substrate. Coat each substrate with 90 mils of the membrane. Bed reinforcing fabric or uncured neoprene into the warm fluid applied membrane, leaving approximately 6-inches of reinforcing fabric or uncured neoprene extending beyond the membrane. Apply a second layer of 125 mils of membrane over the reinforcing fabric or uncured neoprene and allow the assembly to cool to ambient temperature. Cut reinforced membrane into 1-inch wide strips. Pull test reinforcing fabric or uncured neoprene. Acceptance criteria shall be a cohesive failure of the membrane, minimum adhesion of 100 pli, or failure of the sound substrate.

6. The Contractor shall employ environmental and substrate monitoring of temperature, dew point temperature, and relative humidity during mixing and application of the waterproofing.

7. The Contractor shall establish a uniformly gridded area to monitor the application rate.

8. The Contractor shall monitor for large blistering, excessive blistering, and other outgassing distress. All blisters shall be cut open flush with the top of the applied waterproofing and repaired before proceeding with the next layer of waterproofing.

9. The Contractor shall employ a membrane thickness gauge during the initial application each day to establish the application rate for monitoring purposes.

    a) Where the substrate roughness changes, based on ICRI CSP values additional wet mil testing shall be performed to establish local application rates for monitoring purposes.

10. The Contractor shall monitor and track the waterproofing application rate utilizing the gridded area to ensure proper waterproofing thickness application. The Contractor shall provide the Testing Agency with the number of gallons of waterproofing applied to each grid area.

11. The Contractor shall flood-test new and existing drainage systems in accordance with ASTM D 5957. Temporarily plug drain discharge with an inflatable device. Temporarily dam up scupper discharge. Construct ballasted containment as required to contain water. Fill the drain body or scupper with water to 2 inches above the membrane tie-in at the drain body. Fill the drain scupper with water to 2 inches above the bottom membrane tie-in at the scupper. Run flood test for no less than 24 hours. Maintain at least one-person on-site monitoring testing. In the event of precipitation terminate testing immediately and unplug the drainage system. Do not overload the structure with excessive water pressure. The Owner's Testing and Inspection Agency shall periodically witness the testing and perform a final inspection for water infiltration before terminating the flood test.

12. Final Inspection/Post-Installation Meeting: The Contractor shall hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.

3.12 FIELD QUALITY ASSURANCE

A. Responsibilities

1. Owner's Responsibility

a) Owner shall retain the Inspection and Testing Agencies under a separate contract in accordance with the referenced building code for the project.

b) Cost associated with re-inspection, re-testing, additional inspections, and, additional testing shall be paid for by the Owner.

c) The Contractor shall retain the Testing and Inspection Agencies. Testing and Inspection Agencies shall be an agency acceptable to the Owner and Engineer.

d) Cost associated with re-inspection, re-testing, additional inspections, and, additional testing shall be paid for by the Contractor.

2. Contractor's Responsibility

a) It is the Contractors responsibility to request and schedule all inspections and testing required by this Section.

b) Schedule all inspections and testing with the Inspection and Testing Agencies at least 7 days prior to performing the work.

c) Notify the Owner and Engineer of the work schedule at least 7 days in advance.

d) When the Inspection or Testing Agencies report results that are not in conformance with the project requirements or manufacturer's requirements, the Engineer and Owner reserve the right to amend the rate of testing, amend the rate of inspections, request additional testing, and request additional inspections.

1) Contractor shall reimburse the cost of all re-testing, re-inspection, additional testing, and additional inspections.

2) The cost of repair, rework, and/or replacement shall be borne by the Contractor.

3. Inspection and Testing Agencies Responsibility

a) Inspection and Testing Agencies are responsible for conducting, monitoring, and reporting the results of all tests required under this Section.

b) Inspection and Testing Agencies have the authority to reject materials and work not meeting Specifications.

B. Inspections

1. Material Inspections: The Inspection Agency shall periodically inspect on-site materials for general conformance to the project documents and manufacturer's instructions.

2. Adhesion Testing Inspection: Inspection Agency shall witness the Contractor perform as required by Part "Field Quality Control." Testing shall be witnessed at a rate of at least one adhesion test for every 10,000 square feet. If testing reveals adhesion problems witnessed testing rate shall be increased to the more stringent of one adhesion test for every 2,000 square feet or the manufactures recommended testing rate.

3. Surface Preparation Inspections: Inspection Agency shall periodically inspect prepared and cleaned surfaces that are ready for waterproofing application. Note areas that do not meet the surface preparation requirements of the project documents.

4. Application Rate Monitoring: Using the Contractor's grid information and provided volume of waterproofing application per grid point, the Inspection Agency shall employ coverage rate calculations to monitor waterproofing mil thickness during the application of each layer.

a) The calculated mil thickness shall be within 10% of the required thickness specified by the manufacturer's data for each layer of the specified waterproofing system.

5. Waterproofing Application Inspections: Inspection Agency shall periodically inspect the waterproofing application for conformance with the project documents. Verify assembly buildup, detailing, and terminations.

6. Distress Inspections:

a) Inspection Agency shall periodically inspect completed waterproofing. Field mark and document any areas of blistering, delaminating, peeling, cracking, or other common distress conditions.

b) Inspection Agency shall periodically review ceiling and under slab conditions of the waterproofing, where possible, for signs of water infiltration once the system is watertight.

7. Flood Testing Inspections: Inspection Agency shall periodically witness the Contractor shall flood testing of new and existing drainage systems. At a minimum, the inspector

shall review for leaks at the start of each test, at the end of each test, and at least once during the testing procedure.

8. Drainage Inspection: Inspection Agency shall periodically review drainage to verify drains are not clogged with construction debris.

9. Final Inspection: Inspection Agency shall participate in the final punch list review of the waterproofing systems.

C. Testing

1. Material Testing: Testing Agency shall sample materials delivered to the Project site. Samples shall be identified, sealed, and certified in presence of the Contractor. If requested by the Engineer or Owner the Testing Agency shall perform tests for characteristics specified, using applicable referenced testing procedures or, if not referenced, using tests cited in the manufacturer's product data.

2. Thickness Testing: Testing Agency shall employ a membrane thickness gauge to monitor application thickness during the application of the waterproofing when the testing agency is present on-site during coating application. Spot-check the coating application thickness at no less than 10 locations per visit. Perform no less than three readings per spot, discarding any unusually high or low gauge readings. The average of the acceptable gauge readings shall be recorded as the spot measurement. The Contractor shall repair test locations following testing.

3. Flood Testing: Contactor shall flood test each waterproofing area for leaks, according to recommendations in ASTM D 5957, after completing the waterproofing and protection coarse layers but before installing the wear coat or overburden layers. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Testing Inspection shall witness the flood testing.

   a) Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from the top of sheet flashings.
   b) Flood each area for 24 hours.
   c) After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

4. Electronic Leak Detection: Testing Agency shall perform electronic leak detection services in accordance with Section "Electronic Leak Detection." Testing shall be conducted after completing the waterproofing and protection coarse layers but before installing the wear coat or other overburden layers.

5. Electronic Leak Detection: Testing Agency shall perform electronic leak detection services in conformance with ASTM D 7877 and as described below. Testing shall be conducted after completing the waterproofing and protection coarse layers but before installing the wear coat or other overburden layers.

   a) Leak detection equipment shall utilize low voltages 40 volts or below in direct current. High voltage leak detection is not acceptable.

b) Testing Agency and Contractor to coordinate quality assurance efforts to ensure a leak-free membrane assembly is achieved before the Contractor proceeds with additional work.

1) Contractor shall make water, water hosing, and 120-volt electricity (if needed) available for the Testing Agency use during testing. Supply enough water hosing to reach all areas of the waterproofing from the hose connection supplying water.

c) Testing Agency shall survey horizontal and vertical surfaces receiving new waterproofing for breaches. The survey shall include field waterproofing application, flashing waterproofing application, inside corners, outside corners, and penetrations.

d) Testing Agency shall field mark breach locations on membrane protection ply with marker materials approved by the waterproofing manufacturer.

e) Testing Agency shall document the location of the membrane breach on drawings. Photograph each membrane breach. Assemble information into a field report and submit the report to the Owner, Architect, Engineer, and Contractor.

3.13 GARDEN ROOF® COMPONENTS INSTALLATION

A. Root Barrier Protection.

1. Root Stop HD shall be laid over the Hydroflex 30, lapping adjacent sheets 5 feet (1.5 m). A 1 foot (300 mm) overlap is acceptable when Seam Tape is used to continuously seal the lap edges. Root Stop shall be turned up all vertical roofed/flashed surfaces, installing additional material as required, to completely protect waterproofing and flashings.

B. Insulation. Where specified, Styrofoam™ brand insulation shall be installed loose-laid in accordance with manufacturer's recommendations.

C. Air Layer. When insulation ***and*** Moisture Mat are specified an air layer shall be required between the surface of the insulation and the water retention mat. A layer of Hydrodrain®AL or 300 shall be installed over the insulation. The 4 inch (100 mm) selvage edge of the geotextile fabric overlaps adjoining sheets and can be held in place with duct tape.

D. Moisture Mat. Where specified, a layer of Moisture Mat shall be installed over the root barrier (when no insulation is specified) or air layer/ insulation, lapping adjacent rolls a minimum of 4 inches (100 mm). The Moisture Mat shall be turned up all vertical, roofed/flashed surfaces a minimum of 6 inches (150 mm) beyond the anticipated soil level. Any excess shall be trimmed down to the level of the soil.

E. Drainage/Water Retention Component.

1. Gardendrain GR25 shall be installed with white fabric surface up, over the root barrier protection, water retention mat (if used) or Styrofoam™ insulation (if used). Adjacent rolls shall be butt together with extra fabric along one edge folded over and lapped onto the adjacent roll. Gardendrain shall be cut to fit around penetrations, etc. with a heavy-duty utility knife.

2. Gardendrain GR50 [Gardendrain GR30] shall be installed with holes up, over the root barrier protection, water retention mat (if used) or Styrofoam™ insulation (if used). Adjacent panels shall be butt together. Gardendrain shall be cut to fit around penetrations, etc. with a heavy-duty utility knife or small toothed saw.

2. The cups of the Gardendrain shall be filled with lightweight aggregate level with the top surface of the panels where required due to loading conditions. Lightweight aggregates are not used in Gardendrain GR25

F. Filter Fabric.

1. For installations with Gardendrain GR25:

a. Strips of Systemfilter shall be installed at horizontal to vertical transitions at edgings, curbs and penetrations to contain LiteTop engineered growing media. Systemfilter shall overlap adjacent strips a minimum of 12 inches (300 mm) and may be secured with tape during the installation process.

b. Systemfilter shall be installed to a height above the finished LiteTop growing media elevation and any excess trimmed down to the level of the plant materials.

2. For installations with Gardendrain GR30 or GR50:

a. Systemfilter shall be installed fully over the Gardendrain, lapping adjacent rolls a minimum of 12 inches (300 mm) and may be secured with tape during the installation process. Systemfilter shall be installed vertically at all transitions at edgings, curbs, and penetrations to contain LiteTop engineered growing media.

b. Systemfilter shall be installed to a height above the finished LiteTop growing media elevation and any excess trimmed down to the level of the plant materials.

3.14 HARDSCAPE/ACCESSORY INSTALLATION

A. Stone and/or paver ballast shall be installed at all roof perimeters, building walls, penetrations, and access hatches and as required for flashing vegetation barriers, proper wind design, fire breaks, and as walkway/maintenance paths.

1. Ballast design shall be in accordance with DuPont™ and American Hydrotech, Inc. requirements.

B. Checker Block® shall be installed per Hydrotech requirements and as shown on Hydrotech details.

1. Checker Block® shall be installed where indicated on plans and as required per ballasting requirements established by American Hydrotech, Inc.

2. Disk Anchors shall be installed in Checker Block® and elsewhere in Garden Roof to the pattern required per the ballasting requirements established by American Hydrotech.

3. Stainless steel zip ties as supplied by American Hydrotech shall be used to connect Checker Block® units together as required by American Hydrotech, Inc.

C. Metal edge restraints, precast curbing and all specified edging materials shall be installed as shown on plans and details.

D. Drains shall be fitted with inspection/maintenance chambers and grills, built up to ensure access at growing media level as shown on plans and details.

3.15 GROWING MEDIA INSTALLATION

A. LiteTop growing media shall be placed carefully to avoid damage or displacement of other materials such as walls, paving, drainage components, filter fabric, and roofing membrane.

B. LiteTop growing media shall be placed to within 1 inch greater than final grade or to a depth of no greater than 8 inches and compacted as described in 3.08.C. below. For final grades less than 8 inches only one round of compaction shall be performed and remaining growing media loosely placed such that top of growing media exceeds final grade by 1 inch (see 3.08.D. below). For final grades greater

than 8 inches, place growing media at no greater than 6 inches and repeat procedure until growing media has been compacted within 1 inch of final grade.

C. Compaction shall be performed with a 300 – 400 lb. landscape roller. Mechanical compactors, including plate compactors, are not recommended.

D. Where Checker Block® is installed, roller compaction is not possible. Hand compaction shall be employed to properly compact media. After Checker Block® is filled with media, continue media placement until desired grade is achieved.

E. After compaction remaining growing media shall be placed at 1 inch greater than final grade and thoroughly watered or jetted over entire area. Low settled areas shall be filled with additional growing media and re-wet to achieve uniform prescribed final grade.

F. Erosion Control Mat.

1. The erosion control mat shall be installed directly over the growing media and properly staked into place with disk anchors.

2. Stake fastening pattern is based on local wind speed, building height and roof slope. Contact Hydrotech for specific guidelines.

3.16 VEGETATION INSTALLATION

A. Intensive plant materials (specified elsewhere) shall be installed in accordance with the plans and specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and apply materials specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Applicators: Use only workmen thoroughly trained and experienced in skills required, completely familiar with manufacturer's recommended methods of application, and completely familiar with requirements of this Section of specifications.

B. Manufacturer's Directions: Carefully follow manufacturer's printed directions in application. Make available printed directions to Architect's Representative if requested.

1.05 WARRANTY

A. Provide Installer's two (2) year guarantee and Manufacturer's five (5) year non-prorated, material warranty for moisture penetration.

PART 2 - PRODUCTS

2.01 PENETRATING WATER REPELLENT

A. All exterior precast concrete walls of the building shall receive water based siloxane water repellent.
   1. SureKlean "Weather Seal Siloxane WB" by ProSoCo.
   2. Chemprobe/Tnemec Series 633 Prime-A-Pell Plus H2O

B. The water repellent shall be applied in strict accordance with the manufacturer's instructions. Do not alter or dilute the material. Preferred method of application is with low pressure (20 p.s.i.) airless spray equipment or with a heavily saturated brush or roller in two wet-on-wet applications. The wall surface shall be completely dry, clean and free from surface dirt, dust, oil or other surface contaminants.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with application in areas of discrepancy until discrepancy are fully resolved.

3.02 APPLICATION IN GENERAL

A. Preparation: Prepare surfaces to receive water repellent, strictly complying with manufacturer's recommendations.

B. Application: Apply water repellent complying with manufacturer's recommendations, covering areas to prevent penetration of moisture.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install insulation and related items specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection:
   1. Deliver materials to job site and store in safe dry place with labels intact and legible at time of installation.
   2. Protect building insulation materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

1.05 REFERENCES

A. Concealed Installations: Flame Spread rating of not more than 75 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

B. Exposed Installations: Flame Spread rating of not more than 25 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

PART 2 - PRODUCTS

2.01 PERIMETER INSULATION BOARD

A. Provide extruded polystyrene insulation board Owens-Corning Foamular 250, or approved equal.

2.02 CONTINUOUS INSULATION (Mineral Wool)

A. Acceptable Manufacturer: Thermafiber, Inc., which is located at: 3711 Mill St. ; Wabash, IN 46992; Toll Free Tel: 888-834-2371; Tel: 260-563-2111; Fax: 260-563-8979; Email: request info; Web: www.thermafiber.com
   1. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C 612, IVA.
   2. Thickness: As noted on contract drawings.
   3. Type: Thermafiber RainBarrier 45 Insulation
      a. R-value of 4.2 per inch.
      b. Facing: Unfaced
      c. Density: 4.5 pcf.
      d. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0
      e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104
      f. Non-corrosive, ASTM C 665.
      g. Recycled Content Options:
         Pre-consumer recycled content:
         Special "Green" Fiber…….……..….90%
         Dark Fiber Mineral Wool Products…….…..…84%
         EPA Choice Fiber (US Government Buildings)…..…75%
         Standard Mineral Wool Products..……..…70%
         Post-consumer recycled content…….....0%

2.03 INSULATION BOARD

A. Rigid Foam Board Insulation: closed cell polyisocyanurate foam board with glass fiber reinforced core, to ASTM C1289, Type I, Class 2
   1. Thermal Resistance: R-6.5 per 1 inch of thickness
   2. Density (ASTM D1622): nominal 2.0 pcf.
   3. Compressive Strength (ASTM D1621): minimum 25 psi.
   4. Foam Surface Burning Characteristics (ASTM E84): flame spread < 25, smoke developed < 450.
   5. Water Vapor Transmission (ASTM E96): less than 0.03 perms.
   6. Water Absorption by Volume (ASTM C209): maximum 0.1 percent.

B. ACCESSORIES
   1. Joint Tape: 2.0 mil (0.051 mm) thick aluminum tape, 3 inches (75 mm) wide
   2. Mechanical Fasteners - Screw Type: ITW Buildex Multi-Diameter Insulation Teks with caps or similar fastener with a 1-1/4 inch plastic washer.
   3. Mechanical Fasteners - Impalement Type: Stick-N-Pins by Durodyne Company.
   4. Foam Insulation: Dow "Great Stuff"
   5. Sealant: One-part, flexible polyurethane-based elastomeric sealant; moisture curing and non-sagging; to ASTM C920, Type S, Grade NS, Class 25.

2.04 BATT INSULATION

A. Manufacturers: Johns Manville Thermal-SHIELD™ Free, Owens Corning EcoTouch™, Certainteed Sustainable Insulation™ , Knauf EcoBatt™ or approved equal formaldehyde-free fiberglass insulation manufacturers.

B. Material: Glass fiber type bearing the U.L. Classification marking as to fire resistance conforming ASTM C-665:
   1. Unfaced, Type I

C. Batt Insulation Hanger: MFR: Duro Dyne or equal. Self-adhesive anchors with washer
   1. Pin 12 gauge Zinc plated
   2. Base 2"x2" 28 gauge galvanized
   3. Adhesive polyethylene double coated foam tape.

2.05 SPRAY FOAM INSULATION AT VOIDS

A. Dow Chemical FROTH-PAK™ Spray Polyurethane Foam Sealant, or approved equal.

B. Provide a two-component, quick-cure spray polyurethane foam to fill voids where typical building insulation cannot easily be installed.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 INSTALLING CONTINUOUS INSULATION BOARD

A. Install rigid foam board insulation system in accordance with manufacturer's installation guidelines.

B. Install boards with long axis perpendicular to supports. Ensure end joints are fully supported.

C. Install insulation boards to ensure board width spans not less than 3 framing supports.

D. Cut and fit boards to suit project requirements.

E. Fit insulation between wall ties and other obstructions with joints staggered providing ¼' to ½" spacing at end joints.
   1. Press units firmly against inside wythe of masonry or other construction.
   2. Make insulation continuous.

F. Fill all voids between insulation boards with single component insulating foam sealant to provide continuous vapor barrier.

G. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

H. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

I. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

J. Apply joint tape over exposed board joints using a squeegee or bristle brush.

K. Seal all voids and joints that cannot be taped.

L. Apply Flashing at all wall openings.

3.03 INSTALLING BATT AND BLANKET INSULATION

A. After piping and wiring is in place, install and support blanket and batt insulation in position required, and coordinate with framing.

B. Remove insulation torn, displaced, water soaked, and damaged. Replace with new material.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Spray-in-place closed cell urethane foam insulation in exterior assemblies, to provide an air barrier and improved thermal resistance.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

H. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

I. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

J. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

K. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

1.05 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.

B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).

C. Handling: Handle materials to avoid damage.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.

C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.

D. To avoid overspray, product should not be applied when conditions are windy.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: CertainTeed Corp., Insulation Group,800-233-8990; or approved equal.

2.02 SPRAY FOAM INSULATION

A. Insulation: HFC-blown type Closed Cell Foam: CertainTeed CertaSpray Closed Cell Foam is a medium-density, MDI-based polyurethane thermoset rigid foam. When CertaSpray A-side closed cell is mixed with CertaSpray B-side closed cell under pressure in a 1:1 volumetric ratio, they react and expand into a medium-density closed cell foam with an in-place core density of 1.9- 2.2 pcf:

1. Physical and Mechanical Properties:
    a. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
    b. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft2- degrees F)/Btu.
    c. Thermal Resistance (aged): R-5.8 / inch.
    d. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
    e. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
    f. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
    g. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
    h. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Day.
    i. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
    j. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m2.
    k. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.
2. Fire performance
    a. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
    b. Smoke: Less than 450 when tested in accordance with ASTM E 84.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.

C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.

D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Mask and protect adjacent surfaces from overspray or dusting.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.

B. Apply insulation by spray method, to uniform monolithic density without voids.

C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled at the end of this Section.

D. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.

E. Patch damaged areas.

3.04 FIELD QUALITY CONTROL

A. Inspection will include verification of insulation and density.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Products supplied under this section:
   1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:
   1. Section 03 3000 Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.03 SUBMITTALS

A. Quality control/assurance: In accordance with 01 3000
   1. Summary of test results per paragraph 9.3 of ASTM E1745.
   2. Manufacturer's samples and literature.
   3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Vapor barrier shall have all of the following qualities:
   1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   2. Other performance criteria:
      a. Strength: ASTM E1745 Class A.
      b. Thickness: 15 mils minimum
   3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:
   1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
   2. Perminator 15 mil by W. R. Meadows, 800-342-5976.
   3. Vaporguard 15 mil by Reef Industries, 713-507-4250
   4. Moistop Ultra 15 mil by Fortifiber, (800) 773-4777

C. Accessories:
   1. Seam Tape:
      a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
      b. Stego Tape by Stego Industries, 877-464-7834, or approved equal.
   2. Mastic:
      a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
      b. Stego Mastic by Stego Industries, 877-464-7834, or approved equal.
   3. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.
   4. Perimeter/edge seal:
      a. Stego Crete Claw
      b. Stego Term Bar
      c. StegoTack Tape (double-sided sealant tape)
   5. Penetration Prevention: Beast Foot
   6. Vapor Barrier-Safe Screed System: Beast Screed

PART 3 – EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
   1. Level and compact base material.

3.02 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
   2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
      a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.

      OR

      b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
   3. Overlap joints 6 inches and seal with manufacturer's seam tape.

4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier
7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies factory-formed metal wall panels.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A653/A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
   3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   5. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   6. ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
   7. ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
   8. ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

B. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA): SMACNA Architectural Sheet Metal Manual.

1.03 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.04 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Shop Drawings:
   1. Provide elevations showing seam layout and pattern.
   2. Show manner of forming, joining, and securing panels to Project substrate.
   3. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.

4. Panel and fastener calculations to be submitted along with the panel drawings.

E. Samples consisting of 6-inch square specimens of material.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving erection method.

B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

C. Performance Requirements:
1. Static air infiltration of 0.06 cfm/sf (0.028 liters/second) with 6.24 psi (43 kPa) air pressure differential as tested in accordance with ASTM E283.
2. No water infiltration at inward static air pressure differential of not less than 6.24 psi (43 kPa) and not more than 12 psi (83 kPa) as tested in accordance with ASTM E331.

D. Manufacturer's Qualifications: Manufacturer has a minimum of five years experience in manufacturing metal roof systems of this nature. Panels specified in this section shall be produced in a factory environment (not with a portable roll former) with fixed-base roll forming equipment and in line leveling, assuring the highest level of quality control. A letter from the manufacturer certifying compliance will accompany the product material submittals.

E. Installation Contractor's Qualifications:
1. Installation contractor shall be an approved installer, certified by the manufacturer before the beginning of installation of the metal roof system.
2. Project foreman is the person having received certification by the manufacturer specific training in the proper installation of the selected metal roof system and will be present to supervise whenever material is being installed.
3. Provide certification letter that installation contractor has a minimum of three years' of metal product installation experience immediately preceding the date upon which work is to commence.

1.06 DELIVERY, STORAGE & HANDLING

A. Deliver materials in manufacturer's original packaging with identification labels intact.

B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting.
2. Elevate one end of each skid to allow for moisture runoff.

3. Prevent contact with material that may cause corrosion, discoloration or staining.
4. Provide factory installed strippable vinyl film protective coating to panels.

1.07 PRE-INSTALLATION CONFERENCE

A. Prior to installation of roofing system, conduct a pre-installation conference at the project site.

B. Attendance: Owner, Architect, Contractor, Project Superintendent, and Certified Installer

1.08 WARRANTY

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Installer:
1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion.
2. The installation contractor shall issue a separate two (2) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

PART 2 - PRODUCTS

2.01 WALL PANELS – MWP-1

A. Basis of Design: Petersen Aluminum Corp., 800-323-7960, or approved equal by one of the following manufacturer's:
1. MBCI
2. Metal Sales

B. Type: Flush Wall Panels, Smooth Panel
Construction : .032 Aluminum
Install : Concealed Fasteners, direction per elevations
Sizes : Mixture of 7” and 11” wide panels, per elevations
Color: Pac-Clad Premium Metallic Color
Location : Parking Deck Vestibules and Parking Deck Elevator/Stair Entrances where exposed at exterior.

2.02 WALL PANELS – MWP-2

A. Basis of Design: Metal Sales, or approved equal by one of the following manufacturer's:
1. MBCI
2. Peterson Aluminum Corp.

B. Type: TL Series Flush, Equal Rib and Unequal Rob
Construction : .032 Aluminum
Install : Concealed Fasteners, direction per elevations
Panels: A: TL17
B: TL17C
C: TL1224
Color: Custom Kynar color to be selected by Architect.
Location : Utility Enclosures

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of panels.

3.03 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter

B. Remove manufacturer’s protective film from panel surfaces.

C. Coordinate panel installation with work of other trades to provide a noncorrosive and leakproof installation.

D. Prevent galvanic action of dissimilar metals in proximity to one another.

3.04 INSTALLATION

A. Seams: Provide uniform, neat seams.

B. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.

C. Sealant-Type Joints: Provide sealant-type joint where indicated. Form joints to conceal sealant.

3.05 FINAL CLEANING

A. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. The drawings and provisions of the General Conditions, Supplementary Conditions and the sections included under Division 1 Specification Sections, apply to this section.

1.2 SUMMARY:

A. This section includes MG F-Seam Panels used as the exterior or interior cladding.

1.3 PERFORMANCE REQUIREMENTS:

A. Structural performance: provide exterior/interior wall cladding assemblies capable of withstanding the effects of load and stresses from dead loads, wind loads, snow loads and normal thermal movement without evidence of permanent defects of assemblies or components.
   a. Dead load: As required by applicable building code.
   b. Live Load: As required by applicable building code.
   c. Wind Load: Uniform pressure (velocity pressure) of (Insert Design Criteria) lb/sq ft. (Insert Design Criteria), acting inward or outward.
   d. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
   e. Temperature Change (range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Sealed joints shall allow free and silent movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.

C. Manufacturing, installation, and sealing shall prevent deformation of exposed surfaces.

D. Design panel system to accommodate substructure tolerance of +0 to -1/8 inch.

E. Panel support system shall allow for free-floating panel installation.

F. Not Permitted: Vibration harmonics; wind whistles; noises caused by thermal movement; thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system.

G. Preformed metal panel system to withstand code imposed design loads. Maximum allowable deflection of span: L/60.

1.4 SUBMITTALS:

A. Product Data: Manufacturer's product literature for the panel specified.

B. Shop Drawings: For exterior/interior wall panel assemblies and accessories. Include plans; elevations; sections and details.

C. Structural Calculations: Submit a comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement.

D. Quality Assurance Submittals: Submit the following:
   a. Certificates: Product certificates signed by manufacturer certifying materials comply with the specified performance characteristics and criteria, and physical requirements.

E. Samples for initial selections: Manufacturer’s color charts showing the full range of colors available for units with factory-applied color finishes.

F. Samples for verification: Provide color samples of selected color. Samples shall involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 QUALITY ASSURANCE:

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of kind indicated.

B. Manufacturer Qualifications: Minimum of 5 years experience in manufacturing exterior wall panels similar to those specified.

C. Installer Qualifications: Acceptable to manufacturer.

1.6 DELIVERY, STORAGE & HANDLING:

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer’s ordering instructions, and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.
   a. Store materials in accordance with manufacturer’s recommendations.
   b. Handle materials carefully to avoid damage to materials and finishes.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication, and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that wall panel assemblies fit properly to

supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work.

a. Established dimensions: where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of wall panel assemblies corresponding to the established dimensions.

1.8 WARRANTY:

A. Panel Manufacturer: Furnish manufacturer's standard warranty to cover material for repairs to stop leaks resulting from natural deterioration of any component of the assembly including flashings and trim installed as a part of the system. A specimen of the warranty shall be submitted for Architect's review prior to starting application. Warranty is to be in effect from Final Acceptance Date.

B. Installer:

1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion.
2. The installation contractor shall issue a separate two (2) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

PART 2 – PRODUCTS

2.1 MANUFACTURER:

A. Manufacturers: Subject to compliance with requirements, provide products manufactured by MG McGrath Inc., 1387 East Cope Ave; Maplewood, MN 55109; Tel: 651.704.0300; Fax: 651.704.9989; Email: info@mgmcgrath.com; Web: www.mgmcgrath.com

a. MG F-SEAM panel with custom corrugation patterns. Refer to architectural drawings.

2.2 MATERIALS:

A. 280 Muntz Brass : Consisting of 60% Copper and 40% Zinc

a. Thickness: .050”
b. McGrath Custom Pre-weathered Patina Finish: Sahara

2.3 FABRICATION, GENERAL:

A. Tolerances

a. Extrude edges at right angles to the wall plane

B. Panel surfaces shall be free of scratches or marks caused during fabrication

C. Cut extruded horizontal profile to exact required length located to coordinate with horizontal panel joint location.

D. Shop fabricates all panel components. Field cutting for penetrations is the only modification allowed. Do not perform cutting without prior approval from manufacturer.

E. Condensation: Fabricate panels for control of condensation, including vapor inclusion of seals and provisions for breathing, venting, weeping and draining.

2.4 ACCESSORIES:

A. All exposed rivets/fasteners shall be stainless steel.

B. All hidden fasteners shall Climaseal coated or stainless steel.

C. Flashing: aluminum, same finish as for F-Seam aluminum panel where exposed; secured with concealed fastening method.

D. Panel System Sub grits: Provide G90 galvanized steel of gauge and spacing required for panel system structural requirements, as recommended by panel manufacture and in accordance with approved shop drawings. To avoid galvanic reaction, separate dissimilar metals.

E. All proprietary extrusions supplied by fabricator.

F. No exposed sealant to be used at panel-to-panel connections.

2.5 FINISHES, GENERAL:

A. Comply with EN 10025-5 and DAST Rule 007 Metal Finishes Manual for architectural metal products.

PART 3 – EXECUTION

3.1 PREPARATION:

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation. Panel substructure shall be level and plumb. Panel substructure shall be structurally sound as determined by that subcontractor's engineer. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances. Coordinate delivery of such items to project site.

3.2 INSTALLATION:

A. Erect panel's level and plumb, in proper alignment in relation to substructure framing and established lines.

B. Panels shall be erected in accordance with approved shop drawings.

C. Panel anchorage shall be structurally sound and per engineering recommendations.

D. Where steel panel materials come in contact with dissimilar materials, an isolation shim or tape shall be installed at fastening locations.

3.3 CLEANING AND PROTECTING:

A. Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

B. Protect wall panel assemblies from damage during construction. Use temporary protective coverings where needed as approved by the wall panel manufacturer.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install elastomeric sheet roofing system, including:
   1. Roofing manufacturer's requirements for the specified warranty.
   2. Preparation of roofing substrates.
   3. Wood nailers for roofing attachment.
   4. Insulation.
   5. Cover boards.
   6. Elastomeric membrane roofing.
   7. Flashings.
   8. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

1.02 REFERENCES

A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.

B. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.

C. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.

D. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2004.

E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.

F. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting; 2003.

G. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000.

H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2003.

I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

J. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

D. Samples: Submit samples of each product to be used.

E. Specimen Warranty: Submit prior to starting work.

F. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.

G. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference: Before start of roofing work, shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   2. Notify Architect well in advance of meeting.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.06 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Manufacturer Warranty: Elevate Building Products (Formerly Firestone Building Products) 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
   1. Limit of Liability: No dollar limitation.

2. Scope of Coverage: Repair leaks in the roofing system caused by:
    a. Ordinary wear and tear of the elements.
    b. Manufacturing defect in materials.
    c. Defective workmanship used to install these materials.
    d. Damage due to winds up to 55 mph (88 km/h).
3. Not Covered:
    a. Damage due to winds in excess of 55 mph (88 km/h).
    b. Damage due hurricanes or tornadoes.
    c. Hail.
    d. Intentional damage.
    e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

C. General Contractor and Roofing Subcontractor: Required to jointly and separately provide written guarantee that the roofing and flashing will be weathertight and free from defects in materials and workmanship for a period of 2 years from Final Acceptance Date.
1. Leaks and defects include blistering, fishmouths, ridging, splits, open laps, buckles, wrinkles and slippage. Make corrections at Contractor's expense during guarantee period.
2. Roofing inspection and written acceptance by manufacturer, Architect, and Owner will be required. In addition, roofing subcontractor is to schedule a joint inspection by above named parties 60 days prior to expiration of 2 year guarantee and correct defects complying with original specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Elevate Building Products (Formerly Firestone Building Products), or approved equal system by
1. GAF
2. Manville
3. Carlisle

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:
1. Membrane: Thermoplastic olefin (TPO).
2. Thickness: As specified elsewhere.
3. Membrane Attachment: FULLY ADHERED
4. Comply with applicable local building code requirements.
5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
6. Provide assembly complying with UL Design Criteria for 1-90 wind uplift rating.

B. Insulation:
   1. Thickness Shown or as required to achieve R-30 minimum.
   2. Base Layer: Polyisocyanurate foam board, non-composite. Elevate Building Products (Formerly Firestone Building Products) 95+ or approved equal.
      a. Attachment: Loose laid

C. Insulation Cover Board:
   1. Type: Gypsum-based board, 1/4 inch Dens Deck Prime.
   2. Attachment: Mechanical fastening thru insulation board into steel deck.

2.03 TPO MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
   1. Thickness: 0.060 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
   2. Sheet Width: Provide sheets of width necessary to accommodate batten spacing required by manufacturer for project conditions.
   3. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
   4. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C 1549.
   5. Solar Reflectance Index: (SRI) 98 initial, 81 3-year.
   6. Color: White.
   7. Acceptable Product: ULTRAPLY TPO by Elevate Building Products (Formerly Firestone Building Products).

B. Membrane Adhesive: UltraPly Bonding Adhesive.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
   1. Thickness: 0.060 inch plus/minus 10 percent.
   2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
   3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
   4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
   5. Color: White.
   6. Acceptable Product: ULTRAPLY TPO Flashing by Elevate Building Products (Formerly Firestone Building Products)

E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing.

F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer.

G. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

H. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick.

I. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant.

J. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant.

K. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing.

L. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch by 30 inches x length shown on drawings with patterned traffic bearing surface; UltraPly TPO Walkway Pads.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
   1. Thickness: As Shown.
   2. Size: 48 inches by 96 inches, nominal.
   3. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
   4. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
   5. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.

B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
   1. Size: 48 inches by 96 inches, nominal.
      a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   2. Thickness: 1/4"
   3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.
   4. Spanning Capability: Recommended by manufacturer

5. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
6. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
7. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.

C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

2.05 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated in accordance with Section 06 1000.
1. Width: 3-1/2 inches nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
2. Thickness: Same as thickness of roof insulation.

PART 3 - INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.

3.05 ELASTOMERIC MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.

3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

C. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.

3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
4. Provide termination directly to the vertical substrate as shown on roof drawings.

E. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.
5. High Temperature Surfaces: Where the in-service temperature is, or is expected to be, in excess of 180 degrees F (82 degrees C), protect the elastomeric components from direct contact with the hot surfaces using an intermediate insulated sleeve as flashing substrate as recommended by membrane manufacturer.

3.07 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

3.08 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.09 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install metal flashing and sheet metal work specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Job Supervision: Applicator of work in this Section to furnish competent, qualified foreman present and in charge at all times work is performed.

B. Applicable Standard: Refer to the latest edition of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors National Association, Inc. Use as applicable standard for method and quality of work under this Section where not specifically otherwise shown on Contract Drawings. Manufacturer to provide trained metal craftsmen to supervise installation.

1.05 WARRANTY

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Guaranty: Guaranty sheet metal work installed under this Section against leakage or defects for 2 years after substantial completion date. Make good at Contractor expense leakage or defects occurring within this period.

PART 2 - PRODUCTS

2.01 SHEET METAL

A. Galvalume Sheet Steel: Aluminum-zinc alloy coating AZ50, meeting ASTM A792. Keep Galvalume dry during transit, in storage, and at work site.
   1. Finish to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in Custom color to be selected by Architect
      a. Primer is applied to 0.20 - 0.30 mils D.F.T. (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils D.F.T

B. Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars and Temper H55 (light drawn) for tube and pipe.
   1. Sheet Bronze: ASTM B 36/B 36M, Alloy UNS C28000 (muntz metal, 60 percent copper).

C. Soft Temper Sheet Metal: Lead sheet, F.S. QQ-L-201, Grade B, 4 lb. per sq. ft.

D. Gauge of Metal:
   1. Metal components of a roof assembly: 24 gauge (USS .025") minimum
   2. Miscellaneous Flashing: 26 gauge minimum

2.02 ACCESSORIES

A. Fasteners: All metal counter flashing and parapet cap flashing shall be attached with galvanized or cadmium plated screws with neoprene washers. Nails, screws and rivets used at other locations are to be the appropriate type for the purpose as described in the latest edition of the SMACNA Design Manual.

B. Solder for Lead: ASTM B 32, 50% tin and 50% lead used with rosin flux.

C. Roofing Cement: F.S. SS-C-153, Type I, Class A (summer grade) or Class B (winter grade) as applicable.

D. Bitumastic Coating: F.S. TT-C-494, MIL-C-18480, or SSPC - Paint 12, cold applied solvent type bitumastic coating for application in dry film thickness of 15 mils per coat.

2.03 FABRICATION

A. Fabricate metal flashings, counterflashings, trim and related items to comply with profiles and sizes required. Fabricate to comply with the latest edition of the SMACNA "Architectural Sheet Metal Manual", metal manufacturer's recommendations, and recognized industry practices.

B. For continuous running work, fabricate with expansion joints in flashings, spaced sufficiently close to prevent flashing damage and failure in resistance to water penetration. Form flashing to fit substrate in each application.

C. Where sheet metal is required and no material or gauge is indicated on the Drawings, furnish and install highest quality and gauge commensurate with the referenced applicable standard, (SMACNA Manual, latest edition).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to work of this Section, carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with sheet metal installation in areas of discrepancy until discrepancies are resolved.

3.02 WORKMANSHIP

A. General: Form sheet metal accurately to dimensions and shapes required, watertight and weathertight, with angles and broken surfaces true, sharp, and in straight lines. Where intercepting other members, cope to an accurate fit and solder securely. Produce flat surfaces free from waves and buckles.

B. Expansion: Allow a 3/8"-1/2" gap in coping caps between each section. Use 3-1/2" wide prefinished 24 gage cover plate over joints.
1. Set cover plates in visible bead of polyurethane sealant between the cap and cover plate. Wipe joints of excessive sealant.
2. Attach cover plate at the front and back with hex head cadmium screws with neoprene washers, installed in the gap between the metal cap sections.
3. Do not exceed maximum length of 10'-0" for cap, fascia and flashing sections. Furnish with factory formed slots or enlarged holes for fasteners.

C. Paint metal in contact with mortar, concrete, and masonry materials with an alkali-resistant coating. Use heavy-bodied bituminous paint or approved equal.

3.03 MISCELLANEOUS FLASHING

A. General:
1. Where exposed portions are used as a counter-flashings, lap base flashings at least four inches and use thickness of metal as specified for exposed locations.
2. Exposed edge of flashing may be formed as a receiver for two piece counter flashing.
3. Terminate exterior edge beyond face of wall approximately 1/4-inch with drip edge where not part of counter flashing.
4. Turn back edge up 1/4-inch unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
5. Terminate interior raised edge in masonry backup unit approximately 2 inches into unit unless shown otherwise.
6. Under copings terminate both edges beyond face of wall approximately 1/4-inch with drip edge.
7. Lap end joints not less than four inches. Seal laps with sealant.

8. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound.
9. 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.
10. Where ends of flashing terminate turn ends up 1 inch and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
11. Turn flashing up not less than 8 inches between masonry wythes or behind exterior veneer.

3.04 SOLDERING

A. General:
1. Thoroughly clean and tin joint materials prior to soldering.
2. Perform soldering slowly with well heated copper in order to heat seams thoroughly and to completely fill them with solder.
3. Make exposed soldering neat, full flowing, and smooth. Do not use solder where dependence upon its strength is a factor.

B. Cleaning: After soldering, thoroughly wash acid flux with soda solution.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install roof accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

PART 2 - PRODUCTS

2.01 ROOF SCUTTLE AND CURB AT SHIPS LADDER

A. Provide Bilco Co. Type Type NB-20 roof hatch, 30" x 54", or approved equal, factory assembled unit with standard 12" high insulated curb.
   1. Steel: Cover and frame are 14 gauge G-90 paint bond galvanized steel.
   2. Cover: Brakeformed, hollow-metal design with 1" concealed fiberglass insulation, 3" beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load.
   3. Curb: 12" in height with integral capflashing, 1" fiberboard insulation, fully welded at corners, and 3-1/2" mounting flange with 7/16" holes provided for securing frame to the roof deck.
   4. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
   5. Hinges: Heavy-duty pintle hinges with 3/8" Type 316 stainless steel hinge pins.
   6. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
   7. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
   8. Performance Ratings: Complies with UL 790 Class A (burning brand test).
   9. Finish: Steel: Alkyd base red oxide primer.
   10. Hardware: Engineered composite compression spring tubes and steel compression springs packed in grease. All other hardware is zinc plated/chromate sealed.

B. Aluminum Ships Ladder:
   1. Provide Precision Model SL Aluminum Ships Ladder as manufactured by Precision Ladders, LLC., 1-800-225-7814, or approved equal
      a. Capacity: Unit shall support a 500 lb total load without failure.

b. Ladder Stringer: 5 inch by 2 inch by 3/16 inch extruded 6005-T5 aluminum channel. Pitch: 60 to 75 degrees.

c. Ladder Mounting Brackets:
   1) Floor Bracket: 2 inch by 3 inch by 1/4 inch aluminum angle.
   2) Top Bracket: 4-3/4 inch by 5 inch by 1/4 inch aluminum angle.

d. Handrails: 1-1/4 inches Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.

PART 3 - EXECUTION

3.01 INSTALLATION OF ROOF ACCESSORIES

A. Install roof accessories complying with manufacturer's installation specifications, accepted shop drawings, and with projection through roof watertight and weathertight.

B. Separate roof accessories metal surfaces from dissimilar metals and from wood substrates, using thick coating of bituminous compound or separation recommended by metal manufacturer to prevent corrosive action.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section consists of furnishing all labor, materials, equipment and services necessary for and incidental to the complete and proper installation of all sprayed fireproofing and related work shown on the drawings and specified herein.

B. Conform to applicable building code requirements of all authorities having jurisdiction.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Thickness Schedule: Provide schedule indicating material(s) to be used, building elements to be protected with spray applied fireproofing, hourly rating and material thickness provided and appropriate references.
      a. Secondary structural members are to receive the same material thickness as is applied to the primary structural members they are associated with.
   2. Test Data: Submit independent laboratory test results for fireproofing for the following performance criteria in accordance with the applicable building code:
      a. Thickness and Density per ASTM E605
      b. Surface Burning Characteristics per ASTM E84
      c. Bond Strength per ASTM E736
      d. Deflection per ASTM E759
      e. Bond Impact per ASTM E760
      f. Compressive Strength per ASTM E761
      g. Air Erosion per ASTM E859
      h. Corrosion Resistance per ASTM E937

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Society of Testing Materials (ASTM):
   1. ASTM E84 - Surface Burning Characteristics.
   2. ASTM E119 - Standard Methods of Fire Tests of Building Construction and Materials.
   3. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.

4. ASTM E736 - Cohesion/Adhesion of Sprayed Fire-Resistive Material Applied to Structural Members.
5. ASTM E759 - Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
6. ASTM E760 - Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
7. ASTM E761 - Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E859 - Air Erosion of Sprayed Fire-Resistive Material Applied to Structural Members.
9. ASTM E937 - Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver material in original unopened packages, fully identified as to manufacturer, brand or other identifying data and bearing the proper Underwriters Laboratories, Inc. labels for Surface Burning Characteristics and Fire Resistance Classification.

B. Store material off the ground, under cover and in a dry location until ready for use. All bags that have been exposed to water before use will be found unsuitable and will be discarded. Stock of material is to be rotated and used prior to its expiration date.

1.06 PROJECT/SITE CONDITIONS

A. Do not apply fireproofing when air or substrate temperature is below 40EF. Maintain air and substrate temperature at or above 40EF for 24 hours after application.

B. Provide ventilation in poorly ventilated areas to achieve a total air exchange rate of 4 times per hour until the material is substantially dry.

1.07 SEQUENCING AND SCHEDULING

A. Sequence and coordinate application of sprayed fireproofing with work in other sections which would interfere with efficient fireproofing application.

1.08 FIELD QUALITY CONTROL

A. Refer to Special Inspections Section 01 4510.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide products by one of the manufacturers listed in the UL tested assembly indicated by UL Design Numbers on the Drawings.
   1. All designs are to be considered as UNRESTRAINED conditions as defined by U.L.

B. Concealed/Commercial SFRMs: ISOLATEK International: CAFCO® 300 Series (ISOLATEK® Type 300 Series), CAFCO® BLAZE-SHIELD® II (ISOLATEK® Type II)
   1. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
   2. Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
   3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
   4. Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible.
   5. Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
      a. Flame Spread Index [10] or less
      b. Smoke Developed [10] or less
   6. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf (68.9 kPa).
   7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
   8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
   9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
   10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
   11. Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28

C. High Density Exposed SFRMs: ISOLATEK International: CAFCO® FENDOLITE® M-II (ISOLATEK® Type M-II), CAFCO® FENDOLITE® TG (ISOLATEK® Type TG)
   1. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Bond Strength: Minimum 1000-lbf/sq. ft. (47.88-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
   3. Density: Not less than 40 lb/cu. ft. (640 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
   4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design
   5. Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible
   6. Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
      a. Flame Spread Index [10] or less
      b. Smoke Developed [10] or less
   7. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 43,200 psf (2068 kPa).
   8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.

9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
12. Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28 days with or without the use of a mold inhibitor.

2.02 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. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
1. Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. 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.

F. 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.

G. Sealer: If required, a transparent-drying, water-dispersible, tinted protective coating as recommended by fireproofing manufacturer.
1. Product: Subject to compliance with requirements, provide CAFCO® BOND-SEAL (ISOLATEK® Type EBS) or CAFCO® BOND-SEAL Type X (ISOLATEK® Type X) by ISOLATEK International.

H. Topcoat: If required, a topcoat suitable for application over applied fireproofing; of type recommended by fireproofing manufacturer.
   1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
      a. Product: Subject to compliance with requirements, provide CAFCO® FENDOLITE® M-II (ISOLATEK® Type M-II), CAFCO® FENDOLITE® TG (ISOLATEK® Type TG) by ISOLATEK International.
   2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of [30 sq. ft./gal. (0.75 sq. m/L)] [60 sq. ft./gal. (1.5 sq. m/L)] [120 sq. ft./gal. (3 sq. m/L)].
      a. Product: Subject to compliance with requirements, provide CAFCO® TOP-COTE (ISOLATEK® Type TOP-COTE) by ISOLATEK International.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
   1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of the fireproofing materials.
   3. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of the fireproofing is complete in an area.

B. Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

C. The application of fireproofing to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. 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.

3.03 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
   2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.
   3. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray-applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Test and inspect as required by Chapter 17 of the IBC.
2. For reference, utilize AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide.

B. Test and inspect completed work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Application will be considered defective if it does not pass tests and inspections.
1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Preparing surfaces to receive fireproofing.

B. Protection of adjacent surfaces from overspraying.

C. Spray application of water based, intumescent, fireproofing on interior, exposed structural steel wide flange columns, beams, pipe columns, and related exposed structural steel to provide rated fireproofing.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 REFERENCES

A. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 119 - Fire Tests of Building Construction and Materials.

C. U.L., Inc. - Fire Resistance Directory.

1.04 PERFORMANCE REQUIREMENTS

A. Intumescent fireproofing system to provide a fire rating of one, one and one half, two, two and one half, three, three and one half hours.

1.05 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Submit certified test reports indicating the following:
   1. Fire test reports of fireproofing application to substrate materials similar to project conditions.
   2. U.L. Design Listings from U.L., Inc.
   3. Submit applicator’s current certification, by product manufacturer, as a factory trained and manufacturer approved installer of this product.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

B. Applicator: Company specializing in applying the work of this Section with minimum 3 years documented experience and approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire resistance ratings.

B. Submit certification of acceptability of fireproofing materials to authority having jurisdiction and to Architect.

1.08 MOCKUP

A. Provide mockup of applied intumescent fireproofing

B. Provide testing and analysis of mockup to manufacturer=s published data.

C. Apply sample section of 100 sq ft in size to representative substrate on site.

D. Comply with project requirements as to thickness, density, fire rating, and finish texture.

E. Examine installation to determine variances.

F. If accepted, mockup will demonstrate minimum standard for the Work. Mockup may remain as part of the Work.

1.09 ENVIRONMENTAL REQUIREMENTS

A. When temperature is less than 40F, follow manufacturer=s field instructions for cold weather installation. So not apply when surface temperature is less than 5 degrees F above the dew point.

B. Provide ventilation in areas to receive fireproofing during and 72 hours, minimum, after application, to dry materials and dissipate solvent odors.

C. Maintain non-toxic, unpolluted working area. Provide temporary enclosure to prevent spray from contaminating air.

1.10 SEQUENCING AND SCHEDULING

A. Sequence work in conjunction with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.11 WARRANTY

A. Provide one year manufacturer=s warranty.

B. Provide one year applicator=s warranty.

C. Warranty: Fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair such defects or failures.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Albi Manufacturing, Division of StanChem Inc., 401 Berlin St., East Berlin, CT 06023, 860-828-0571, or approved equal product from Carboline or Cafco.

2.02 MATERIALS

A. Intumescent Fireproofing: ALBI CLAD TF, Single component, water based, factory mixed, asbestos free, intumescent material blended for uniform texture; conforming to the following requirements:
   1. Surface Burning Characteristics, ASTM E84:
      a. Flame Spread: 2.
      b. Smoke Developed: 5.

B. Primer: Albi 487S, 490W, or type recommended or approved by fireproofing manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive work.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

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

D. Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.

E. Beginning of installation means applicator accepts existing substrate.

3.02 PREPARATION

A. Work in accordance with SSPC guidelines SSPC-SP-1, SSPC-SP-2, SSPC-SP-3, or SSPC-SP-6 as appropriate to prepare substrate.

B. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.

C. Seal all penetrations or open ended fireproofing termination by chamfering at a 45 degree angle and sealing with high heat silicone sealant.

D. Install reinforcement over structural members as indicated on Drawings, or U.L. Fire Resistance Directory Listings.

3.03 PROTECTION

A. Protect floor areas from this Work by completely covering with tarps or 4 mil polyethylene sheets.

B. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting.

C. Close off and seal ductwork in areas where fireproofing is being applied.

3.04 APPLICATION

A. Apply primer and fireproofing in accordance with manufacturer=s instructions. Do not apply to surfaces which would prohibit proper adhesions.

B. Apply primer according to primer manufacturer=s recommendations. Provide primer Acut-back@ three inches for bolted connections and 12 inches for welded connections.

C. Apply fireproofing in sufficient thickness to achieve rating, with as many passes necessary to cover with monolithic blanket of uniform hardness, density and texture. Spray, and roll smooth the finished surface.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 4510.

B. Inspections will be performed to verify compliance with requirements.

C. Patch fireproofing, which has been cut away to facilitate work of other trades, so as to maintain complete coverage of full thickness on appropriate substrate.

D. Correct unacceptable Work and provide further inspection to verify compliance with requirements, at no cost.

3.06 CLEANING

A. Clean work under provisions of Section 01 7000

B. Remove excess material, overspray, droppings, and debris.

C. Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping for fire-rated construction. Contractor is responsible for identifying various conditions requiring firestopping material and for submitting proposed UL Tested Assemblies for Architects review.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Material Safety Data Sheets: Submit MSDS for each firestop products.
   2. Shop Drawings: Show typical installation details for methods of installation. Indicate which firestop materials will be used where and thickness for different hourly ratings.
   3. Installer Documentation: Submit document from Firestop Manufacturer wherein Manufacturer recognizes, i.e. approves installer for said Manufacturer's Firestop products.
   4. Prepare job mock-up of the material proposed for use in the project as directed by Architect. Approved mock-ups may be left in place as part of the finished project and will constitute the standard for remaining work, including aesthetics.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

B. Firestopping material shall be asbestos free and free of any PCBs.

C. Do not use any product containing solvents or that requires hazardous waste disposal.

D. Do not use Firestop Products which after curing, dissolve in water.

E. Firestopping shall be performed by a contractor trained or approved by Firestop Manufacturer.

1.05 PRODUCT DELIVERY, STORAGE AND HANDING

A. Deliver material in the manufacturers' original, unopened containers or packages with manufacturer's name, product identification, lot numbers, UL-labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

C. All Firestop materials shall be installed prior to expiration of shelf life.

1.06 PROJECT CONDITIONS

A. Conform to Manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

1.07 WARRANTY

A. Firestop Contractor shall warranty that firestopping systems used meet firestopping requirements as herein specified.

1.08 SEQUENCING

A. Coordinate this work as required with work of other trades.

B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide materials from one of the following manufacturers:
   1. Hilti
   2. Cafco
   3. STI
   4. 3M
   5. Approved Equal.

2.02 MATERIALS

A. Provide mortars, sealants, caulks, putty, collars, pillows, wrap strips, composite sheets and related materials as required by the UL Design Assembly proposed for each individual application.

B. Accessories:
   1. Forming/Damming Materials: Mineral fiberboard or other type recommended by manufacturer.
   2. Primer, Sealant and Solvent Cleaner: As recommended by manufacturer.

C. Seal all penetration of sound isolating construction with non-hardening material.

2.03 SAFING INSULATION

A. Provide Thermafiber semi-rigid product compling with ASTM C665, Type I; minimum density of 4.0 pcf; passing ASTM E136 for combustion characteristics and with Fire Hazard Classification when tested according to ASTM E84; flame spread of 15 or less, fuel contribution of 0 and smoke development of 0.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where Firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect.

B. Verify that environmental conditions are safe and suitable for installation of Firestop product(s).

3.02 CONDITIONS REQUIRING FIRESTOPPING

A. General:
   1. Provide firestopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing, or otherwise.
   2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.

B. Building Exterior Perimeters:
   1. Where exterior facing construction is continuous past a structural floor, and a space would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural floor, provide firestopping to equal the fire resistance of the floor assembly. Mineral wool by itself is not an acceptable firestop, neither is mineral wool used with beads of caulking applied along length of mineral wool/curtain wall or mineral wool/floor slab junctures. If mineral wool

is part of firestop system, the mineral wool must be completely covered by appropriate thickness of UL listed Firestop Sealant.

2. Firestopping shall be provided whether or not there are any clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.
3. Where an exterior wall of composite type construction passes a perimeter structural member, such as a girder, beam, or strut, and the finish on the interior wall face does not continue up too close with the underside of the structural floor above, thus interrupting the fire-resistive integrity of the wall system, and a space would otherwise remain open between the interior face of the wall and the lower edge of the structural member, provide firestopping to continuously fill such open space.

C. Interior Walls and Partitions:
1. Where a wall or partition is continuous past a structural floor, such as at stairwells and vertical shafts, and a space would otherwise remain open between the wall face and perimeter edge of the adjoining structural floor, provide firestopping.
2. Provide firestopping whether or not there are any clips, angles, plates, or other members bridging or interconnecting the wall and floor systems, and whether or not such items are continuous.
3. Where the top edge of a fire-rated wall or partition abuts and is at right angle to fluted-type metal decking, and the construction is such that would otherwise leave the flute spaces open, provide firestopping.
4. Where the bottom track or plate of a partition meets the concrete slab provide firestopping sealant.
5. Where the bottom track or plate of a partition meets the top of the concrete block wall below the drywall partition provide firestopping sealant.

D. Penetrations:
1. Penetrations include conduit, cable, wire, pipe, duct, electrical boxes, fire extinguisher cabinets, toilet accessories or other elements which pass through or penetrate one or both sides of a fire rated floor, wall, or partition.
   a. If "5 sided" gypsum board enclosures are omitted where metal electrical back boxes not exceeding 16 square inches occur at one side only of a wall within a single stud cavity; provide fire stopping material described in this Section to completely encompass the back box and its annular space.
2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814.
3. Where penetrations occur at fire-rated walls or partitions of solid-type construction, provide firestopping to completely fill spaces around the penetration, in accordance with ASTM E 814.
4. Where penetrations occur at fire-rated walls or partitions of hollow-type construction, provide firestopping to completely fill spaces around the penetration, on each side of the wall or partition, in accordance with ASTM E 814.
5. 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 of opening.

E. Provide firestopping to fill miscellaneous voids and openings in fire-rated construction in a manner essentially the same as specified above.

3.03 INSTALLATION

A. General:
1. Installation of Firestops shall be performed by applicator/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply Firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Coordinates with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire related construction have been permanently installed prior to installation of Firestops, schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of Firestops.
4. At gypsum board fire walls the entire gap between the floor slab up to the bottom edge of the gypsum board is to be filled 100% and continuous.

B. Dam Construction: Install dams when required to properly contain Firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the Firestop system.

C. Field Quality Control:
1. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of firestopping which is to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code authorities.
5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.04 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, materials, tools, and equipment required to completely close (with caulking compound or sealant) all joints to give a finished appearance. Items to be caulked or sealed include but are not limited to the following:
   1. Hollow metal frames.
   2. Exterior doors, louvers, windows and any other openings in exterior walls.
   3. Plumbing fixtures.
   4. Flooring, paving and sidewalk joints.
   5. Joints shown on drawings or specified to be caulked or sealed.
   6. All joints or gaps between similar or dissimilar materials that do not receive closure trim are to be caulked/sealed with the appropriate material as listed in Part 2 of this Section.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Applicators: Use workmen thoroughly skilled and specially trained in techniques of caulking, and completely familiar with manufacturer's published recommendations for caulking material used.

B. Rejection of Installed Caulking: Lack of skill by caulking installers is sufficient ground for Architect to reject installed caulking and to require its removal and complete recaulking at Contractor's expense.

C. Guarantee: Guarantee caulking materials and workmanship, in writing for 2 years after substantial completion date. Repair at Contractors expense any defects developing within guarantee period.

D. Submit manufacturer's product data sheets and color selection information for every brand and type of sealant, caulk and accessory item proposed for use on this project.

1.05 PRODUCT HANDLING

A. Protection: Protect caulking materials before, during, and after installation. Protect installed work and materials of other trades. In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

B. Storage: Store caulking materials and equipment under conditions recommended by manufacturer. Do not use materials stored for period of time exceeding maximum recommended material shelf-life.

1.06 JOB CONDITIONS

A. Inspection: Carefully inspect installed work of trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

C. Do not install sealants under adverse weather conditions, or when temperatures are not within manufacturer's recommended limitations for installation. Install sealants only when forecasted weather conditions are favorable for proper care and development of high early bond strength.

PART 2 - PRODUCTS

2.01 MATERIALS FOR CAULKING AND SEALING

A. Select caulking materials for specific locations complying with manufacturers recommendations. Provide caulking, sealant and accessory items in color(s) selected to match adjacent materials or as selected by Architect from manufacturer's complete line.

B. 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: 250 g/L.
   2. Sealant primers for Nonporous Substrates: 250 g/L.
   3. Sealant primers for Porous Substrates: 775 g/L.

C. Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. Silicone Sealant 790/791/795 by Dow-Corning Corp.
   2. Sonolastic-OmniPlus by BASF.
   3. Silpruf SCS2000 by GE

D. Silicone Sealant for Weather Barrier Membranes: Refer to Weather Barrier specification and provide Dow Corning 758 Silicone Weather Barrier Sealant.

E. For soft joints adjacent to Architectural Precast Concrete and Cast Stone products, use Tremco, Inc., Spectrem 3, or approved equal Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT.

F. Mildew-Resistant Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
1. Silicone Sealant 786 by Dow-Corning Corp.
2. Sanitary 1700 by GE
3. Tremsil 200 Sanitary by Tremco

G. Acrylic Latex Caulk (interior only): General purpose, gun grade, nonsag, paintable, nonstaining latex sealant complying with ASTM C834.
1. Sonolac by Sonnoborn.
2. AC-20 + Silicone by Pecora.
3. Tremflex 834 by Tremco.

H. Acoustical Sealant: General purpose, gun grade, nonsag, paintable, nonstaining latex sealant complying with ASTM C834.
1. SHEETROCK Acoustical Sealant by U.S. Gypsum
2. AC-20 FTR by Pecora
3. Acoustical Sealant GSC by Grabber Construction Products
4. Acoustical Sealant by Tremco

I. Polyurethane Sealant (for vertical surfaces): Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
1. NP-1 by BASF.
2. Vulkem Dymonic FC by Tremco
3. Dynatrol I by Pecora.
4. QSC-102 by Carlisle.

J. Polyurethane Sealant (for horizontal surfaces): Single component, non-priming, self leveling, pourable grade product meeting ASTM C920, Type S, Grade P, Class 25.
1. SL-1 by BASF.
2. Vulkem 45SSL by Tremco
3. NR-201 by Pecora.
4. QSC-131 by Carlisle.

K. Parking Structure Silicone:
1. Horizontal (except cove joints) Non-Traffic Bearing: Single component, self-leveling, gray in color.
    a. Dow SL Parking Structure Sealant
    b. Dow FC Parking Structure Sealant, Fast Cure
    c. Tremco Spectrum 900-SL
2. Horizontal Traffic Bearing and Vertical and Cove: Traffic bearing, single component, non-sag, gray in color.
    a. Dow NS Parking Structure Sealant
    b. Tremco 800

2.02 SEALANT BACKER RODS

A. Sealant Backer Rod for general use except at floor and deck joints: Open cell type as recommended by sealant manufacturer for compatibility with sealant.

B. Sealant Backer Rod for use at floor and deck joints: Closed cell type as recommended by sealant manufacturer for compatibility with sealant.

C. Provide rod sized and shaped to control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

2.03 MISCELLANEOUS MATERIALS

A. Joint Cleaner Compound: Use type recommended by sealant and caulking compound manufacturer for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Use type recommended by sealant manufacturer for joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Use self adhesive polyethylene tape or plastic tape recommended by sealant manufacturer. Apply to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

D. Joint Filler: W.R. Meadows, Sealtight Standard Cork, Expansion Joint Filler produced from clean, selected, granulated cork bonded with a phenolic resin, or approved equal meeting ASTM D 1752, Type II.

2.04 GENERAL APPLICATION GUIDE

A. Interior caulking, except joints with ceramic tile, metal, glass and aluminum: Acrylic Latex Caulk.

B. Sound rated walls, partitions and ceilings: Acoustical Sealant.

C. Interior and Exterior joints with metal, glass and aluminum: Silicone sealant.

D. Joints with ceramic tile and plumbing fixtures: Mildew resistant Silicone sealant.

E. Horizontal and Vertical building joints: Polyurethane sealant.

F. Paving Joints: Refer to Division 32

G. Horizontal and Vertical building joints: Parking Structure Silicone

PART 3 - EXECUTION

3.01 CHOICE OF CAULKING MATERIAL

A. Use sealant and caulking materials best suited to the installation and recommended by caulking material manufacturer.

3.02 INSPECTION

A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed. Do not proceed with joint sealer work until unsatisfactory conditions are corrected.

3.03 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants and caulking compounds. Remove dirt, insecure coatings, moisture and substrates which could interfere with gasket seal and bond of sealant or caulking compound. Etch concrete and masonry joint surfaces when recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces recommended by sealant manufacturer.

B. Prime or seal joint surfaces where required, and when recommended by sealant manufacturer. Confine primer/sealer to areas of sealant bond. Do not allow spillage and migration onto adjoining surfaces.

3.04 INSTALLATION

A. Comply with manufacturer's printed instructions except when more stringent requirements are specified, and except when manufacturer's technical representative directs otherwise.

B. Set joint filler units at depth and position in joint as required to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod except when required to be omitted or recommended to be omitted by sealant manufacturer for application required.

D. Install bond breaker tape when required by manufacturer's recommendations to ensure liquid-applied sealants will perform as intended.

E. Employ proven installation techniques, which ensure sealants are deposited in uniform, continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise required, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints occur between a horizontal surface and vertical surface, fill joint to form a slight cove, so joint will not trap moisture and dirt.

F. Install liquid-applied sealant to depths required and as recommended by sealant manufacturer.

G. Spillage: Do not allow sealants and compounds to overflow from joint confines or to spill onto adjoining work, or to migrate into voids of exposed finished. Clean adjoining surfaces to eliminate evidence of spillage without damaging adjoining surfaces.

H. Recess edges of exposed joint fillers slightly behind adjoining surfaces, unless otherwise required, so compressed units will not protrude from joints.

I. Acoustical Sealant Application: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

1. Where sound rated walls and partitions are penetrated by pipe, conduit, duct, etc.; pack annular space with acoustical fiberglass insulation until flush with both faces of wall. Seal both sides and the entire annular space between the penetrating item and the wall board with acoustical sealant. Also, seal at top and bottom edges of acoustical walls and partitions where wall board abuts a horizontal surface. Joint is to be full and continuous from slab to gypsum board edge at bottom of gypsum board walls.
2. Do not allow any rigid material or connection to bridge the separation between the acoustical construction and the penetrating item. Upon inspection, if bridging is found to exist, all sealed penetrations may be ordered removed and resealed at Contractor's expense.

3.05 CURE AND PROTECTION

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Cure and protect sealants in manner which will minimize increases in modules of elasticity and accelerated aging effects.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Exterior and interior expansion control assemblies, complete.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings:
   1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, entire route of each joint system, and attachments to other work. Where joint system change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
   2. Schedule: Prepared by or under supervision of supplier. Include the following information in tabular form:
      a. Manufacturer and model number of each joint system.
      b. Joint system location cross-referenced to drawings.
      c. Nominal joint width.
      d. Movement capability.
      e. Classification as thermal or seismic.
      f. Materials, colors, and finishes.
      g. Product options.

1.04 QUALITY ASSURANCE

A. Obtain expansion joint cover assemblies from one source from single manufacturer.

B. Installer Qualifications: Approved by manufacturer.

1.05 PROJECT/SITE CONDITIONS

A. Deliver joint covers to project site in new, clean, unopened containers of size and strength to protect materials during shipping.

B. Store materials in original containers in dry location.

1.06 WARRANTY

A. Provide manufacturer's standard warranty one year material and workmanship warranty for each type of expansion joint system, except two years for roof expansion assemblies by manufacturer and installer.

1.07 COORDINATION

A. Coordinate work with work of other trades.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Construction Specialties, Inc. is specified. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Balco, Inc.
   2. MM Systems.

2.02 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions, ASTM B 209, alloy 6061-T6 for plate and 5052-H32 alloy for sheet.
   1. Protect aluminum surfaces to be placed in contact with cementitious materials with a protective coating.
   2. Aluminum Finish: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations. Apply finishes in factory after fabrication. Protect finishes on exposed surfaces before shipment.
      a. Mill finish.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames. Seal color as selected by Architect.

C. Strip Seals: ASTM E 1783; preformed elastomeric membrane or tubular extrusions having an internal baffle system and secured in or over a joint by a metal locking rail. Seal color as selected by Architect.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, filler materials, lubricant, adhesive, and other accessories compatible with material in contact, as indicated and required for complete installations.

2.03 EXPANSION JOINT ASSEMBLIES

A. General: Provide assemblies of design, basic profile, materials, and operation indicated. Provide units comparable to those specified to accommodate joint size, variations in adjacent surfaces, and structural movement without material degradation or fatigue when tested according to ASTM E 1399.
   1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abutts other materials.
   2. Include closure materials and transition pieces, tee-joints, corner, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

B. Design assemblies for sizes and movement characteristics as indicated on drawings.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces where joint assemblies will be installed for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations, including preparing substrate, applying materials, and protecting installed units.

B. Provide anchorage devices and fasteners where necessary to secure assemblies to in-place construction, included threaded fasteners with drilled-in expansion shields for masonry. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of assemblies.

3.03 INSTALLATION

A. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper installation and performance.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Location in continuous contact with adjacent surfaces.

5. Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
6. Locate anchors at interval recommended by manufacturer, but not less than three inches from each end and not more than 24 inches o.c.

B. Seals In Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Mechanically lock seals into frames or adhere to frames with adhesive of pressure-sensitive tape as recommended by manufacturer.

C Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

D. Roof Expansion Assemblies: Extend roof expansion joint assemblies over curbs with factory-fabricated transitions to provide continuous uninterrupted, waterproof roof expansion assembly.

3.04 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

3.05 SCHEDULE

A.

END OF SECTION