USDA Forest Service

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Redwood Sciences Laboratory
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Roofing Specifications

SECTION 05 52 17 ROOFTOP FALL PROTECTION

PART 1 - GENERAL
1.1 REFERENCES

A. American National Standards Institute (ANSI): ANSI A14.3 - American National Standards for Ladders - Fixed - Safety Requirements.

B. American Welding Society: AWS D1.1 - Structural Welding Code - Steel.

C. American Welding Society: AWS D1.3 - Structural Welding Code - Sheet Steel.

D. California Occupational Safety & Health Administration (CAL OSHA): 1620 - Design of Temporary Railing.

E. California Occupational Safety & Health Administration (CAL OSHA): 1621 - Railings and Toe Boards.

F. California Occupational Safety & Health Administration (CAL OSHA): 3214 - Stair Rails and Handrails.

G. Occupational Safety and Health Administration (OSHA): 29 CFR 1910.28 Duty to Have Fall Protection and Falling Object Protection.

H. Occupational Safety and Health Administration (OSHA): 29 CFR 1910.29. Walking-Working Surfaces.

I. Occupational Safety and Health Administration (OSHA): 29 CFR 1926.500 - Scope, Application, and Definitions Applicable to this Subpart.

J. Occupational Safety and Health Administration (OSHA): 29 CFR 1926.502 - Fall Protection Systems Criteria and Practices.

1.2 SUBMITTALS

K. Product Data: Manufacturer's data sheets on each product to be used, including:
   1.3 Preparation instructions and recommendations.
   1.4 Storage and handling requirements and recommendations.
   1.5 Installation methods.

   Shop Drawings: Drawings showing plans, elevations, sections and details of components. Show member sizes and part identification, fasteners, anchors, fittings and evidence of compliance with structural performance requirements.

B. Manufacturer's Certificates:
   1.1 Certify that Railings and Base Castings are made in USA. Provide steel mill and foundry certificates for verification prior to shipment.
   1.2 Manufacturer must be American Welding Society Welding Certified for Welding Standards AWS D1.1 and AWS D1.3. Third party qualification documentation required prior to shipment.

1.2 DELIVERY, STORAGE, AND HANDLING
   1.1 Deliver materials to the job site in good condition and adequately protected against damage as handrails are a finished product.
   1.2 Inspect rail sections for damage before signing the receipt from the trucking company. Truck driver must note damaged goods on the bill of lading if damaged product is found.
   1.3 Store products in manufacturer's unopened packaging until ready for installation.
   1.4 Products to be palletized and labeled by roof level or designated drop zone.

PROJECT CONDITIONS

Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

WARRANTY

Warranty: Provide manufacturer's limited two-year warranty.

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Simplified Safety or approved equal for parapet railing for rooftop.

PERMANENT GUARD RAILS

Roof Edge Protection: Provide Safety Rail Company permanently attached fall barrier system on roof, including pipe railings, bases, accessories and fittings.

2.1 Product: Floor Mount Guardrail System, Permanent.

2.2 System top and mid rail provided in accordance with OSHA Standards - 29 CFR.29 (b)(1-14).

2.3 Structural Load: 200 lb (90.7 kg), minimum, in any direction to all components in accordance with OSHA Regulation 29 CFR 1926.502.

2.4 Tested and independently certified to be in accordance with OSHA fall protection for guardrail regulations, sections 29 CFR 1910.29, 29 CFR 1926.500, 29 CFR 1926.502 and 29 CFR 1926.503.

2.5 Railings: 1-5/8 inch (41 mm) O.D. hot rolled pickled electric weld tubing, free of sharp edges and snag points.

A. Railing to be permanently attached to bases and building structure.

2.6 Height: 42 inches (1067 mm), minimum.

2.7 Length: Available in 1 ft (305 m) increments from 2 to 10 ft (0.61 to 3.05 m) measures to the center of each leg post.

2.8 Length: As measured in field to install on full length of low parapet section as indicated on drawing.

2.9 Single Post Receivers: The first and last piece of a safety railing installation.

2.10 Double Post Receiver: The intermediate receiver for in-line railing runs.

2.11 Accessories:

2.12 Finish: Steel surfaces.

A. Hot Dip Zinc Galvanized and factory finished powder coat paint.

B. Color: bronze from manufacturer’s standard color line to match new parapet flashing. Submit sample for approval.

PART 3 - EXECUTION

SCHEDULE 0 - EXAMINATION

PRODUCT DATA SHEET 0 - Do not begin installation until substrates have been properly prepared.

PRODUCT DATA SHEET 1 - If substrate preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

SCHEDULE 1 - PREPARATION

PRODUCT DATA SHEET 0 - Clean surfaces thoroughly prior to installation.

PRODUCT DATA SHEET 1 - Prepare surfaces using the methods recommended by the manufacturer .

SCHEDULE 2 - INSTALLATION

PRODUCT DATA SHEET 0 - Install in accordance with manufacturer's instructions, ap-

proved submittals and in proper relationship with adjacent construction.

PRODUCT DATA SHEET 1 - Seal beneath screwed in base plates at all penetrations made in to new parapet flashing so that water tightness of parapet wall is not compromised.

SCHEDULE 3 - PROTECTION

PRODUCT DATA SHEET 0 - Protect installed products until completion of project.

PRODUCT DATA SHEET 1 - Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 552173

SECTION 074113 - FORMED METAL ROOF PANELS

PART 1 - GENERAL

3.1 SUMMARY

A. Prefinished standing seam aluminum roof panels.

3.2 DESIGN CRITERIA

A. General: Installed metal panel roof system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Installer shall comply with current code requirements based on authority having jurisdiction.

D. Wind Uplift Performance: Roofing system shall meet the intent of systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A UL 790, for application and roof slopes indicated.

3.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

3.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

3.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

3.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

3.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by metal panel manufacturer.

3.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
3. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 4 - PRODUCTS

4.1 PERFORMANCE REQUIREMENTS

A. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.
2. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
3. Fire/Windstorm Classification: Class 1A- 90.

4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
5. Temperature Change (Range): 120 deg F, ambient; 180 deg F , material surfaces.

4.2 STANDING SEAM ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels. Include accessories required for weathertight installation.

B. Provide PAC-CLAD Snap-Clad .032 aluminum 12" wide standard smooth continuous interlock panel, 1 ¾" high rib

1. Material: .032 aluminum nominal thickness.

   a. Exterior Finish: 2-coat fluoropolymer.
   b. Color: To match existing (to be replaced) bronze parapet flashing from manufacturer's standard color range.

4.3 UNDERLAYMENT MATERIALS

A. Provide WIP 300 HT Self-Adhering Synthetic Underlayment by Carlisle – Pac-Clad.

4.4 INSULATION

A. Provide H Shield Polyisocyanurate 1 ½" thickness

4.5 COVER BOARD

A. Provide 1/2" USG Securock Gypsum Fiber Cover Board

4.6 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub framing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Gutters: at stair shaft eaves: provide gutters to match existing profile.
   1. Color: Factory finished to match existing (to be replaced) bronze parapet flashing from manufacturer's standard color range.

C. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

    a. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
    b. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
    c. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.

4. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
5. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
6. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

4.7 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

4.8 FINISHES

1. Panels and Accessories:
2. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
3. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 5 - EXECUTION

5.1 PREPARATION

A. Miscellaneous Supports: Install sub framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

B. Replace damaged sheathing with CDX plywood, thickness to match existing, or other underlayment approved by roofing manufacturers and project COR.

5.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below and on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.
      a. Flashings: Install flashings to cover underlayment to comply with manufacturer’s requirements.

5.3 GUTTER INSTALLATION
   A. Space gutter hangers at 18” O.C.
   B. Provide and install continuous gutter leaf guards.

5.4 INSULATION INSTALLATION
   A. Install per manufacturer’s recommendations using SIP WD fasteners for plywood decking.

5.5 COVER BOARD INSTALLATION

A. Use fasteners in accordance with Factor Mutual Global requirements.

B. Install fasteners in compliance with roof manufacturer’s recommendations and FMG Loss Prevention Data Sheet 1-29.

5.6 METAL PANEL INSTALLATION

A. Continuous Interlock Standing Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
3. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
4. Flash and seal panels with weather closures at perimeter of all openings.

a. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

b. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

5.7 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113

SECTION 075216 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

5.8 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

1. ASTM D 1079 "Standard Terminology Relating to Roofing and Waterproofing."
2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
3. Roof Consultants Institute "Glossary of Building Envelope Terms."

B. Sheet Metal Terminology and Techniques: SMACNA "Architectural Sheet Metal Manual."

5.9 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Installer shall comply with current code requirements based on authority having jurisdiction.

D. Wind Uplift Performance: Roofing system shall meet the intent of systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A UL 790, for application and roof slopes indicated.

5.10 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

5.11 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives and sealants, indicating VOC content.
   2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

   1. Layout and thickness of insulation.
   2. Base flashings and roofing terminations.
   3. Flashing details at penetrations.
   4. Tapered insulation, including slopes.
   5. Roof plan showing fastening spacings, and patterns for mechanically fastened roofing system.
   6. Crickets, saddles, and tapered edge strips, including slopes.
   7. Insulation-fastening patterns for corner, perimeter, and field-of-roof locations.

D. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

E. Verification Samples: Provide for each product specified.

F. Installer Certificates: Confirmation that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

5.12 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

   1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roof insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

5.13 CLOSEOUT SUBMITTALS

A. Maintenance data.

5.14 QUALITY ASSURANCE

A. Qualifications:
1. Installer: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

5.15 WARRANTY

A. Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by Johns Manville Roofing Systems indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 329.

C. Test Reports:

1. Roof drain and leader test or submit plumber’s verification.
2. Core cut, if required.

3. Roof deck fastener pullout test, if required.

D. Moisture Survey

1. Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:

a. Infrared Thermography
b. Nuclear Backscatter

E. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

5.16 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

5.17 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

5.18 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, roofing membrane, roof insulation, fasteners, Adhesives, cover board, walkway products, manufacturer’s edge metal

products, and other approved single-source components of roofing system marketed by the manufacturer.

2. Guarantee Period: 20 years from date of Substantial Completion.
3. Contractor is required to list US Forest Service Region 5 as the Specifier/Consultant of record in the appropriate fields ("Specifier Account") when applying for the manufacturer's warranty.

B. Installer's Guarantee: Submit roofing Installer's guarantee, signed by Installer, covering work of this Section, including all components of roofing system, for the following guarantee period:

1. Guarantee Period: Five years from date of Substantial Completion.

PART 6 - PRODUCTS

6.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746/C3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

D. See Appendix A for roof plan and dimensions.

E. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-90.

F. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical to that specified for this Project.

1. Wind Uplift Load Capacity: 90 psf.

G. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

H. ENERGY STAR Listing: Roofing system to be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

I. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to ANSI/CRRC S100.

J. Exterior Fire-Test Exposure: ASTM E108 or UL 790, ╟Class C; for application and roof slopes indicated; testing by a qualified testing agency.

1. Identify products with appropriate markings of applicable testing agency.

K. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.

1. Identify products with appropriate markings of applicable testing agency.

6.2 MANUFACTURERS

A. SBS-modified bituminous membrane roofing**:** See the following articles for individual roof materials required.

1. Manufacturers: Subject to compliance with requirements, provide products by Johns Manville or equal.
   a. Any proposed substitutions must be fully documented and approved.
   b. See full system outline and graphics in Appendix C.

B. Source Limitations: Obtain components for roofing system from same manufacturer as roofing membrane or manufacturer approved by roofing membrane manufacturer.

1.1 BASE PLY AND CAP SHEET MATERIALS

A. Roofing Membrane Sheet: SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.

1. ASTM D 6164, Grade S, Type I, polyester-reinforced, Basis of design: DynaLastic 180 S

B. Roofing Membrane Cap Sheet: SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.

1. ASTM D 6164, Grade G, Type I, polyester-reinforced, Basis of design: DynaLastic 180 FR CRG

1.2 FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides. Basis of design: PermaPly 28

B. Backer Sheet**:** SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.

1. ASTM D 6164, Grade S, Type I, polyester-reinforced, Basis of design: DynaLastic 180 S

C. Flashing Sheet: SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.

1. ASTM D 6164, Grade G, Type I, polyester-reinforced, Basis of design: DynaLastic 180 FR or DynaLastic 180 FR CRG

D. Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitch bonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator. Basis of design: PermaFlash System

1.3 AUXILIARY ROOFING Materials

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

B. Roofing Asphalt: ASTM D 312-15, Type IV**.**

C. Asphalt Primer: ASTM D 41. Basis of design: JM Asphalt Primer

D. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, one-part, asphalt-based, trowel-grade mastic, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of design: MBR Utility Cement

E. One-part, solvent-free, moisture-curing, elastomeric cold-application adhesive specially formulated for compatibility and use with SBS membrane applications. Basis of design: DynaSet 1k

F. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-part, elastomeric, liquid-applied, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of design: MBR Flashing Cement

G. Mastic Sealant: As required by Johns Manville.

H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors. Basis of design: JM Termination Systems

I. Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer. CR Roofing Granules

J. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

1.4 WALKWAYS

A. Walkway Pads: Mineral-granule-surfaced, reinforced modified asphalt composition, slip-resisting pads, manufactured as a traffic pad for foot traffic provided by roofing system manufacturer, with a pad size of 32-inch x 32-inch. Basis of design: DynaTred Walkway

1.5 COVER BOARD

A. High-Density Polyisocyanurate: ASTM C 1289, Type II, Class 4, Grade 1, High-density Polyisocyanurate technology bonded in-line to inorganic coated glass facers with greater than 80 lbs. of compressive strength. Basis of design: ProtectoR HD

1. Thickness: 1/2 inch (13 mm)
2. R-value: 2.5

1.6 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), Basis of design: ENRGY 3
1. Provide insulation package with minimum R Value: R8
2. Provide insulation package with minimum thickness: 1.5”.
3. Provide insulation package in multiple layers.
4. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.
   a. Determined in accordance with CAN/ULC S770 at 75ºF (24ºC)

1.7 TAPERED INSULATION

A. Tapered Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Basis of design: Tapered ENRGY 3

1.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide saddles, crickets, tapered edge strips, and other insulations shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of design: Tapered Fesco Edge Strip.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of design: All Purpose Fasteners and UltraFast Plates

D. Insulation Cant Strips: ASTM C 728, perlite insulation board. Basis of design: FesCant Plus

PART 7 - EXECUTION

7.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. General:
      a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
      b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   2. Wood Decks:
      a. Verify that wood decking is visibly dry and free of moisture.
      b. Verify that wood has ability to provide minimum fastener pull-out resistance.
         1) Provide documentation of pull-out resistance values in accordance with ANSI/SPRI FX-1 2016.
   3. Wood Decks:
      a. Verify that parapet wood blocking is visibly dry and free of moisture.
      b. Remove and replace any damaged sections.
   4. Ensure general rigidity and proper slope for drainage.
   5. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units more than 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner’s Representative and shall be corrected prior to installation of roofing system.

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

7.2 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. Perform fastener-pullout tests according to roof system manufacturer's recommendations.

1. Submit test result within 24 hours of performing tests.

    a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Proceed with each step of installation only after unsatisfactory conditions have been corrected.

7.3 RE-ROOF PREPARATION

A. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives, etc.
1. Remove an area no larger than can be re-roofed in one day.

B. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, parapet flashing, vents, sumps, and like components necessary for application of new membrane.

C. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.
1. Install decking to match existing as directed by Owner's Representative.

D. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
2. Secure of flashing and install new metal counterflashing prior to re-installation of unit.

3. Perimeter nailers shall be elevated to match elevation of new roof insulation.

E. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.

7.4 INSTALLATION OF ROOFING, GENERAL

A. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.

1. Remove and discard temporary seals before beginning work on adjoining roofing.

B. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing components or adjacent building construction.

7.5 INSTALLATION OF INSULATION

A. Coordinate installation of roof system components so insulation and cover board are not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated on tapered insulation plan in Appendix B.

D. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.

E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Loose Laid Insulation: Loose lay all layers of insulation with staggered joints.

7.6 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
   1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Mechanically Fastened Cover Board: Install cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof cover board to deck type.
   1. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

7.7 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24), contact the membrane manufacturer for installation instructions regarding installation direction and back nailing

D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

7.8 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install one modified bituminous roofing membrane base sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, with the following installation method:
   1. Unroll roofing membrane sheets and allow them to relax.
   2. Install one lapped base sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
      a. Enhance fastening rate in perimeter and corner zones according to code or manufacturer, whichever is more stringent.
      b. Side and end laps shall be installed using heat welding techniques.
      c. Fasteners in field of sheets shall be stripped in per manufacturer’s requirements prior to installing cap sheet.
   3. Adhere modified bituminous roofing membrane base sheet and cap sheet to substrate in cold-applied adhesive according to roofing system manufacturer’s instruction.

B. Extend membrane and cap sheet up walls or parapets, wrap over wood blocking and under new flashing. Refer to manufacturer's standard flashing details.

C. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
   1. Repair tears and voids in laps and lapped seams not completely sealed.
   2. As required, apply roofing granules to cover exuded bead at laps while bead is hot.

D. Install roofing membrane sheets so side and end laps shed water.

7.9 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets.
   3. Flashing Sheet Application: Adhere flashing sheet to substrate in approved adhesive applied at rate required by roofing system manufacturer.

B. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

C. Flash all penetrations using liquid applied flashing system.

7.10 PARAPET FLASHING AND EDGE METAL INSTALLATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Provide edge details as recommended by roofing manufacturer

C. Install in accordance with the membrane manufacturer's requirements and SMACNA's "Architectural Sheet Metal Manual."

D. Join individual sections in accordance with the membrane manufacturer's requirements and SMACNA's "Architectural Sheet Metal Manual”.

7.11 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
   1. Sweep away loose aggregate surfacing and set walkway pads in additional cold applied adhesive.
   2. Install walkway pads 32 inches in width full perimeter of all mechanical units.
   3. Install walkway pads 32 inches in width full perimeter of stair and elevator shafts.

7.12 EQUIPMENT RE-INSTALLATION

A. Contractor to have HVAC Equipment, including but not limited to exhaust fans, lab exhaust fans, intake ductwork, etc., uninstalled and reinstalled by licensed HVAC professionals.

B. Equipment to be reinstalled according to design and manufacturer’s instructions, and to be balanced where needed.
   1. Special attention should be paid to equipment servicing laboratories, in uninstalling and reinstalling them per code and design.

7.13 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Perform the following tests:

1. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ASTM D7954/D7954M.

    a. Perform tests before overlying construction is placed.
    b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.

        1) Cost of retesting is Contractor's responsibility.

    c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.

2. High-Voltage Membrane Testing: Testing agency surveys flashings and parapet walls to locate discontinuity in the roof membrane using an electrically charged metal "broom head."

    a. Perform tests before overlying construction is placed.
    b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.

        1) Cost of retesting is Contractor's responsibility.

    c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

7.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing components that do not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 075216

SECTION 22423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: For each type of product.

C. Sustainable Design Submittals:
   1. Product Data: For adhesives and sealants, indicating VOC content.
   2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

D. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

   1. Layout and connection to interior piping
   2. Flashing and connection to new roof membrane
   3. Flashing details at penetrations.

E. Installer Certificates: Confirmation that Installer is approved, authorized, and licensed to install roof drains and associated piping.

F. Product Data: for each type of product indicated and required.

1.2 QUALITY ASSURANCE.

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
B. Inspect entire existing drain assembly and fittings. Remove and replace as needed and to comply with roof drain and roof membrane manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe; Wade Div.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: Match dimension of existing drains to be removed and replaced.
5. Outlet Location: Bottom.
6. Outlet Size: match that of existing to be replaced
7. Underdeck Clamp: Required.
8. Dome Material: PE.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Boots:
   1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; 4-inch outlet; and shop-applied bituminous coating.
   2. Size: Inlet size to match downspout and 4-inch outlet.
B. Conductor Nozzles for Emergency Drain:
   1. Description: Nickel bronze body with threaded inlet and nickel bronze wall flange with mounting holes.
   2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Verify in field what type of clean outs exist. Inspect, with COR, and modify or replace as required to provide fully functioning roof drains.
B. Provide the following as needed:
C. Floor Cleanouts FCO:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe; Wade Div.
      d. Zurn Plumbing Products Group; Specification Drainage Operation..

2. Standard: ASME A112.36.2M, for adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule Material: ABS.
6. Clamping Device: Required.
7. Outlet Connection: Inside caulk.
8. Closure: Plastic plug.
9. Adjustable Housing Material: ABS Plastic with threads.
10. Frame and Cover Material and Finish: Scoriated Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Medium Duty.

D. Test Tees:
1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or Hubless, cast-iron soil- pipe test tee as required to match connected piping.
4. Closure Plug: raised head, brass.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

E. Wall Cleanouts WCO:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. Smith, Jay R. Mfg. Co.
   c. Tyler Pipe; Wade Div.
   d. Zurn Plumbing Products Group; Specification Drainage Operation..
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.4 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft..

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04- inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill- phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains as indicated in plan or in place of existing roof drains to be removed and according to roof membrane manufacturer's written installation instructions.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

B. Upon field inspection, install the following as needed to replace existing
   1. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.
   2. Install conductor nozzles at exposed bottom of conductors where they spill on to grade.
   3. Install cleanouts in above ground piping and building drain piping according to the following instructions unless otherwise indicated.
   4. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   5. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   6. Locate cleanouts at minimum intervals of 100 feet.
   7. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

G. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Replace existing piping as required and match existing materials and dimensions as approved by COR.

3.3 FLASHING INSTALLATION

A. Provide and install flashing materials that comply with roof drain and roofing membrane manufacturer’s recommendations.

B. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

C. Set flashing on roofs in solid coating of product recommended by roof membrane manufacturer.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.as required.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

APPENDIX A

ADD ROOF PLAN

APPENDIX B

ADD TAPERED INSULATION ROOF PLAN

APPENDIX C

ADD JOHNS MANVILLE SYSTEM INFO SHEETS (2)