

**ROOF PROJECTS – OREGON ZOO
ATTACHMENT 1
FELINE BUILDING ROOF REPLACEMENT
ATTACHMENT 2
HOOFSTOCK BUILDING ROOF REPLACEMENT**

Project Manual

RFB # 13-2394

APRIL 2013

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SECTION 07 5216
SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This Section outlines the requirements for the supply and installation of the SBS modified bituminous sheet roofing.
 - 1. The membrane will be installed as part of a roof assembly, which consists of: SBS membrane, backer board, tapered roof deck insulation, and existing deck substrate.

1.2 RELATED WORK:

- A. Division 01 Section "General Requirements"

1.3 REFERENCES:

- A. American Society of Testing and Materials (ASTM):
- B. Factory Mutual Research Corporation (FMRC):
- C. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual-current edition.
- D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- E. Underwriters Laboratories (UL) - Roofing Materials and Systems Annual Directory.
- F. CERTA Certified Roofing Torch Applicator
- G. OSHA Occupational Safety and Health Administration

1.4 PERFORMANCE REQUIREMENTS

- A. The roof assembly shall remain watertight and shall not permit the passage of water under ponding or hydrostatic pressure. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.

1.5 SUBMITTALS

- A. Product Data for each of the listed product. Include manufacturer's printed installation instructions.

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- B. Shop Drawings:
 - 1. Provide complete installation details of roofing including but not limited to walls, curbs, drains, penetrations, edges, control joints, and all terminations. Show layout of sheets, location of field splices and attachment details showing specific wall and deck construction, entire roof assembly, and additional blocking as required.
 - 2. Include notation of roof slopes.
- C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install the roofing system
- D. Product Certificates: Signed by roofing manufacturer certifying that the roofing system complies with specified requirements.
- E. Manufacturer's Approval: Submit manufacturer's approval of all components of roof assembly, including insulation, as not being injurious to the membrane or roofing system as located.
- F. Sample Warranty: Submit in accordance with Section 01
- G. Closeout Submittals:
 - 1. Warranty: Upon completion of work under this section, submit an executed copy of the warranty in accordance with Section 01.
 - 2. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices for roofing membrane specified. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of membrane roofing.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in work of this Section with minimum 5 years continuous documented experience for roofing work comparable to Project Scope. Installer must be certified or approved by roofing manufacturer to install specified system.
 - 1. Applicator must have installed at least five roofs of similar materials and methods specified for this project.
- B. Manufacturer's Qualifications: Must have a minimum of 10 years' experience manufacturing SBS modified bitumen roofing membranes, minimum 5 years' such as the base system specified in this Section.
 - 1. Provide a factory trained technician to conduct inspections and to ascertain that roofing system has been installed in accordance with the manufacturer's warranty requirements.
- C. Source Limitations: Obtain components for roofing system approved by roofing system manufacturer.
- D. Regulatory Requirements
 - 1. Conform to applicable Federal, State and Local codes.
- E. Pre-Installation Conference: Conduct conference at Project site.
 - 1. Include all parties responsible for work of this section including manufacturer's representative.
 - 2. Review installation procedures and coordination required with related and interfacing work.
 - 3. Inspect and make notes of project site conditions prior to installation.

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- F. Mockups: Before beginning installation, install roofing mock-up, as directed by Owner or Owner's Representative, to demonstrate surface preparation, corner treatment, and execution quality.
 - 1. Mock-up shall include typical base and cap ply installation, typical penetration flashing, roof edge detailing, and typical drain installation.
 - 2. Mock ups should be three foot by three foot.

1.7 DELIVERY, STORAGE AND MARKING:

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weather tight facilities, and in strict compliance with manufacturer's instructions.
- C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.8 PROJECT CONDITIONS

- A. Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. 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.

1.9 WARRANTY:

- A. Roofing assembly, including insulation and membrane flashing, to be guaranteed by manufacturer and Contractor to the Owner against leaks, failures, or damage due to wind. Guarantee to provide full labor and materials as required to restore roof system to weathertight condition without cost to Owner.
 - 1. Manufacturer's warranty to provide the primary coverage and will be looked to for initial relief from all claims made by the Owner.
 - a. Warranty Period: 20 years.
 - 2. Contractor's warranty to provide secondary coverage to the extent that the manufacturer's warranty does not apply. The Contractor will be looked to for relief from all claims made by the Owner and not provided by the manufacturer.
 - a. Warranty Period: 2 years.
- B. Warranties to be non-prorated.
- C. Green Roof (Alternate).
 - 1. Green roof warranty is to cover the following:
 - a. Overburden removal and replacement should there be a warrantable leak.
 - b. Establishment period for plants; minimum 90% coverage in two years.

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PART 2 - PRODUCTS

2.1 GENERAL

- A. A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate. Both reinforcement mats shall be impregnated/saturated and coated each side with an SBS modified bitumen blend.
- B. The cross sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°F (-10°C). Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles.
- C. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147.
- D. Assembly components:
 - 1. Existing Concrete for Felines Roof; Plywood decking for Hoofstock Roof
 - 2. Primer for Felines roof; pre-primed substrate board for Hoofstock
 - 3. Vapor Barrier
 - 4. Polyisocyanurate insulation
 - 5. Cover board
 - 6. Membrane base ply
 - 7. Membrane finish ply
 - 8. Membrane flashing

2.2 MANUFACTURERS

- A. Subject to compliance with specified requirements, product system from the following manufacturers may be used.
 - 1. Siplast
 - 2. Soprema
 - 3. Tremco

2.3 MEMBRANE BASE PLY

- A. Membrane base ply shall have the following characteristics:
 - 1. Thickness (avg): 91 mils (2.3 mm) (ASTM D 5147)
 - 2. Thickness (min): 87 mils (2.2 mm) (ASTM D 5147)
 - 3. Weight (min per 100 ft² of coverage): 62 lb (3.0 kg/m²)
 - 4. Maximum filler content in elastomeric blend - 35% by weight
 - 5. Low temperature flexibility @ -13°F (-25°C): PASS (ASTM D 5147)
 - 6. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 - 7. Peak Load (avg) @ 0°F (-18°C): 70 lbf/inch (12.3 kN/m) (ASTM D 5147)
 - 8. Ultimate Elongation @ @ 73°F (23°C): 50% (ASTM D 5147)
 - 9. Dimensional Stability (max): 0.1% (ASTM D 5147)
 - 10. Compound Stability (min): 250°F (121°C) (ASTM D 5147)
 - 11. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 - 12. Reinforcement: fiberglass mat

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2.4 MEMBRANE FINISH PLY

- A. The Roofing Membrane finish ply shall have the following characteristics:
1. Thickness (avg): 130 mils (3.3 mm) (ASTM D 5147)
 2. Thickness at selvage (coating thickness) (avg): 98 mils (2.5 mm) (ASTM D 5147)
 3. Thickness at selvage (coating thickness) (min): 94 mils (2.4 mm) (ASTM D 5147)
 4. Weight (min per 100 ft² of coverage): 90 lb (4.4 kg/m²)
 5. Maximum filler content in elastomeric blend: 35% by weight
 6. Low temperature flexibility @ -13° F (-25° C): PASS (ASTM D 5147)
 7. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 8. Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 9. Ultimate Elongation @ 73°F (23°C): 55% (ASTM D 5147)
 10. Dimensional Stability (max): 0.1% (ASTM D 5147)
 11. Compound Stability (min): 250°F (121° C) (ASTM D 5147)
 12. Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
 13. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 14. Reinforcement: fiberglass mat Surfacing: ceramic granules

2.5 FLASHING PLY

- A. The Flashing Ply shall have the following Characteristics:
1. Thickness (avg): 154 mils (3.9 mm) (ASTM D 5147)
 2. Thickness at selvage (coating thickness) (avg): 130 mils (3.3 mm) (ASTM D 5147)
 3. Thickness at selvage (coating thickness) (min): 126 mils (3.2mm) (ASTM D 5147)
 4. Weight (min per 100 ft² of coverage): 114 lb (5.5 kg/m²)
 5. Maximum filler content in elastomeric blend: 35% by weight
 6. Low temperature flexibility @ -13° F (-25° C): PASS (ASTM D 5147)
 7. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 8. Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 9. Ultimate Elongation @ 73°F (23°C): 55% (ASTM D 5147)
 10. Dimensional Stability (max): 0.1% (ASTM D 5147)
 11. Compound Stability (min): 250°F (121° C) (ASTM D 5147)
 12. Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
 13. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 14. Reinforcement: fiberglass mat
 15. Surfacing: ceramic granules

2.6 PRIMER:

- A. Water based primer as recommended by manufacturer.

2.7 FOAM ADHESIVE:

- A. Low rise foam adhesive consists of moisture cure polyurethane foam applied in beads and shall be FM tested material.

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2.1 COLD ADHESIVE:

- A. Non-toxic, liquid adhesive specifically design for the membranes specified above. Solvent free technology adhesive in single component modified asphalt adhesive.

2.2 SEALANT

- A. A moisture-curing, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials.

2.3 LIQUID FLASHING

- A. Manufacturer's approved specialty flashing system consisting of a catalyzed polymethyl methacrylate primer, basecoat and topcoat, combined with a non-woven polyester fleece.

2.4 ROOF INSULATION

- A. Rigid insulation shall be Polyisocyanurate foam board insulation with fiber glass mat facers.
 - 1. Provide insulation to form part of the specified roof assembly capable to resist uplift pressure design loads.
- B. The insulation shall have a minimum aged R-value of 5.6 per inch thickness and the following characteristics:
 - 1. Compressive Strength: minimum 25 lb/sq. inch. (0.12 MPa) per ASTM D 1621..
 - 2. Water Absorption: less than 1% per ASTM C 209
 - 3. Water Vapor Transmission: less than 1.0 perm per ASTM E 96
 - 4. Dimensional Stability: less than 2%, 7 days per ASTM D 2126.
 - 5. Provide two layers of insulation above roof deck.
 - a. Base Layer: 2 inch thickness.
 - b. Top layer may be tapered but shall meet requirements of tapered insulation board.
- C. Tapered Insulation Board: Tapered board in sufficient shapes and sizes as required to provide positive drainage to roof drains. Boards 1/2 inch thick or less must have facers to maintain integrity of board.
- D. Insulation Securement: Adhered using foam adhesive per wind uplift requirements.

2.5 SUBSTRATE AND COVERBOARD

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
- B. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.

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2.6 METAL FLASHING

A. General:

1. All sheet metal not otherwise called for to be a minimum gauges/referenced in SMACNA Manual for comparable construction. Use heavier gauges if called for on drawings or specifications and where required by conditions of installation.
2. Include strippable protective plastic film on exposed prefinished faces of sheet metal. Film to be removed during installation.

B. Zinc-Coated (Galvanized) Sheet Steel:

1. Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M
2. Conforming to ASTM A653/A653M, G90 (1.25 oz. per square foot) coating designation, structural quality. Material to withstand flat bending on itself at any direction at room temperature without flaking.
3. Finish: Two-Coat Fluoropolymer per AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

C. Fasteners:

1. Nails: Same metal as sheet metal flashing or other non-corrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
2. Screws: neoprene gasketed, hex head type, or incorporate a washer with a laminated neoprene gasket. Exposed screws to have pre-finished heads of color matching the metal being fastened

D. Sealant for Metal Flashing Seams:

1. Silicone, one part, medium modulus, non-sag sealant; Type and Grade: S (Single component) and NS (non-sag); Class: 40.

2.7 ECO ROOF ALTERNATE (FOR HOOFSOCK ONLY)

A. Provide a proprietary eco roof system by the same manufacturer as the roofing membrane.

B. A vegetated roof waterproofing membrane assembly shall consist of 2 plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate.

C. The green roof membrane shall be a membrane designed for waterproofing per NRCA standards.

D. The modified bitumen finish ply shall be fully adhered to the modified bitumen base ply.

E. The assembly components shall consist of:

1. Plywood Decking
2. Substrate Board
3. Vapor Barrier
4. Polyisocyanurate insulation
5. Backer board
6. Membrane base ply

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7. Membrane finish ply
8. Root Barrier
9. Drainage mat
10. Engineered soil
11. Vegetation

2.8 MANUFACTURERS

- A. Subject to compliance with specified requirements, product system from the following manufacturers may also be used.
1. Siplast
 2. Soprema
 3. Tremco

2.9 MEMBRANE BASE PLY

- A. Membrane base ply shall have the following characteristics:
1. Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
 2. Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
 3. Weight (min per 100 ft² of coverage): 76 lb (3.7 kg/m²)
 4. Maximum filler content in elastomeric blend: 35% by weight
 5. Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
 6. Maximum Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 7. Maximum Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 8. Elongation @ 5% Maximum Load (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
 9. Dimensional Stability (max): 0.1% (ASTM D 5147)
 10. High Temperature Stability (min): 250°F (121°C) (ASTM D 5147)
 11. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 12. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria

2.10 MEMBRANE FINISH PLY

- A. The Membrane finish ply shall have the following characteristics:
1. Thickness (avg): 160 mils (4.0 mm) (ASTM D 5147)
 2. Thickness (min): 154 mils (3.9 mm) (ASTM D 5147)
 3. Weight (min per 100 ft² of coverage): 107 lb (5.2 kg/m²)
 4. Maximum filler content in elastomeric blend: 35% by weight
 5. Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
 6. Maximum Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 7. Maximum Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 8. Elongation @ 5% Maximum Load (avg.) @ 73°F (23°C): 95% (ASTM D 5147)
 9. Dimensional Stability (max): <0.1% (ASTM D 5147)
 10. High Temperature Stability (min): 250°F (121°C) (ASTM D 5147)
 11. Reinforcement - non-woven polyester geotextile
 12. Surfacing - polyester protective film or sand

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2.11 ECO ROOF COMPONENTS:

- A. Root Barrier:
 - 1. High density polyethylene; 60-mil thickness (ASTM D 5199)

- B. Drainage Mat:
 - 1. Composite drainage mat with non-woven needle-punched polypropylene filter fabric.
 - 2. Compressive strength: 15,000 lbs/ft² compressive strength.
 - 3. Flow rate: 21 gpm/ft flow capacity per unit width.

- C. Growing Medium:
 - 1. Proprietary material consisting of mixture of mineral light weight aggregates and premium organic components to meet planting selection requirements.
 - 2. Provide growing media data sheet for Owner review and approval.

- D. Vegetation:
 - 1. Proprietary pre-grown sedum tiles by the roof membrane manufacturer.
 - 2. Provide vegetation data sheet for Owner review and approval.
 - 3. Place vegetation in accordance with the Owner.

- E. Drainage Separator:
 - 1. Aluminum with slots at the bottom edge for drainage; sized to match soil height.
 - 2. Thickness: 0.080"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system. Ensure that:
 - 1. Deck substrates are smooth, clean, dry and free of defects and debris that would adversely affect installation of membrane. Remove sharp projections.
 - a. Test substrates for moisture content or water vapor transmission in accordance with roofing manufacturer's recommendations.
 - 2. Roof drains have been installed at proper elevations relative to finished roof surface.
 - 3. Damaged or defective deck areas have been repaired prior to commencement of work under this Section.

- B. Verify substrates to receive roofing have adequate slope throughout (minimum 2%, or as shown in drawings).
 - 1. Verify no build-up of materials can result upon roofing and flashing installation that can impact proper slope to drain.

- C. Begin roofing application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Application of roofing indicates acceptance of surfaces and conditions.

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3.2 INSULATION APPLICATION

- A. Install insulation to existing concrete deck with hot asphalt in accordance with the manufacturer's requirements.
- B. All board stock shall be installed with joints staggered a minimum of six inches (152 mm) from those of adjoining board stock (insulation installed in-plane) and from those of the board stock installed beneath.
- C. Insulation board shall be cut to fit tight against blocking or penetrations.
- D. Install only as much insulation to the roof as can be covered the same day with roofing membrane. At the conclusion of each day's work, seal exposed edges of the insulation. Cut and remove seal upon continuation of the work.

3.3 SUBSTRATE BOARD APPLICATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- B. Adhere Substrate Board with low rise foam adhesive, as required to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.

3.4 PRIMER APPLICATION

- A. Prime all dissimilar surfaces to which the roofing membrane shall come in contact. Apply at the rate recommended by the manufacturer. Coat with primer all metal flashings and fascia that come in contact with membrane.

3.5 MEMBRANE APPLICATION

- A. General:
 - 1. Install roofing membrane on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations.
 - 2. Perform roofing work on a continuous basis as surface and weather conditions allow.
 - 3. Protect adjoining surfaces against any damage that could result from roofing installation.
 - 4. Install only as much roofing as can be completed in one day. If weather conditions do not permit such completion, exposed areas shall be temporarily weatherproofed to prevent any water or snow infiltration from damaging other materials already installed, in particular, the thermal insulation.
- B. Base ply installation
 - 1. Install Base Ply in accordance with manufacturer's recommendations.
 - 2. Beginning at low point of roof, unroll one-half the first roll for positioning and re-roll.
 - 3. Each strip shall have minimum 3-inch side laps and 6-inch end laps. End and side laps of successive plies shall be staggered minimum 12-inches.
 - 4. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.

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- C. Base flashing ply installation
1. Install Base Flashing Ply in accordance with manufacturer's recommendations and as specified below.
 2. Base flashing ply shall be laid in strips three (3) feet wide to the vertical surfaces, extending onto the flat surface of the roof a minimum of four (4) inches. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches with the laps of the base ply.
- D. Finish ply installation
1. Apply Finish ply to smooth SBS base ply using cold adhesive a rate of 1-2 gallons per square applied in a smooth, even, continuous layer without breaks or voids so that in no place shall ply touch ply.
 2. Base ply and finish ply seams shall be staggered a minimum of twelve (12) inches.
 3. Finish ply shall have minimum side laps of three (3) inches and end laps of six (6) inches.
 4. Ensure the two membranes are perfectly welded, without air pockets, wrinkles, fishmouths or tears.
- E. Finish ply flashing installation
1. Install Cap Flashing Ply in accordance with manufacturer's recommendations and as specified below.
 2. Finish ply flashing shall be laid in strips three (3) feet wide.
 3. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches from finish ply laps in order to avoid excessive thickness.
 4. Finish ply flashing shall be extended down the vertical surface and onto the flat roof at a distance of six (6) inches.
 5. Apply Finish Flashing Ply in accordance with manufacturer's recommendations, directly on its base ply, proceeding from bottom to finish followed by the torching of the roof tie-in.
 6. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.
- F. Penetration Details
1. Apply liquid flashing at penetrations as shown in the drawings and as recommended by the membrane manufacturer.
 2. Liquid flashings shall consist of minimum 2 coats with reinforcing fabric.
 3. Where liquid flashing shall remain exposed, embed granules into liquid flashing to match appearance of finished roofing cap ply.
- G. Roof Drains. Unless otherwise recommended by manufacturer, apply roofing as follows:
1. Provide a smooth transition from drain bowl to deck surface.
 - a. Prime all metal surfaces.
 - b. Using a trowel, set a 6 inches (152 mm) wide layer of mastic around the drain bowl edge as water cut-off.
 2. Install base membrane with lap centered on bowl ensuring a tight seal at drain.
 - a. Install a fully primed, 30 inches (762 mm) square sheet of 4-lb. lead flashing set in mastic.
 - b. Apply a reinforcing membrane material ("target") cut from roll of ASTM D 6164 Type II Grade S membrane three feet (914 mm) square centered on drain.
 - c. Extend membranes 1 inch (25 mm) beyond the inside edge of the drain bowl and temporarily secure with clamping ring.
 3. Install field cap membrane ply.
 - a. Extend membrane 1 inch (25 mm) beyond the inside edge of the drain bowl.
 - b. Position membrane so as to avoid the occurrence of any seams at drains.

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- c. Seal off drain by running a hot trowel along the edge and firmly pressing against the rim.
 - 4. Install clamping ring and drain covers supplied with drain.
 - 5. Test all drains for proper flow and water tightness. Correct defects.

- H. Curbs
 - 1. Inspect and verify that all curbs are properly secured to deck, are level, a minimum 8 inches above finished roof, primed and ready to receive flashings.
 - 2. Base ply membrane is to run horizontally tight up against the vertical curb or cant as required.
 - 3. Install roofing membrane as shown in the drawings and in accordance with the manufacturer's instructions.

- I. Metal Flashing and Coping Installation
 - 1. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required.
 - 2. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 3. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 4. Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no movement joints allowed within 24 inches of corner or intersection.
 - 5. Joints in metal coping at roof curbs and parapets shall be standing seam.
 - 6. Sealant: Install where indicated or where required to make watertight.

3.6 WATER CUT-OFF

- A. At end of day's work, and when precipitation is eminent, construct a water cut-off at open edges. Construct cut-off with same membrane and asphalt used for roofing system. Allow cut-off to withstand extended periods of wet weather. Completely remove water cut-off prior to resuming installation of roofing system.

3.7 FIELD QUALITY CONTROL

- A. Manufacturers Field Review:
 - 1. Manufacturer Field Inspection: Coordinate with the manufacturer's technical representative to conduct periodic in-progress inspections to verify installation is in compliance with manufacturers' recommendations and meets all warranty requirements. At a minimum, inspections shall be required at start-up and at intervals of approximately 30%, 60% and 90% completion. The manufacturer shall provide a written report of their observations.
 - 2. Final Inspection: Arrange for manufacturer's Technical Representative to inspect membrane installation on completion. A final inspection report from the Technical Representative, certifying that the roofing system has been satisfactorily installed in according with the manufacturer's warranty requirements shall be provided.

- B. Water ponding/run-off test.

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1. Where slope of deck or drainage may be in question, upon request from Architect, apply water to fully cover surface to which roofing has been applied. Areas where accumulation of water occur as a result of inadequate slope or build-up of flashing materials, as determined by the Architect, shall be corrected by methods approved by roofing membrane manufacturer and Architect.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

- A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs, structures, vehicles and utilities.
- B. Clean-up and remove daily from site wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- C. Clean roofing materials from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

--- E N D ---

SECTION 05 51 33 – ALUMINUM ACCESS LADDER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aluminum access ladder.

1.2 REFERENCE STANDARDS

- A. AA – Aluminum Association.
- B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. OSHA 1910.27 – Fixed Ladders.

1.3 SUBMITTALS

- A. See Section 013300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Reproduction of the design documents does not suffice as shop drawings.
 - 1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
 - 2. Provide reaction loads for each hanger and bracket.
- C. Samples: Samples of manufacturer's standard colors and finishes for selection by Architect.
- D. Calculations and Details: Signed and Sealed by a Structural Engineer, verifying the bidder-designed element meets the requirements of the Building Code in effect at time of submittal.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
- B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurement before fabrication.

1.7 WARRANTY

- A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
 - 1. Defects in materials and workmanship.
 - 2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

1.8 EXTRA MATERIALS

- A. Furnish touchup kit for each type and color of paint finish provided.

1.9 COORDINATION

- A. Coordinate ladder brackets with existing features at proposed location such as handrail extensions, exhibit rockwork, roof copings, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: O’Keeffe’s, Inc.; 325 Newhall St. San Francisco, CA 94124; or approved equal.

2.2 PRODUCT

- A. Fixed Access Ladder with standard duty rails; Model 500 as manufactured by O’Keeffe’s Inc or approved equal

2.3 FINISHES

- A. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.4 MATERIALS

- A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
- B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

- A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
- B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.
- C. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
- D. Fit and shop assemble items in largest practical sections, for delivery to site.
- E. Fabricate items with joints tightly fitted and secured.
- F. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

METAL FABRICATIONS

- H. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.6 ACCESSORIES

- A. Fasteners, General: No pre-drilling or powder-actuated fasteners (PAFs) prior to coordination with General Contractor and Zoo Representative.
- B. Bolts, Nuts, and Washers: ASTM A 325, Type 1.
 - 1. Where connecting galvanized components: Galvanized to ASTM A 153.
 - 2. Where Stainless Steel is indicated and/or where connecting stainless steel components: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
 - 1. Material for Exterior Locations and Where Stainless Steel is indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel is indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.7 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.

- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. No pre-drilling or use of powder-actuated fasteners (PAFs) prior to coordination with Zoo Representative.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete and items to be covered with sprayed fireproofing

3.3 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION