

SECTION 07 61 00

SHEET METAL ROOFING

PART 1- GENERAL

1.01 SECTION INCLUDES

- A. Copper sheet roofing
- B. Copper gutters, down spouts
- C. Copper flashing and trim

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Copper roofing, including gutters, downspouts, and related flashings, will be measured for payment by the lump-sum method, acceptably furnished and installed.
- B. Payment: Copper roofing, including gutters, downspouts, and related flashings, will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B29 Specification for Refined Lead
 - 2. ASTM B32 Specification for Solder Metal
 - 3. ASTM B370 Specification for Copper Sheet and Strip for Building Construction
 - 4. ASTM D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
- B. Federal Specification (FS):
 - 1. TT-S-230 Sealing Compound Elastomeric Type, Single Component, Chemically curing (For Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 2. TT-S-1543 Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 3. TUU-B-790 Building Paper, Vegetable Fiber Kraft (Waterproofed, Water Repellant and Fire Resistant)
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
SMACNA Architectural Sheet Metal Manual

D. Underwriters Laboratories Inc. (UL)

UL580 Test for Uplift Resistance of Roof Assemblies

UL790 Test for Fire Resistance of Roof Covering Materials

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittals, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings and Product Data: Submit detailed Shop Drawings of copper roofing and related gutters and downspouts and installation details for review. Include manufacturer's product data for copper materials and manufactured items. Include manufacturer's specifications and details for a pre-engineered, factory-manufactured roofing system.

C. Samples:

1. Submit two sample squares, 8 by 10 inches in size, of the copper pan sheet.
2. Submit sample standing-seam or batten-seam assembly, as indicated.
3. Submit samples of anchors and mechanical fasteners proposed for use for the type of substrate.

1.05 QUALITY ASSURANCE

A. Codes and Standards:

1. Comply with applicable requirements of the California Building Code, Chapter 15, Roofs and Roof Structures.
2. Roofing shall meet Underwriters Laboratories' requirements for Class A copper roofing assembly in compliance with UL 790 and Class 90 wind uplift resistance in compliance with UL 580.
3. Shop or site fabricated sheet copper roofing shall be fabricated and installed in accordance with SMACNA Architectural Sheet Metal Manual, applicable Charts and Plates, and related specifications.
4. Pre-engineered and factory-manufactured copper roofing shall meet all requirements specified herein and shall be installed in accordance with the roofing manufacturer's installation instructions and written recommendations
5. Supervise waterproofing underlayment and flashings of roof penetrations in connection with copper roofing work.

B. Performance Requirements:

1. Copper sheet roofing work, gutters and downspouts, and related flashings shall be fabricated and installed by a licensed subcontractor, skilled and experienced in the type of work involved.
2. The Contractor and copper roofing materials manufacturer or supplier/installer shall design roof-edge details to prevent wind-uplift and damage to the roof from high winds and storms,
3. The Contractor and copper roofing material manufacturer or supplier/installer shall determine the probability of thermal and structural movement in the roofing system and shall provide for expansion and contraction in the roofing system as required to provide a serviceable roof without failures.
4. Provide copper roofing capable of withstanding thermal expansion and contraction movements for an ambient temperature change of 150 degrees F. without failure, including air and water leakage, and without noise from metal-to-metal contact in movement.

C. Copper Roofing Manufacturer's Field Services:

1. Where the roofing is to be a pre-engineered, factory-manufactured roofing system, the copper roofing materials' manufacturer shall inspect and approve all copper roofing installations and shall provide field services at no additional cost to the District.
2. The Contractor shall make all necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection services to ensure the proper installation of the copper roof and related flashings.
3. The manufacturer's representative shall be present at the time any phase of the work is performed. Copper roofing shall be applied only over surfaces previously approved by the manufacturer's representative.

1.06 ENVIRONMENTAL CONDITIONS AND PROTECTION

- A. Provide protection of all station and building roof areas from moisture and rain. Provide waterrepellent coverings as required. Leave no unroofed deck areas exposed to moisture and rain at any time, prior to installation of roofing.

1.07 GUARANTY

- A. Copper roofing and related flashing installations shall be guaranteed against leakage, defective materials, and inferior work quality of the completed work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. In addition to the guaranty requirements specified in General Conditions Article GC4.9, provide a 5-year roofing system guaranty or warranty, which shall state in essence that the Contractor and roofing installer shall, at their expense, make or cause to be made any repairs necessary to maintain the applied roof and related flashings in a watertight condition for a period of five years. The guaranty shall be effective from the date of Substantial Completion, and shall be

signed by the roofing installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roof Type: Copper roofing system shall be of the type indicated, shop or site fabricated or factory-manufactured standing-seam or batten-seam system suitable for the site installation conditions. All materials for shop or site fabricated roofing system shall conform with the SMACNA Architectural Sheet Metal Manual. Site fabricated batten-seam roofs shall employ pressure-treated preservative wood battens. Factory-manufactured batten-seam roofs may employ a snap-on structural batten system of indicated profile.
- B. Sheet Copper: Standard cold-rolled copper sheet for building construction, conforming with ASTM B370, 16 oz., 20 oz., 24 oz., or 32 oz. per square foot as indicated or required. Where copper weights are not indicated, provide 16 oz. copper sheet. Provide sheets in as long lengths as practical to minimize joints. Gutters and downspouts shall be fabricated of 24 oz. copper. Cleats shall be minimum 20 oz. copper. Copper finish shall be as indicated.
- C. Sheet Lead: Standard 0.062-inch thick lead sheet weighing 4 pounds per square foot, arsenicalantimonial and pig lead and tubing alloy meeting the requirements of ASTM B29. Use sheet lead and tubing for flashing of vent pipes and other penetrations of the roof.
- D. Solder: Grade A meeting requirements of ASTM B32, composed of 50 percent pig lead and 50 percent block tin, warranted pure. Flux shall be an approved brand of soldering flux for copper or muriatic acid neutralized with zinc.
- E. Wood Nailers and Battens: Wood nailers and battens shall be "Construction" or "No.1" grade Douglas fir, pressure-treated with preservative, as specified in Section 06 10 00 - Rough Carpentry, of size and dimensions indicated or required. Moisture content shall not exceed 19 percent.
 - 1. Anchors and Fasteners: Wood nailers and battens shall be anchored to metal decking with self-drilling, self-tapping, tempered steel screws manufactured for the purpose of securing items to metal decking. Screws shall be specially treated to prevent corrosion. Wood nailers and battens shall be anchored to concrete substrates with expansion-type anchors as specified in Section 05 5000 - Metal Fabrications.
- F. Roofing Felt: Asphalt-saturated glass felt, conforming with ASTM 02178 and weighing 30 pounds per 100 square feet.
- G. Building Paper (Slip Sheet): Rosin-sized, unsaturated paper, weighing approximately 6 pounds per 100 square feet, or a water-repellent smooth building paper meeting requirements of FS uuB-790.
- H. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners and accessories shall conform with the following requirements:

1. Nails shall be hard copper, bronze, or brass. Where sheet metal is built in over roofing materials or other sheet metal, use nails or screws with 1-inch copper washers. Rivets shall be soft copper rivets. Screws shall be standard brass or bronze wood screws, as required. Sheet metal screws shall be self-drilling, self-tapping stainless steel or tempered non-corrodible steel of proper size and length to suit conditions.
 2. Screw heads shall be furnished with neoprene washers.
 3. Straps: Straps and miscellaneous fastenings, where required, shall be half-hard copper or half-hard 70-30 brass of size indicated or required. Where not indicated, provide straps of 1/8-inch thick by 1-inch wide size.
- I. Sealant: Calking or sealing compound shall be a silicone synthetic rubber elastomeric sealant that cures at normal temperature to a flexible firm rubber, tack free, in gun grade consistency. Sealant shall be specially designed for adhesion to the surfaces to which it will be applied, and shall meet or exceed the minimum requirements of FS TT-S-230 or FS TT-S-1543, as applicable.
- J. Dielectric Isolating Material: Alkali-resistant bituminous paint or varnish.

2.02 FABRICATION

- A. Form and fabricate standing-seam copper roofing, gutters, downspouts, and related flashings as indicated and in accordance with the approved Shop Drawings and the SMACNA Architectural Sheet Metal Manual. Properly reinforce sheet copper roofing as required for strength and appearance.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION OF SUBSURFACES

- A. Examination of Roof Deck Surfaces: Before starting the installation of any roofing work, examine all surfaces that the copper roofing and flashings are to be applied.
- B. Cleaning and Preparation of Subsurfaces: Surfaces that copper roofing and flashings are to be applied shall be dry, clean of dirt and dust. Surfaces shall also be free from sharp protrusions and defective surfaces which will prevent a level and plane installation. Fill all joints, cracks, or depressions in subsurfaces with patch or underlayment material recommended by the manufacturer of the copper roofing system components.
- C. Responsibility: Nothing specified herein shall be construed as relieving the Contractor of full responsibility for the waterproof quality of the finished installation. Surfaces that copper roofing and flashings are to be applied shall be in proper condition in every respect for installation of the copper roofing and flashings.
- D. Protection: Protect structures to be roofed from moisture and rain until completion and acceptance of the roofing work

3.02 INSTALLATION

A. Installation Standards:

1. Install shop or site fabricated standing-seam or batten-seam sheet copper roofing and related gutters, downspouts, and flashings as indicated and in accordance with the approved Shop Drawings and the SMACNA Architectural Sheet Metal Manual.
2. Install factory-manufactured copper roofing and related gutters, downspouts, and flashings as indicated and in accordance with the approved Shop Drawings and the materials' manufacturer's installation instructions and written recommendations.

B. Flashings and Metal Trim: Provide flashings, counterflashings, ridge flashings, metal trim, and any other fabricated items and miscellaneous copper sheet metalwork indicated or required to provide a complete and watertight installation.

C. Gutters and Downspouts: Install gutters and downspouts as indicated and in accordance with the approved Shop Drawings and pertinent provisions of the SMACNA Architectural Sheet Metal Manual.

D. Work Quality:

- I. Standing-seam and batten-seam sheet copper roofing shall be finished straight and true.
Exposed work shall be free of dents and other defects. Corners shall be reinforced and seams made waterproof. Edges of sheet copper shall be hemmed.
2. Provide for expansion and contraction in sheet copper roofing and gutters by means of expansion joints or other appropriate methods of the SMACNA Architectural Sheet Metal Manual. Provide reinforcement as required.
3. Isolate and protect dissimilar metals from contact with each other by applying a heavy coating of the specified isolation material to contact surfaces.
4. Provide waterproof neoprene washers wherever required fasteners penetrate sheet metal.
Exposed fasteners will not be permitted for any portion of this work.
5. Gutters shall have bottoms that slope continuously from expansion joints to downspout outlets as indicated.

E. Calking and Sealing: Calk or seal joints and laps of sheet copper as indicated or required for a waterproof installation. Beads of sealant that will be concealed in the finished work shall be continuous with no voids of materials. Interface and coordinate the calking and sealing work of this Section with the work specified in Section 07 90 00 - Joint Protection.

F. Flashings for Roof Penetrations:

- I. Flashings of roof penetrations shall be 4-pound lead. Flashings shall be accurately formed to conform with roofing contours and configurations and as required to assure a watertight installation. Flashings shall be built in as the roofing work progresses. Flash and bum lead against any penetrations through its surface.

2. vent flashings shall be of 4- pound lead tubing. Flanges shall be minimum 18-inches square, and lead tubing shall be long enough to permit tuming lead into the end of vent pipe.

3.03 **FIELD QUALITY CONTROL**

- A. After completion of copper roofing and related work, a water test shall be performed for all roof areas, penetrations, and accessories by applying a sheet of water along the ridge or other high areas. The test shall be performed under the Engineer's observation.
- B. Should a leak appear, it shall be repaired, and the roof areas shall be retested as specified above until all work is watertight and acceptable.

END OF SECTION 07 61 00

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Field formed roof drainage systems.
 - 2. Roof flashing and trim.
- B. Related Section:
 - 1. Section 07 71 00 - Prefabricated Roof Specialties: Manufactured roof specialties.

1.2 SUBMITTALS

- A. Shop Drawings: Show layouts, profiles, shapes, seams, dimensions, and details for fastening, joining, supporting, and anchoring sheet metal flashing and trim. Include provisions for expansion and contraction.
- B. Samples: Submit 12 inch x 12 inch sample for each type of exposed finish required.

1.3 QUALITY ASSURANCE

- A. Standards:
 - 1. Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
 - 2. Comply with The NRCA Roofing and Waterproofing Manual installation details.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

PART 2 – PRODUCTS

2.1 SHEET METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation, metallic coated by the hot-dip process, structural quality, 24 gage minimum.
- B. Prefinished Metal (provide at locations exposed to Public view in final construction):
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation, metallic coated by the hot-dip process, structural quality, 24 gage minimum.
 - 2. Coating System: Thermocured Fluoropolymer system; complying with AAMA 2605.

- a. Acceptable Coatings Manufacturers:
 - 1) PPG Industries, Inc.
 - 2) Valspar Corporation
 - 3) BASF
 - b. Substrate: Cleaned and pretreated with chromium phosphate.
 - c. Coating System:
 - 1) Primer: Type as recommended by the Fluoropolymer manufacturer, 0.20 mil minimum coating thickness.
 - 2) Color coat: Fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605, 1.0 mil dry film thickness.
 - 3) Clear coat: As recommended by the Fluoropolymer manufacturer if required for color selected.
 - d. Color: Color: Match adjacent surfaces or as indicated on drawings.
3. Strippable film: Liquid applied to top side of painted coil to protect finish during fabrication, shipping and field handling.

2.2 ACCESSORIES

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.
- C. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Provide fasteners designed to withstand design loads.
 - 1. Galvanized or Prefinished Steel: Pre-finished galvanized steel with soft neoprene washers at exposed fasteners.
 - 2. Exposed Fasteners: Pre-finished heads matching color of adjacent pre-finished sheet metal.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: As specified in Section 07 92 00 – Joint Sealant.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

- H. Prefinished Metal Seam Sealers and Adhesives: As recommended by prefinished metal manufacturer for waterproof and weather-resistant seaming and adhesive applications of flashing and sheet metal work.
- I. Solder: ASTM B32, 50/50 type.
- J. Flux: FS O-F-506.
- K. Polyethylene: Black, 6 mil.

2.3 FABRICATION

A. General:

1. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricates items where practicable. Obtain field measurements for accurate fit before shop fabrication.
2. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
3. Solder and seal metal joints or use seam sealer/adhesive as recommended by prefinished metal manufacturer. After soldering, remove flux. Wipe and wash solder joints clean.
4. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
5. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal, and in thickness not less than that of metal being secured.

B. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flatstock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Material: Pre-finished galvanized steel, 22 gauge.

C. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Material: Pre-finished galvanized steel, 22 gauge.

2.4 FINISH

- A. Shop prepares and prime exposed ferrous metal surfaces.
- B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 1.5 mil.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
 - 1. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
 - 2. Verify membrane termination and base flashings are in place, sealed, and secure.
- B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

3.2 INSTALLATION – GENERAL

- A. General:
 - 1. Conform to NRCA and SMACNA Manuals.
 - 2. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - a. Torch cutting of sheet metal flashing and trim is not permitted.
 - 3. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 4. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 5. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - a. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- B. Metal Protection: 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 fabricator or manufacturers of dissimilar metals.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tem edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.

1. Do not solder prefinished sheet.
2. Assemble parts and solder using regular non-corrosive resin flux. Heat metal thoroughly too completely sweat solder through full contact area.
3. Remove flux residue by scrubbing, neutralizing with ammonia or a 5 to 10 percent solution of washing soda, followed by a clear water rinse.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped and sealed joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and sealwatertight with sealant. Slope to downspouts.
 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Secure in a waterproof manner. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

END OF SECTION

SECTION 08 520 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fixed and operable aluminum-framed windows.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size required by AAMA/WDMA 101/I.S.2/NAFS.
- B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - 1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed: 90 mph.
 - b. Importance Factor: I.
 - c. Exposure Category: A.
 - 2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
- C. Air infiltration for fixed windows: 0.06 cu. Ft/min/sq. ft. of assembly surface areas, measured at a reference differential pressure across assembly of 0.3 inches water gage.

- D. Drain water entering joints, condensation occurring in glazing channels or migrating moisture occurring within the system to the exterior.
- E. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details
- C. Samples: For each exposed finish.
- D. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - b. Faulty operation of movable sash and hardware.
 - c. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
 - d. Failure of insulating glass.
 - 2. Warranty Period:
 - B. Window: Two years from date of Substantial Completion.
 - C. Glazing: Five years from date of Substantial Completion.
 - D. Metal Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Northwest Aluminum Series 127 H-Bar or comparable window that has a 1" window section and is compatible with Kawneer 451 series frame units. Comparable products by the following may be submitted for approval:
 - 1. EFCO Corporation.
 - 2. Kawneer; an Alcoa Company.
 - 3. TRACO.
 - 4. Wausau Window and Wall Systems.

2.2 WINDOW

- A. Window Type: As indicated on Drawings.
- B. Comply with AAMA/WDMA 101/I.S.2/NAFS.
 - 1. Performance Class and Grade: As indicated.
- C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.
- D. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
 - 1. U-Factor: 0.55 Btu/sq. ft. x h x deg F or less.
- E. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.50, determined according to NFRC 200 procedures.

2.3 GLAZING

- A. Glass: Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, complying with Division 08 Section "Glazing."
- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.4 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside of window and provide for each operable exterior sash or ventilator.
 - 1. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Architectural C-24 class.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - 2. Finish: Match aluminum window members.

2.5 FABRICATION

- A. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- B. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- C. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- D. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.

- E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- F. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- G. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.6 ALUMINUM FINISHES

- A. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611
- B. Baked-Enamel Finish: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2604 except with a minimum dry film thickness of 1.5 mils, medium gloss.
 - 1. Color: Match City's sample.
- C. High-Performance Organic Finish 2-coat, thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2605. If clear coat is required, provide 3-coat system.
 - 1. Color and Gloss: Match City's sample.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- G. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- H. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- I. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: City will engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.
 - 2. Testing Extent: Three windows as selected by City and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
 - 3. Test Reports: Shall be prepared according to AAMA 502.
 - 4. Remove and replace noncomplying aluminum window and retest as specified above.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 51 13