

SECTION 041000

MASONRY RESTORATION
(PART OF FILED SUB-BID SECTION 041000)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Attention is directed to the existing structure conditions, geometry and dimensions at the site. The contractor shall become thoroughly familiar with the existing conditions in order to assess the metal stair work required. Submittal of a bid to perform the work of this section acknowledges a thorough understanding of existing conditions.

1.2 INCLUDED IN THIS SECTION

- A. Cutting, pointing and localized repair of exterior brickwork to remain
- B. Resetting of replacement cast stone units
- C. Selective removal or dismantling and resetting or replacement of damaged or designated brick masonry
- D. Replacement of rusted steel lintels
- E. Infill of existing openings

1.3 SCOPE OF WORK

- A. The Work shall include all masonry work, the nature and quantities of which are detailed and described herein and on the contract drawings.
- B. The masonry Contractor shall be responsible for coordinating and insuring that all flashing and weep holes are installed.

1.4 RELATED SECTIONS

- A. Section 021000 – Temporary Shoring
- B. Section 024100 - Demolition
- C. Section 040012 – Cleaning Masonry
- D. Section 045000 – Cast Stonework Restoration
- E. Section 055000 - Structural Metal Fabrications

1.5 REFERENCES

- A. Comply with the following standard material specifications:
1. ASTM C33 - Concrete Aggregates
 2. ASTM C141- Hydrated Hydraulic Lime
 3. ASTM C144 - Sand for Mortar and Grout
 4. ASTM C216 - Fired Clay Units
 5. ASTM C270 - Mortar and Mortar Testing for Unit Masonry
 6. ASTM C1713 – Mortars for the Repair of Historic Masonry
 7. ASTM A276, Type 304 - Threaded Round Stainless Steel Bar Stock
 8. ACI 301 - Concrete Mix Design and Placement
 9. ASTM C144 - Sand for Mortar and Grout
 10. ACI 318 - Building Code Requirements for Reinforced Concrete for Buildings
 11. ACI 530 - Building Code Requirements for Masonry Structures
 12. ACI 530.1 - Specifications for Masonry Structures
 13. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement
 14. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
 15. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate
 16. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
 17. ASTM A580 - Stainless and Heat-Resisting Steel Wire
 18. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
 19. ASTM B370 - Copper Sheet and Strip for Building Construction
 20. ASTM C55 - Concrete Building Brick
 21. ASTM C90 - Load-Bearing Concrete Masonry Units
 22. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale)
 23. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
 24. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
 25. UL - Fire Resistance Directory

1.6 SUBMITTALS

- A. Submit the following items to the Engineer for review:
1. Test reports required as per paragraph 1.6 - Quality Control.
 2. Product Data: Submit manufacturers' technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
 3. Product data sheets and samples.
 4. Concrete mix design where needed.
- B. Submit shop drawings and samples for all masonry fabrications.
1. Provide Cast Stone samples per Section 047200.
 2. Provide samples for replacement brick to match existing in size and color.
- C. Perform field-constructed mock-ups for review by the Architect:
1. Samples of new structural pointing and patching mortars and grouts cured in same fashion as will be applied to structure.
 2. 24"x24" raking (joint cutting) test/sample patches for (as preparation for repointing work) to be provided by the Contractor at exterior and interior wall surfaces and located as agreed with Architect on site. No raking or joint cutting shall be started until samples are approved.

3. 24"x24" pointing / repointing test/sample patches to be provided by the Contractor at exterior and interior wall surfaces and located at agreed with the Architect on site. No repointing shall be started until samples are approved.
4. Work that does not match the approved sample panels shall be rejected and redone. The Contractor shall be responsible for producing as many sample panels as necessary to provide a match of existing adjacent work that meets the satisfaction of the Architect.

1.7 QUALITY CONTROL

- A. Comply with all referenced standards for the products employed.
- B. Comply with requirements of Massachusetts State Building Code.
- C. Coordinate times of Special Inspections to comply with Massachusetts State Building Code.
- D. All masonry work shall be performed by individuals with more than ten year well-referenced experience with historic brick and stone masonry restoration.
- E. All masonry work shall be performed by individuals with more than ten years of well-referenced experience with similar projects.
- F. During periods of cold or questionable weather, keep a log of work including air temperature and weather conditions, work started and completed per day, and tests taken. No work shall be done when the ambient temperature of the structure or the air is less than 45 degrees F.
- G. Produce mortar and grout samples in the form of 2" x 2" x 2" flat slabs, placed against wooden side forms and backing, for easy removal of cured sample. Provide 8 samples per mortar and grout type taken on different days and cured under conditions that match field conditions to testing laboratory for compression testing. Provide at least four 2" x 2" x 2" field cut samples of existing mortar to the testing laboratory for comparative compression testing. Contractor shall arrange for and pay for all testing and shall submit results at 7 days and at 28 days to the Engineer. Adjustments in mix and re-tests shall be made as required at no additional cost to the owner. Test existing mortar samples and trial mixes at least three weeks before commencing masonry work.
- H. Masonry Contractor shall be a qualified, well-referenced brick and stone mason with at least 10 years of experience in brick construction, repair, and restoration.
- I. Mortar colors and textures shall match existing cleaned stone and mortar surfaces. The contractor shall prepare an area of sufficient size to demonstrate the finish of tuck pointing mortar between the stones and stone filler mortar on the stones.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
- B. Protect mortar and other cementitious materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

- C. Restore any damage to site caused by storage, mixing or construction work.
- D. Packing and Loading of Materials: Carefully pack and load finished stone for shipment using all reasonable and customary precautions against damage in transit. Do not use any material that may cause staining or discoloration for blocking or packing.
- E. Store brick in a way that is conducive to pre-wetting and moisture acclimation, removing plastic wrapping. Spray with water at the beginning and end of each work day.
- F. Store cementitious materials off the ground, under cover and in dry location.
- G. Store aggregates where grading and other required characteristics can be maintained.
- H. Protect mortar materials and stone accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.9 SEQUENCING/SCHEDULING

- A. Order replacement brick units (if needed) at the earliest possible date, to avoid delaying completion of the Work.
- B. Utilize sequence that best suits the work.
- C. The existing exterior brickwork is in a dangerously unstable state. Schedule work to remove and/or at least brace all unstable masonry elements by the earliest possible opportunity in order to make conditions safe.

1.10 PROJECT CONDITIONS

- A. Do not repoint mortar joints or repair masonry unless air temperatures are between 40°F (4°C) and 80°F (27°C) and will remain so for at least 48 hours after completion of work. During periods of questionable weather keep a log of work including air temperature and weather conditions, work started and completed per day and tests taken.
- B. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.
- C. Protect sills, ledges and projections from mortar droppings.
- D. Protection: Protect and maintain all work in a dry safe condition for the duration of the work.
- E. Protection of Work: Cover tops of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover in place.
 - 2. Staining: Prevent grout or mortar from staining the face of stone to be left exposed. Remove immediately grout or mortar in contact with such stone.
 - 3. Protect surrounding surfaces from rain-splashed soil and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.
- F. Remove all masonry determined to be frozen or damaged by freezing conditions.

- G. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.
- H. Protection During Cleaning: Protect persons, motor vehicles, construction site and surrounding buildings from injury resulting from stone cleaning work.
 - 1. Protect all non-stone surfaces. Review all protective measures with Engineer.
 - 2. Protect all non-masonry surfaces. Review all protective measures with Architect.
 - 3. Prevent cleaning solutions from coming into contact with pedestrians, motor vehicles, plant materials, buildings and other surfaces that could be injured by such contact.
 - 4. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 5. Dispose of run-off from cleaning operations by legal means and in a manner which prevents soil erosion, undermining of paving and foundations, and damage to adjacent landscaping.

1.11 COLD WEATHER PROTECTION

- A. Do not perform any wet masonry work when temperature of surrounding area is below 40 degrees F., or below 45 degrees F. and falling, or forecast by public news media to fall to or below 35 degrees F. within 24 hours without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing. Minimum temperature within heated enclosure shall be 40 degrees F. Do not use masonry materials which are likely to contain frost. Do not use accelerating ingredients with any mortar. Mortar shall harden without freezing and with no damage from frost. Protect all work against freezing for not less than 48 hours after installation.
- B. Do not lay masonry units that are cold and wet or frozen. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen setting beds.
- C. Comply with requirements of International Masonry All-Weather Council's "Guide Specification for Cold-Weather Masonry Construction". Heat materials and provide temporary protection of completed portions of stone work.

1.12 HOT WEATHER PROTECTION

- A. Protect masonry work in hot weather to prevent excessive evaporation of setting beds and grout. Provide artificial shade, wind breaks and use cooled materials as required. Use fresh mortar. Discard mortar that has stiffened due to hydration.

PART 2 - PRODUCTS

2.1 MASONRY UNITS

- A. Brick: Re-used or new as needed, or ASTM C216, Grade SW, Low Absorption. Minimum strength shall be 8,000 psi, maximum water absorption shall be 8%. Provide new brick only as required if existing units cannot be salvaged, to match size and shape of existing surrounding brick. Color shall be one shade darker than the existing brick in its present condition.
- B. Limestone: Re-use existing limestone units at all locations.

- C. Cast Stone:
1. Re-use existing cast stone units unless otherwise designated on the drawings as new replacement units.
 2. Provide new replacement units where designated in accordance with Section 047200.

2.2 MORTAR AND GROUT

- A. Mortar and Grout Materials:
1. Cement: Type 1 white and/or gray cement as follows: Portland Cement: ASTM C150 complying with staining requirements of ASTM C91 for a low-alkali cement having a maximum of 0.60% equivalent alkalis. Mortar shall show no efflorescence when cast in a 2" x 7" x 1/2" slab consisting of 1 part of the cement to be used, 2 parts Ottawa plastic mortar sand and distilled water, and subjected to a 7 day "wick test" conforming to ASTM C67.
 2. Hydrated Lime: ASTM C207, Type S
 3. Coarse Aggregate For Grout: ASTM C-33, 3/8" dia. minimum gravel or stone
 4. Fine Aggregate / Sand: Natural sand selected to produce mortar color match after repointing and cleaning. Match size, texture and gradation of existing aggregate.
 5. Fine Aggregate / Sand:
 - a. Sand For mortar and grout: ASTM C144, washed, to match surrounding in color where visible.
 - b. For surface fill: Clean, fine sand free of salts
 6. Water: Potable, clean, free of oils, acids, alkalis and organic matter.
 7. Grouting Aid: Equal or Equivalent to "Interplast-N" Expanding / Fluidifying Grouting Aid as manufactured by the Sika Corporation of Lyndhurst, NJ.
 8. Crack Seal for Lime-Cement Grout Injection: Lime-cement mortar to stay in place or removable caulking or jute.
- B. Provide mortar conforming to ASTM C1713 "Proportion Specification" in the formulation(s) as listed below.
1. Provide the following:
 - a. Structural mortar for Back-up Masonry Reconstruction and Re-setting shall be 1 part Portland Cement, part Hydrated Lime and _ parts Bulk Sand.
 - b. Mortar for exposed masonry Resetting or Pointing/ Repointing shall be 1 part Portland Cement, 1 part Hydrated Lime and 6 parts Bulk Sand. Sand shall be properly selected and blended to match the color, texture and appearance of the existing mortar sand, and when used, Portland Cement shall be a combination of white and gray cement that best suits the color matching of the existing mortar binder. Where additionally needed, up to 10% by mineral oxide pigment by weight of binder may be added to best match the color of the original mortar. Pigments shall be chemically pure mineral oxides, alkali proof and light fast, and shall be equal or equivalent to "Solomon Grind" as manufactured by Chem Services Inc, of Springfield, IL.
 2. The Contractor shall review test data and products with the Architect and any required adjustments shall be made. Contractor shall then submit a record mortar mix design along with product data sheets to the Architect for verification and review before beginning any mixing and/or setting.

- C. Injection and Gravity-Feed Grout (where and as may be required for grout filling of encountered voids);
1. Provide the following:
 - a. For cracks and spaces of minimum clear dimension of less than 1/4"– 1 part Portland Cement and 2 parts Hydrated Lime slurry with up to 18 gallons of mixing water per bag of Cement. Add 0.5% Grouting Aid by weight of binder.
 - b. For cracks and spaces of clear dimension between 1/4" and 2" - Fine Grout with following proportions by volume: 1 part Portland Cement, 2 parts Hydrated Lime and 4.5 parts to 9 parts fine Sand plus water to suit application. Minimum mixing water to suit injection or gravity placement. Add 0.5% Grouting Aid by weight of binder.
 - c. For spaces of minimum clear dimension of more than 2" - Coarse Grout with following proportions by volume: 1 part Portland Cement, 2 parts Hydrated Lime and 4.5 parts to 9 parts fine Sand, and up to 1.5 parts Pea Gravel (reducing the volume of sand accordingly). Add 0.5% Grouting Aid by weight of binder.

2.3 MORTAR AND GROUT MIXING

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B. Mix grout in accordance with ASTM C94 or thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 Fine or Course grout.
- C. Mortar colors shall be chosen to match cleaned stone and mortar surfaces. Chemically clean an 18" square area of wall at a location to be designated in the field by the Architect for use in color comparison.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.
- E. The contractor shall review the water content and any required adjustments along with proposed products with the Engineer. Contractor shall then submit a record mortar mix design along with product data sheets to the Engineer for verification, review and approval before beginning any mixing or installation.

2.4 REINFORCEMENT, ANCHORAGE AND ADHESIVE PRODUCTS

- A. Horizontal Joint Reinforcement: Ladder type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16" diameter side rods with 9 gage cross ties, hot dip galvanized.
- B. Setting pins for setting stone units shall be one of the following, as indicated on the Contract Drawings:
 1. Stainless Steel Rods- ASTM A276, Type 304, plain
 2. Fiberglass Connecting Rods: "Strongwell (Extren)" Straight Thermal Cure pins meeting ASTM D3917, ASTM D3918, ASTM D3647 and ASTM D4385 as manufactured by the Morrison Molded Fiber Glass Company of Chatfield, MN, or approved equal.
- C. Sealant for Setting of Pins and Sealing Joints where indicated
 1. Provide 2-component polyurethane complying with ASTM C-920 and Federal Specification TT-S-00227.
 2. Provide closed cell backer rod at all sealant joints. Backer rod shall be carefully sized per sealant manufacturer instructions for each Sealed Joint.

3. Sealant shall be equal or equivalent to the Sika or Tremco product lines.
- D. Adhesive Anchoring System for Miscellaneous Embedded Items (where indicated on the Contract Drawings as "Adhesive Anchors"):
1. For anchorage to masonry: Equal or Equivalent to Hilti HY70 Adhesive Injection System with properly sized Screen Tubes as manufactured by the HILTI Corporation of Tulsa, OK.
 2. For pinning of stone Dutchmen or fragments to parent units: Sikadur Injection Gel as manufactured by the Sika Corporation of Lyndhurst, NJ.
- E. Inter-wythe Ties for Brickwork
1. In bonded collar joint construction (below second floor): 2" wide x 12 ga. stainless steel Hohmann & Barnard #345 "Buck Anchors" on a 16" x 24" pattern.
 2. Anchors for brick veneer ties shall be 1/4" x 3" stainless steel threaded rods drilled and adhesive-set 2 1/2" into back-up masonry (including parging where present) with screen tubes, or equivalent drilled expansion or screw-type anchors.
 3. Veneer Tie System: "Posi-Tie" system as manufactured by Heckman Building Products, Inc. of Melrose Park, IL
 4. Wept Cavity Veneer Tie System: "Posi-Tie" system as manufactured by Heckman Building Products, Inc. of Melrose Park, IL
 5. Bonded Veneer Tie System: 3/16" diameter all-thread stainless steel rods bent into a U-shape, drilled and adhesive-set into existing back-up masonry mortar joints

2.5 MISCELLANEOUS PRODUCTS

- A. Sealant and Backer Rods
1. Provide closed cell backer rod at all sealant joints. Backer rod shall be carefully sized per sealant manufacturer instructions for each joint.
 2. Provide 2-component polyurethane complying with ASTM C-920 and Federal Specification TT-S-00227E.
 3. Acceptable manufacturers: Equal or equivalent to Sika, Tremco product line.
 4. Backer Boards shall be Preservative Pressure Treated (P/T) Southern Yellow Pine adhered to the interior faces of the step treads with an approved paste-type epoxy adhesive.
- B. Provide Plastic Shims as needed for initial leveling and floating of stone units into bedding mortar. These shall be a stone-suitable product that is equal or equivalent to those supplied by Korolath of New England, Woburn, MA.

2.6 MORTAR WASHDOWN CLEANER

- A. For non-pigmented mortars, use equal or equivalent to "Sure Klean 600 Detergent" as manufactured by ProSoCo Corp.
- B. For pigmented mortars use equal or equivalent to "Vana Trol" as manufactured by ProSoCo Corp.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS OF THE WORK

- A. An effort shall be made to minimize the need for on-site storage of masonry materials, close coordination of the field personnel, material suppliers and the general contractor shall be maintained to provide for a steady flow of materials on a close to as-needed basis.
- B. All dismantled work shall be fully documented and the original geometry of the structure (before bulging and sagging) be established. Reconstruction shall be done to replicate original geometry.
- C. Inspect all masonry within work areas, identify all required repairs and removals.
- D. Perform all other indicated masonry work in accordance with the requirements of this section and all references.

3.2 REMOVAL OF DESIGNATED OR DAMAGED MASONRY

- A. Provide and install all temporary shoring, bracing and support to surrounding construction before beginning removal. Removal shall be done slowly and methodically to maintain stability to all remaining elements at all times. Contractor shall be responsible for maintaining integrity and safety of surrounding construction, in general, during work per the requirements of Section 021000.
- B. Carefully remove designated masonry, maintaining support to all surrounding and supported elements that are otherwise dependent upon the masonry being removed for support or stability. Following removal of the exterior grade veneer units, remove all remaining back-up masonry, storing both in separate locations. Clean and store all salvageable brick units for re-use, provide replacement bricks for units that cannot be re-used.
- C. Following removal of designated masonry, inspect and remove additional masonry that is loose, damaged or can be separated with unassisted hands.
- D. Clean the exposed surfaces of the remaining material, and remove shards of material which have become loose during work or have shifted from their proper positions. Notify Engineer immediately of the number of brick wythes that need to be removed before preceding with work.
- E. Notify the Engineer of any masonry beyond immediate work area, which becomes loosened during work. Stop work immediately, provide additional bracing and review with Engineer before resuming.
- F. Protect the existing interior structure from the external weather and from dust and debris caused by these operations. Provide weather protection as needed until the external envelope is restored.

3.3 UNUSED ANCHOR REMOVAL

- A. Remove masonry anchors, brackets, wood nailers and other extraneous items no longer in use unless specifically indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. If item cannot be removed without damaging surrounding masonry, cut off items flush with surface and core drill surface surrounding item as close around item as practical.

- B. Patch holes where items were removed to match surrounding construction.

3.4 RESTORATION OF EXISTING BACK-UP MASONRY TO REMAIN

- A. Remove all loose masonry units, mortar and residue from surface of back-up construction without disturbing or weakening or destabilizing the masonry. Employ a "pressure washer" and regulate the nozzle pressure to clean but not damage the surfaces. Nozzle pressure shall be in the range of 600 psi with a 15 degree fan at the tip.
- B. Identify and remove loose units and re-set them with new mortar slushed into surrounding voids. Add bricks or stones as may be appropriate to re-stitch the wall to a sound, unfragmented condition.
 - 1. Locate damaged and/or loose brick or stone units to be removed. Pull unit(s) out of wall with a gentle rocking action, driving wedges into surrounding joints only as required to snap this joint off. Stones shall be removed one at a time, bricks may be removed up to 4 at a time.
 - 2. Set new replacement brick units into wall in orientation and locations of existing damaged units. Pre-wet existing construction and fully butter all contact surfaces of new units during setting, striking mortar at distance of 1" back from the ashlar face of the masonry to allow for final tuck pointing.
- C. Grout-inject cracks and small voids encountered, and fill hollow cavities encountered in existing masonry to remain in accordance with this Section.
- D. Fill hollow cavities encountered in existing masonry to remain with extended lime-cement grout or mortar per the requirements of this Section.
- E. Inspect all joints and rake deteriorated or softened mortar joints to a minimum depth of 1", or as deeply as necessary to reach sound mortar, but not to exceed one half of the thickness of the joint without supplementary means of support. Employ tools that are sharp and will completely cut out joints at intersections without splitting or damaging stones. Drive hardwood shims into joints that will be cut more deeply than 1 ½" to prevent the wall construction from shifting. Cut joints shall match the approved sample patch.
- F. Push the new pointing mortar into the joints, evacuating air bubbles with the sharp end of a trowel, and strike surface of joints to match existing surrounding joints. Provide "shed joints" to shed water away from horizontal projections that may otherwise collect water. Hold mortar back from Architecturally exposed surfaces by ½" to 1" to allow for final tuck of finished pointing mortar.
- G. Moist-cure all work under a tarpaulin or plastic sheets. Following curing period, maintain weather protection to interior of structure until exterior wall system is replaced.
- H. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

3.5 INSTALLATION OF DOWELS, ANCHORS, TENSION RODS AND CONNECTORS

- A. Drill holes for embedded anchors, dowels and pinning rods as follows:
 - 1. Locate holes within the existing masonry so that they are at least 2" from the nearest joint intersection and within the faces of existing units rather than in the joints.
 - 2. Monitor Conditions of brick or stone units as the drill is advancing into them. Check for vibration or movement of brick units halfway through each by tapping with the bit. Notify the Engineer if the brickwork or stonework feels "soft".

3. All holes greater than ½" diameter shall be drilled using a diamond tipped core drill, dry application on interior surfaces, wet or dry application on exterior surfaces. Do not use a rotary hammer or impact type hammer for holes greater than ½" in diameter.
- B. Install Adhesive-Set connectors, pins and dowels as shown on the Contract Drawings and as described below using the applicable Injection System.
1. Carefully drill holes of the proper oversize diameter for the screen tube (in masonry) and for injection resin or sealants 1/8" larger in diameter than the anchor rod or pin, or as indicated on the Drawings or specified by the manufacturer of the injection system if different.
 2. Locate and size anchors and pins in as indicated in the Contract Documents and as needed per Engineer's field instructions following exposure of hidden conditions.
 3. Provide embedments as noted or instructed but not less than 8" embedment at ½" diameter and larger anchors or 4" embedment at anchors of less than ½' diameter.
 4. Incrementally core-drill all holes being careful not to damage or loosen substrate and being careful to avoid embedded metal if any.
 5. Simultaneously with injection of holes, pre-butter rods' surfaces with injection resin so that there is a uniform coating all around the rod of between 1/16" and 1/8" in thickness and insert rods immediately thereafter.
 6. Wipe off excess resin and clean out remaining hole depth. Do not allow resin to leak out of holes and stain stone surface(s). Remove resin immediately if this happens!
 7. Monitor progress and quality of work, adjusting techniques as may be necessary with approval of the Engineer. Check that annular space is filled around the end of each rod following insertion. If properly installed, resin should be oozing out beyond end of rod all around annular space, showing that the annular space and the hole are completely filled. Supplementary injection may be necessary due to the presence of voids.
- C. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.
- D. The contractor shall be prepared to load test completed pin and anchor installations in the existing masonry at the request of the engineer. The contractor shall provide up to three tests per type of installation in his base bid and shall provide additional tests as required to certify the installations per the satisfaction of the engineer if initial tests fail. Test shall be completed using a load cell against the structure tightened by turn-of-the-nut.
- 3.6 RECONSTRUCTION AND BONDING OF MULTI-WYTHE BRICK MASONRY
- A. Install drilled and grout-set reinforcing steel into the existing structure per the requirements of this Section and as indicated on the drawings. Install longitudinal reinforcing with 24" lap joints concurrently with the brick masonry reconstruction.
- B. Lay-up new brickwork with lateral headers to tooth wythes together at a 16" by 16" pattern and toothing into existing construction with in the horizontal longitudinal direction with full running bond.
1. Repeatedly pre-soak surfaces to which new work will be bonded to a period of not less than 24 hours. Allow to surface dry to a dull but saturated finish and hand rub a cement paste slurry within 30 minutes before applying new work.
 2. Lay a bed of mortar against intact masonry surfaces to surround the unit(s) to be reset. Hand rub a mortar paste slurry over contact surfaces of stones to be set and existing surfaces to which new work will be bonded, and pre-butter depressions that are deeper than 1/4" to provide a non-concave surface. The bedded mortar should match the finished joints in thickness plus an allowance for sloughing.

3. Brick units shall be re-set to within 1/4" of their previous positions and surface alignment, with individual joints' widths along all sides within 1/8" of their cumulative average width per stone. Reconstruct masonry using conventional and accepted techniques. Add header bricks between new wythes at a 24" x 16" pattern and anchor new wythes to existing construction using bent Retrofit Masonry Anchors. All horizontal and vertical joints (including collar joints) shall be completely filled with mortar that shall match the existing construction.
 4. Strike outer joints to a depth of 1/2" recess from brick faces and surrounding masonry at exterior wall surfaces to allow for final tuck pointing, and tool joints at interior surfaces to meet the outer surfaces of the bricks with a profile that matches the surrounding existing work.
- C. Following a curing period of not less than one nor more than 7 days, final tuck-point exterior surfaces of walls to match the adjacent original construction and the approved test sample. Provide feathered transitions from new to adjacent, existing mortar, angled at approx. 45 degrees from the exterior brick surface plane.
 - D. Moist-cure all completed work for periods of not less than 72 hours.
 - E. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.
- 3.7 GROUTED REINFORCED CONCRETE UNIT MASONRY BACK-UP CONSTRUCTION
- A. Establish lines, levels, and coursing indicated. Interior face of CMU construction shall conform to the planes established in the Contract Drawings. Exterior face of CMU shall conform as closely as possible to the contours of the backs of the veneer stones, with units being sized at 8", 10" and 12" width, as needed to minimize the amount of "fill" space between the CMU and the facing stones.
 - B. Maintain 8", 10" or 12" nominal masonry courses to uniform, straight lines established between the corners of the structure. Adjust to deviations in elevation of the substrate by varying mortar joint thickness (1/4" min thick) or saw-cutting units.
 - C. Concrete Masonry Units shall be set in running bond with flush mortar joints. Provide bond-beam blocks with empty bottom shells in top course. All CMU construction shall be fully grouted.
 - D. Setting and bonding of units shall comply with the following:
 1. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 4. Remove excess mortar as work progresses.
 5. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
 6. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 7. Cut mortar joints flush where water resistant coating is applied.

- E. Install steel reinforcement, inserts and anchors:
 - 1. Install reinforcing steel and/or joint reinforcement and vertical bar reinforcing per notes and details on structural drawings.
 - 2. Lap joint reinforcement ends minimum of wall thickness dimension. Lap bar reinforcing to develop full tension capacity of bar.
 - 3. Install inserts and anchors as indicated on the structural drawings.
 - 4. Support and secure reinforcing bars from displacement.

 - F. Grouting shall comply with the following:
 - 1. Following installation of reinforcing steel, inserts and anchors, place and consolidate grout fill without causing displacement in these items.
 - 2. When grouting is stopped for more than one hour, terminate grout 1 1/2" below top of upper masonry unit to form a positive key for subsequent grout placement, except at top course where grout shall be flush with tops of units.
 - 3. Perform Low Lift Grouting: Place first lift of grout to a height of 16" to three courses and rod for grout consolidation. Place subsequent lifts in 8-inch increments and for grout consolidation.

 - G. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.
- 3.8 RE-SETTING OF CAST STONE WORK
- A. Provide new cast stone units in accordance Section 047200 Cast Stone and perform all required repairs to cast stones to be re-used in accordance with Section 045000 Cast Stone Restoration.

 - B. At bed joints, add lead shims as needed to help float large units without squeezing out the mortar. Install stone anchors at proper alignments and stack next courses of units properly over them. Incorporate cotton chord weeps as indicated below next courses' head joints and clean sloughed mortar off internal stone perches at voided construction to expose tops of lower courses and weeps. Tool the interior edge of the mortar bedding at cavities to provide "shed joints" at a 1:1 slope, keeping the weep extensions clear of mortar. Incorporate flashing where indicated, providing solid bedding below the flashing to minimize "oil canning".

 - C. At head joints, fill the gaps between stone ends solidly with mortar, using backer rods at the interior edges of cavity construction if needed. Add slate shims if greater than 1" thickness, in order to minimize shrinkage and sloughing.

 - D. At bonded collar joints, hand rub a mortar paste slurry over the contact surfaces of the stone to be set and pre-butter depressions which are deeper than 1/4" to provide a non-concave surface. After setting and adjusting the stone units, pack bonded collar joints with mortar, adding stone aggregate shims if greater than 1" in thickness to minimize sloughing and shrinkage. Aggregate shall be washed, moistened pea-stone if the joint is between 1" and 3" in width, and small loose stones of suitable size if joint width is greater than 3".

 - E. Stones shall be re-set to within 1/4" of their previous positions and surface alignment, with individual joints' widths along all sides within 1/8" of their cumulative average width per stone. Properly size lead shims as needed to support the weights of the units, not relying solely on the bedding mortar for support. Install all anchors and ties to match the original tie and anchor arrangements (to be verified by the Engineer) or as specifically indicated on the detail drawings, if more frequent or larger.

- F. Strike outer joints at a recessed depth of 2 ½ times the joints' widths from the surrounding masonry and provide dovetail transitions to existing surrounding joints and to those that are to be re-pointed or removed.
- G. Finish point outer surfaces of the joints to match surrounding work after not less than 24 hours from the setting of the stones and filling of the joints.
- H. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

3.9 REPLACEMENT OF RUSTED ANGLE LINTELS

- A. Remove rusted angle lintels and jacked supported and concealing masonry.
- B. Following demolition and removal of brickwork for new opening create 8" wide bearing areas at each end of the top of the opening.
- C. Install new galvanized steel angle lintels as indicated on the contract drawings, setting these on a thin film of leveling mortar but not on a full bed so that the angles fit within a coursing joint.
- D. Replace brickwork around and over lintels, along with flashing and weeps if and as indicated.

3.10 PREPARATION OF JOINTS FOR REPOINTING

- A. Rake mortar joints in existing construction in areas designated to be repointed to a minimum depth of 2.5 times the mortar joint width, 1", or as deeply as necessary to reach sound mortar (whichever is greatest), but not to exceed one half of the thickness of the stone thickness without supplementary means of support. Employ tools that are sharp and will completely cut out joints at intersections without splitting or damaging stones or bricks. Raking work shall match the approved test sample.
- B. Gently drive wedges or hardwood shims into wide, deep cracks in masonry where there is a possibility that the vertical and in-plane lateral support of masonry work will be compromised during deep raking of the joints. This should at least be done where more than half of the length of a specific joint is removed to a depth of more than one third of the thickness of the stone.
- C. Cut flashing reglets in new or existing masonry as indicated on the Contract Drawings.
- D. Wire brush clean and then pre-wet the joints and allow for the existing mortar to dry or saturate to a dull, non-glossy finish immediately before applying new mortar.
- E. Where applicable, lead-abate all immediate lead-painted masonry surface areas that will be affected by cutting and pointing work, prior to starting masonry operations.

3.11 RE-POINTING

- A. Pre-wet prepared mortar joint surfaces until they are saturated but surface dry. At flashing reglets, verify that flashing has been fully installed and is stable.
- B. Apply final "tuck" lift of pointing mortar, tooling joints to exactly match the existing joint profiles that are adjacent to the work.

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- C. Where so specified, point joints and beds with specified sealant after first installing the specified backup material and applying primer if required, all in strict accordance with the printed instructions of the sealant manufacturer. Test all sealants for compatibility prior to use. Tool all sealants to insure maximum adhesion to contact surfaces.
- D. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.
- E. Clean mortar from all surfaces following completion and curing of work.
- F. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.
- G. The Contractor shall be responsible for matching the joints of the mock-up surrounding work and shall re-cut and replace any joints that are poorly formed or do not match the mock-up or the surrounding work, as determined by the Engineer, at the Contractor's own expense.
- H. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.
- I. Chemically clean all surfaces following completion and curing of work, being careful to reveal the mortar aggregate but to not over-etch, weaken or discolor the mortar. Remove excess mortar from the surface before it sets using a bristle brush or by rubbing the surface with burlap or clean sand. If mortar is left on the surface, wash surface clean using dilute solutions of Hydroclean HT-455.
- J. Completed work shall match approved sample patch or shall be re-done at the Contractor's expense.

3.12 FINISH POINTING

- A. Pre-wet prepared mortar joint surfaces until they are saturated but surface dry. At flashing reglets, verify that flashing has been fully installed and is stable.
- B. Apply a 3/8" base lift of tuck pointing mortar, and allow to cure. Base lift shall have a struck recess for tuck-pointing to lock into.
- C. Apply final "tuck" lift of tuck pointing mortar and strike-off for flush surface.
- D. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.
- E. Clean mortar from all surfaces following completion and curing of work.
- F. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.
- G. The Contractor shall be responsible for matching the joints of the mock-up surrounding work and shall re-cut and replace any joints that are poorly formed or do not match the mock-up or the surrounding work, as determined by the Engineer, at the Contractor's own expense.
- H. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.
- I. Chemically clean all surfaces following completion and curing of work.

- J. Completed work shall match approved sample patch or shall be re-done at the Contractor's expense.

3.13 CLEANING AND PROTECTION OF COMPLETED MASONRY WORK

- A. As work proceeds and upon completion, remove excess mortar, smears and droppings. Clean adjacent and adjoining surface of marks arising out of execution of work in this Section.
- B. Sweep up and remove daily sand, cleaning compounds and mixtures, dirt, debris and rubbish. Sweep or flush away nightly, all residual washed materials. Keep the premises neat and clean at all times.
- C. After installation and pointing are completed, carefully clean all surfaces of all dirt, excess mortar, grout splatter, stains and/or other site incident defacements. Clean soiled surfaces using a non-acidic solution that will not harm stone or adjacent materials. Consult stone fabricator for acceptable cleaners. Do not use wire brushes, acid or other solutions which may cause discoloration. Use nonmetallic tools in cleaning operation. Apply in accordance with cleaner manufacturer recommendations.
- D. Mechanically remove all loose mortar and concrete splatter with hand tools without scratching, gouging or otherwise marring the existing substrate.
- E. Clean all masonry to remain per Section 040012 Cleaning Existing Masonry.

3.14 INSTALLATION OF FLEXIBLE SEALANTS

- A. Provide backer rod and sealant where indicated on the Contract Drawings.
- B. Install backer rod and sealant in strict accordance to manufacturer's instructions. Use primer where recommended by manufacturer.
- C. Size backer rod for each joint size.
- D. Install sealant to the depth recommended by the manufacturer for each width of joint. Joint profile shall match adjoining mortar profile. Face of joint shall be sanded so that color and texture shall match adjoining mortar joints.
- E. Sealant at backer rod shall be installed at all locations indicated on Drawings and at all locations subject to structural or thermal movement.

3.15 SETTING/ RE-SETTING TOLERANCES

- A. Maximum Variation from Plane of Wall: 1/4" in 10 feet or as required by elevator clearances
- B. Maximum Variation from Plumb: 1/4" per story non-cumulative, 1/2" total, or as required by elevator clearances.
- C. Maximum Variation from Level Coursing: 1/8" in 4 feet, 1/4" in 10 feet
- D. Maximum Variation of Joint Thickness: 1/8"

END OF SECTION

SECTION 040012

CLEANING EXISTING MASONRY
(PART OF FILED SUB-BID SECTION 040012)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SECTION INCLUDES:

- A. Work Included: Cleaning existing masonry (both brick and cast stone)

- B. Remove:

1. Dirt and soil
2. Waterproof coatings
3. Cementitious coatings
4. Surface sealants, but not joint sealants
5. Water repellents
6. Tar, asphalt, and bitumens
7. Paint and coatings
8. Graffiti and graffiti resistant coatings
9. Rust and metallic stains
10. Ivy and organic growth
11. Efflorescence and lime
12. Animal feces
13. Carbon encrustation and soot
14. Body oils, finger prints, hand prints, foot prints
15. All other non-masonry substances, stains, and contamination

1.3 SUBMITTALS:

- A. Product Data: Manufacturer's data including instructions, recommendations, and restrictions.

1.4 QUALITY CONTROL:

- A. Observation: Perform quality control under direct observation of the Owner's consultant.
- B. Written Records: Provide detailed written records for each cleaning test, each cleaning condition, each substrate, and each contamination type.
 1. Record cleaner used, cleaner concentration, cleaning techniques, cleaner dwell time on surface, tools used, water temperature, water pressure, and other relevant information.
- C. Cleaner Testing: Before creating mock ups and before production cleaning, test cleaners, cleaner concentrations, and cleaning techniques on small test samples at inconspicuous locations approved by Engineer.
 1. Repeat cleaner testing until successful cleaning is achieved, as judged by the Engineer and Architect.

- D. **Cleaning Mock Ups:** Provide mock ups at the earliest possible time and before ordering production quantities of cleaning materials.
1. **Mock Up Locations and Solar Orientations:** Comply with Engineer's directions.
 2. **Mock Up Size and Quantities:** Provide minimum 3 x 6 feet cleaning mock ups for each cleaning condition, each substrate, and each contamination type included in this section
 3. **Cleaning Workers:** Use the same workers for both mock ups and production cleaning.
 4. **Repeat Successful Cleaner Testing:** Use the same cleaners, cleaner concentrations, cleaning techniques, cleaner dwell time on surface, water temperature, water pressure, tools, and techniques used.
 5. **Adverse Reactions:** Allow cleaning mock ups to dry for at least seven days to allow time for adverse reactions to become evident.
 6. **Repeat Mock Ups:** Repeat mock ups until successful cleaning is achieved, as judged by the Engineer and the Owner's restoration consultant.
 7. **Update Records:** Update written records to record changes from successful cleaner testing, if any.
 8. **Protect:** Protect approved mock ups from damage and modification.
 9. **Disposition:** Approved mock ups shall be incorporated into the completed Project.
- 1.5 **DELIVERY, STORAGE, HANDLING:**
- A. Comply with Division 1 General Requirements and manufacturer's instructions and recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Diedrich Technologies, Inc., www.diedrichtechnologies.com
- B. EaCo Chem, Inc., www.eacochem.com
- C. Hydrochemical Techniques, Inc., www.hydroclean.com
- D. Prosoco, Inc., www.prosoco.com

2.2 MASONRY CLEANING MATERIALS:

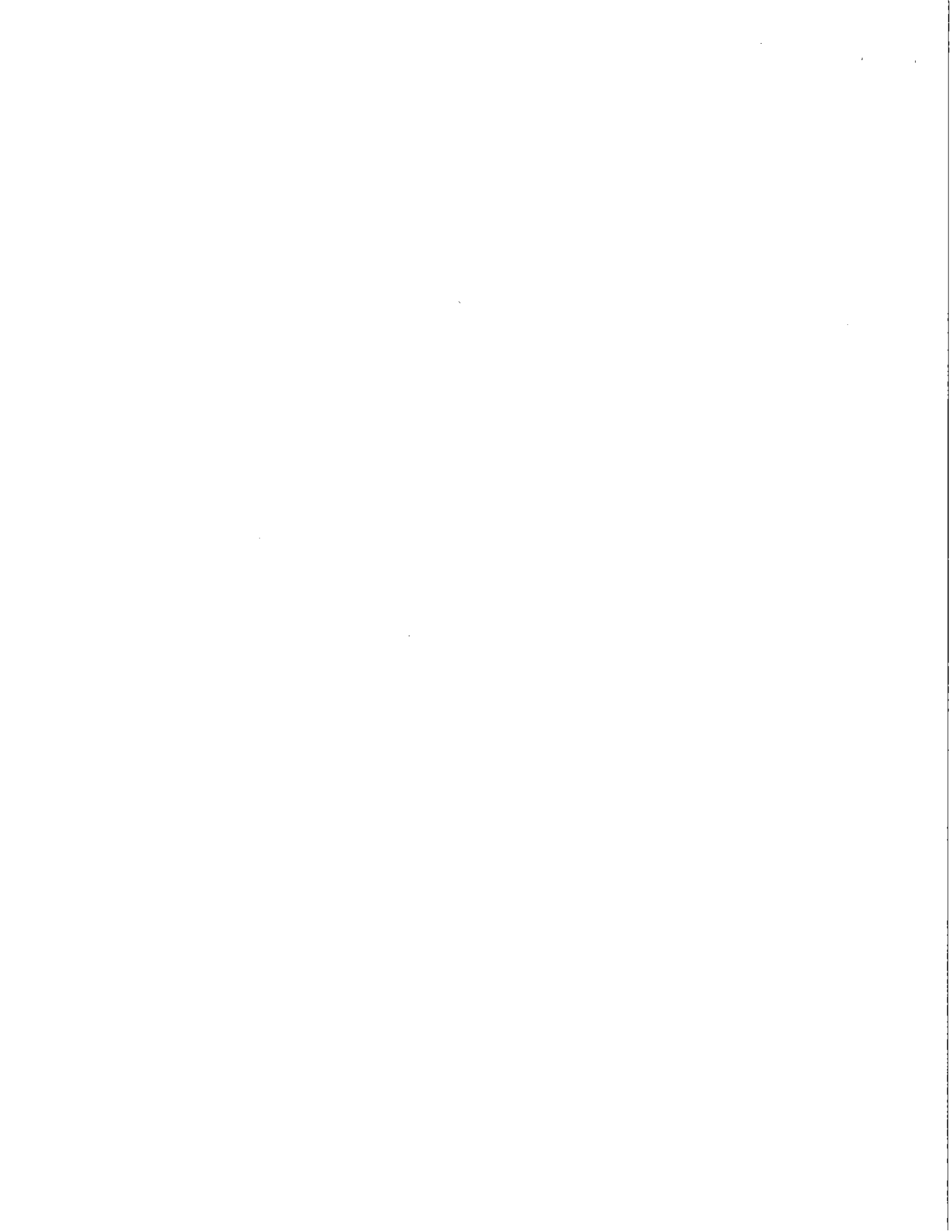
- A. **Cleaners:** Provide cleaners specifically manufactured for each substrate and soiling condition.
- B. **Water:** Clean, drinkable, and free of deleterious materials.
1. **180 Degrees F Water:** Required for removal of paint, tar, and asphalt.
- C. **Brushes:** Soft bristle with fiber type recommended by cleaner manufacturer for each cleaner used.
- D. **Pressure Cleaning Equipment:**
1. **Water Pressure at Contact Point of Material:** ≤500 psi. Testing shall be completed prior to full washing to confirm pressure washing practices do not damage masonry or mortar with high pressure water.
 2. **Spray Tip:** ≥15 degree spread.
 3. **Water Flow Rate:** 3 to 6 gallons per minute.

PART 3 - EXECUTION

3.1 MASONRY CLEANING:

- A. Comply with cleaner manufacturer's instructions and recommendations.
- B. Repeat cleaning procedures successfully used on "Cleaning Mock Ups".
 - 1. Cleaning Workers: Use the same workers for both mock ups and production cleaning.
- C. Pre-wet surfaces to be cleaned.
- D. Mix cleaner with water if recommended by cleaner manufacturer.
- E. Apply cleaner by hand with soft brush.
- F. Work cleaner into all cracks, crevices, and details.
- G. Gently agitate the surface and lift contamination.
- H. Allow cleaner to remain on the surface for time period recommended by cleaner manufacturer.
- I. Do not allow cleaner to dry on the surface.
- J. Rinse thoroughly and completely with specified water and pressures.
- K. Keep spray nozzle ≥ 8 inches from the surface.
- L. Repeat cleaning until acceptable cleaning is achieved.
- M. Do not damage substrates.
 - 1. Removal of soil and stains is expected to change appearance.
 - 2. Do not "bleach", streak, or change actual substrate colors.
- N. Protect cleaned areas from bleaching, streaking, and resoiling/restaining.

END OF SECTION



SECTION 045000

CAST STONE RESTORATION
(PART OF FILED SUB-BID SECTION 045000)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Attention is directed to the existing structure conditions, geometry and dimensions at the site. The contractor shall become thoroughly familiar with the existing conditions in order to assess the metal stair work required. Submittal of a bid to perform the work of this section acknowledges a thorough understanding of existing conditions.

1.2 SECTION INCLUDES

- A. Provide all labor, materials, equipment, and services required to complete the work as described on the drawings, as specified in this section, and as may be required.
- B. Scope for Cast Stone Repair
 - 1. Patching with specified mortars all spalls in cast stone indicated on the drawings
 - 2. Cutting out of corroded sections of steel reinforcement at spalls where directed by project engineer and treatment of exposed ends prior to patching
 - 3. Scraping and coating of corroded section of steel reinforcement at spalls prior to patching
 - 4. Removal of failed cast stone patches and re-patching with specified repair mortar

1.3 RELATED SECTIONS

- A. Section 040012 – Cleaning Masonry
- B. Section 041000 – Masonry Restoration

1.4 SUBMITTALS

- A. Epoxy Adhesive: Manufacturer's data and MSDS sheets on epoxy adhesive.
- B. Stainless Steel Dowels, Plates: Sample of each type of anchor or fastener.
- C. Patching Material: Manufacturer's data and numbers of standard colors.
- D. Product data and MSDS sheets for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
- E. Samples for verification purposes, prior to erecting the mockup, of the following:
 - 1. Each new exposed masonry material to be used for replacing existing materials. Include in each set of samples the full range of colors and textures to be expected in the completed work.

2. Each type of adhesive
 3. Each type of anchor
- F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- G. Restoration program for each phase of the restoration process, including protection of surrounding materials on building and site during operations. Describe in detail the materials, methods, and equipment to be used for each phase of the restoration work.
1. If alternative methods and materials to those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this project.
- 1.5 QUALITY ASSURANCE
- A. Patching
1. The goal of patching is to reestablish flush surfaces and original profiles on spalled or exfoliated limestone/cast stone or brownstone units. Patches should match the existing stone in color, texture, exposed aggregate and physical properties.
- B. Repointing
1. The goal of repointing is to remove all failed and deteriorated joints to a sufficient depth without damaging the edges of the stone or widening the existing joints. New mortar should be compatible with the stone and resemble the original mortar in color, texture and appearance.
- C. Crack Repair
1. The goal of crack repair is to remove and replace incompatible or failed mortars, grouts or sealants and replace them with compatible materials.
- D. Contractor shall maintain an experienced full-time supervisor on the job site during times that stone masonry restoration and cleaning are in progress. Restoration Specialist: Engage an experience masonry restoration and cleaning firm that has specialized in the types of work required for this project.
1. Field Supervision: Require restoration specialist firm to maintain an experienced full-time supervisor on the job site during times that stone masonry restoration and cleaning are in progress.
- E. Manufacturer Qualifications: A company regularly engaged in producing masonry cleaning compounds, which have been used on similar projects with successful results, and that retains factory-trained representatives who are available for consultation and jobsite inspection and assistance at no additional cost.
- F. Field-Constructed Mockups: Prior to start of general masonry restoration, prepare the following sample panels on the building where directed by Architect. Prepare sample panels using same materials and methods proposed for the Work, and under same weather conditions to be expected during construction as a standard for judging the completed Work.
1. Dutchmen: Submit one sample of a stone dutchman in a location to be selected by Architect/Engineer/Conservator. The dutchmen mockups will be evaluated for craftsmanship, fit, tooling, carving and seams.
 2. Cementitious Patches: Prepare a minimum of six sample patches using approved composite mortar colors. Samples to be evaluated for color, texture, tooling, shaping and

in the case of cast stone for exposed aggregate. Provide a minimum of two samples each for brownstone matching, limestone matching and cast stone matching. Cast stone samples to have matching exposed aggregate pressed into surface or mixed into top coat.

- G. Source of Materials: Obtain materials for stone masonry restoration from a single source for each type of material required (stone, cement, sand, etc.) to ensure a match of quality, color, pattern, and texture.

1.6 REFERENCE STANDARDS

- A. ASTM C119: Definitions of Terms Relating to Natural Building Stones
- B. ASTM C144: Aggregate for Masonry Mortar
- C. ASTM C150: Portland Cement
- D. ASTM C170: Compressive Strength
- E. ASTM C270: Mortar for Unit Masonry

1.7 SEQUENCING/ SCHEDULING

- A. Perform masonry restoration work in the following sequence:
 - 1. Disassemble cast stone cornice elements placing number of stone from setting drawing in a concealed location
 - 2. Remove pins and old mortar
 - 3. Repair existing masonry with Dutchmen or patching as directed
 - 4. Replace existing masonry with new masonry materials
 - 5. Rebuild cornice incorporating repaired original cast stone as well as new elements

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Site Storage of Stone: Upon receipt at the building site or storage yard, stack the stone on timber platforms at least 4" above the ground. Take extreme care to prevent staining during storage. If storage is to be for a prolonged period, place polyethylene or other suitable plastic film between any wood and finished surfaces. Use also as an overall protective covering. Plug Lewis holes during freezing weather to prevent the accumulation of water. Do not use salt for the melting of ice formed in Lewis holes or on pieces, or for any purpose involving its contact with the stone.
- B. Store and handle stone units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.
- C. Protect stone during storage and construction against moisture, soiling, staining and physical damage.
 - 1. Handle to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges with wood or other rigid materials. Lift with wide-belt type slings wherever possible. Do not use wire rope or ropes containing tar or other substances that might cause staining. If required use wood rollers and provide cushion at end of wood slides.
 - 2. Store on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack to distribute weight evenly and to prevent breakage or cracking. Protect stored

materials from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around materials.

- D. Deliver stone materials in undamaged condition. Deliver cleaning materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
- E. Store cementitious materials off the ground, under cover and in dry location
- F. Store aggregates where grading and other required characteristics can be maintained
- G. Protect mortar materials and stone accessories including metal items to prevent deterioration by corrosion and accumulation of dirt

1.9 PROJECT CONDITIONS

- A. Protection of Work During Erection: Cover top of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Do not apply concentrated loads for at least 3 days after building masonry walls.
 - 3. Staining: Prevent grout or mortar from staining the face of stone to be left exposed. Remove immediately grout or mortar in contact with such stone.
 - 4. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.
- B. Remove all stone determined to be frozen or damaged by freezing conditions.

1.10 COLD WEATHER PROTECTION

- A. Do not erect, clean or repoint any stone when temperature of surrounding area is below 40 degrees F., or below 45 degrees F. and falling, or forecast by public news media to fall to or below 35 degrees F. within 24 hours without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing. Minimum temperature within heated enclosure shall be 40 degrees F. Do not use masonry materials which are likely to contain frost. Do not use accelerating ingredients with any mortar. Mortar shall harden without freezing and with no damage from frost. Protect all stone against freezing for not less than 48 hours after installation.
- B. Do not lay stone units that are wet or frozen. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen setting beds. Remove any ice or snow formed on stone bed by carefully applying heat until top surface is dry to the touch. Remove and replace stone work damaged by frost or freezing.

1.11 HOT WEATHER PROTECTION

- A. Protect stone work in hot weather to prevent excessive evaporation of setting beds and grout. Provide artificial shade, wind breaks and use cooled materials as required. Use fresh mortar. Discard mortar that has stiffened due to hydration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Epoxy Adhesive for Setting Pins and Stone to Stone Contact: Equal to Sikadur 35, Hi-Mod LV high strength adhesive ASTM C881 as manufactured by Sika Corporation, Lyndhurst NJ.
- B. Cast Stone Patching: System 45 LC from Edison Coatings, Inc, Plainville, CT Telephone 1 (800) 697-8055 with crushed stone aggregate and sand added to the surface of the repair in order to blend patch with adjacent original material. Mix Parts A and B in a sufficient ratio to obtain stiff patching mix.
- C. Cementitious Crack Grout: For cracks up to 3/16" Jahn M30 for cracks 3/16 to 9/16 Jahn M-40 as distributed by: Cathedral Stone Products, Jessup, MD, or approved equal.
- D. Water for Cleaning and Mixing with Mortars: Potable water. If not potable filter through an Aquapure (or equal) filtration system to remove iron and particulates. The water shall be filtered with a 5-micron particulate filter placed in line with the water supply. All hoses, fittings, pumps shall be made from non-ferrous alloy parts.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect surfaces adjacent to work area from damage or staining.

3.2 CAST STONE PATCHING AT LOSS

- A. Cut out deteriorated cast stone and adjacent cast stone that has begun to deteriorate. Remove additional stone so that patch will not have feathered edges and will be at least ¼ inch thick.
- B. Remove loose particles, soil, debris, oil, and other contaminants from existing stone units at locations indicated by cleaning with a stiff-bristle brush.
- C. Mix materials as per manufacturer's directions.
- D. Place patching mortar in layers no thicker than 2 inches. Roughen surface of each layer to provide a key for the next.
- E. Build patch up ¼ inch above surrounding stone and carve surface to match adjoining stone after mortar has begun to harden. Press approved aggregate into the surface of the patch to achieve a match to the adjacent exposed aggregate cast stone. Distribute aggregate evenly to achieve a uniform appearance consistent with the aggregate distribution in the adjacent original areas.
- F. Keep each layer damp for 72 hours or until mortar has set.
- G. Unacceptable patches are defined as those with hairline cracks or that show separation from unit at edges, and those that do not match adjoining unit in color or texture. Remove patches and refill to provide patches free of those defects.

3.3 CAST STONE PATCHING AT REBAR SPALLS

- A. Expose corroded rebar by removing adjacent cast stone matrix.
- B. Scrape corroded rebar to remove all scale or loose and flaking material. After scarping, coat rebar with approved zinc rich spray galvanizing compound or approved equal.
- C. If rebar is completely corroded, cut out section of exposed corroded rebar and coat exposed ends with rich spray galvanizing compound or approved equal.
- D. Patch area of loss as per above section 3.2

3.4 CRACK REPAIR AT CASTSTONE

- A. Review areas to be grouted with project engineer/architect/conservator.
- B. Follow manufacturer's instructions for mixing material, sealing crack prior to injection and for injecting material.
- C. Clean surfaces of excess grout.

END OF SECTION

SECTION 073126

SLATE SHINGLES

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Slate shingles.
 - 2. Underlayment.
 - 3. Snow guards.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the Enterprise Green Communities Criteria. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers and cants.
 - 2. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
 - 1. Slate Shingle: Full size, of each color, size, texture, and shape.
 - 2. Ridge Cap: 12-inch-long Sample.
 - 3. Fasteners: Three fasteners of each type, length, and finish.
 - 4. Snow Guard: Base, bracket, and 12-inch-long rail.

- C. Material Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each slate variety.
- D. Maintenance Data: For roofing to include in maintenance manuals.
- E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each color of slate shingle from single quarry capable of producing slate of consistent quality in appearance and physical properties.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups including related roofing materials.
 - a. Size: 48 inches long by 48 inches wide.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Warranty: Standard form in which roofing Installer agrees to repair or replace slate roofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: [Two] [Five] <Insert number> years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's Warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:

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

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Slate Shingles: 25 sq. ft. of each type and color, in unbroken bundles.

PART 2 - PRODUCTS

2.1 SLATE SHINGLES

A. Slate Shingles: ASTM C 406, Grade S1; hard, dense, and sound; chamfered edges, with nail holes machine punched or drilled and countersunk. No broken or cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Greenstone Slate Company, Inc.
- b. New England Slate Company (The).
- c. North Country Slate.
- d. Structural Slate Company (The).

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- e. Tatko Stone Products, Inc.
- f. U.S. Quarried Slate Products, Inc.
- g. Vermont Structural Slate Company, Inc.

- 2. Thickness: Match existing.
- 3. Surface Texture: Match existing.
- 4. Size: Match existing.
- 5. Nail Holes: Two per shingle.
- 6. Butt Shape: Standard square cut.
- 7. Color: Match existing.
- 8. Weather-Exposure Color Change: Unfading.

B. Starter Slate: Slate shingles with chamfered nail holes front-side punched.

- 1. Length: Exposure of slate shingle plus head lap.

C. Ridge Slate: Slate shingles fabricated with vertical grain orientation.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, Inc.
 - b. GCP Applied Technologies (formerly W.R. Grace).
 - c. Henry Company.

2.3 SNOW GUARDS

A. Snow-Guard Pads: Fabricated [copper] [cast-bronze] [zinc] [stainless-steel] [aluminum] <Insert material> units, designed to be installed without penetrating slate shingles, and complete with predrilled holes or hooks for anchoring.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
 - b. M. J. Mullane Company, Inc.
 - c. SnoGuard.
 - d. Snow Management Systems.
 - e. Zaleski Snow-Guards for Roofs, Inc.

B. Snow-Guard Rails: Units fabricated from metal baseplate anchored to fixed bracket and equipped with three bars.

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
 - b. M. J. Mullane Company, Inc.
 - c. SnoGuard.
 - d. Snow Management Systems.
2. Brackets and Baseplate: Stainless steel.
3. Bars: Stainless steel, mill finished.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in slate-shingle roofing and remain watertight.
- D. Slating Nails: ASTM F 1667, copper, smooth shanked, wire nails; 0.135-inch minimum thickness; sharp pointed; with 3/8-inch-minimum diameter flat head; of sufficient length to penetrate a minimum of 3/4 inch into sheathing.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- E. Wood Nailers and Beveled Cant Strips: Comply with requirements for pressure-preservative-treated wood in Section 061000 - ROUGH CARPENTRY.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 - SHEET METAL FLASHING AND TRIM.
- B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 UNDERLAYMENT INSTALLATION
- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install over entire roof deck lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches, staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
- 3.3 METAL FLASHING INSTALLATION
- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 - SHEET METAL FLASHING AND TRIM.
1. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- 3.4 WOOD NAILERS
- A. Install wood nailers at ridges, hips and rakes, and securely fasten to roof deck.
- B. Install beveled wood cant at eaves and securely fasten to roof deck.
- 3.5 SLATE-SHINGLE INSTALLATION
- A. General: Beginning at eaves, install slate shingles according to manufacturer's written instructions and to details and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
1. Install wood nailer strip cant at eave edges.
 2. Install shingle starter course chamfered face down.
- B. Install first and succeeding shingle courses with chamfered face up. Install full-width first course at rake edge.
1. Offset joints of uniform-width slate shingles by half the shingle width in succeeding courses.

2. Offset joints of random-width slate shingles a minimum of 3 inches (75 mm) in succeeding courses.
 - C. Maintain a 3-inch-minimum head lap between succeeding shingle courses.
 - D. Maintain uniform exposure of shingle courses between eaves and ridge.
 - E. Extend shingle starter course and first course 1 inch over fasciae at eaves.
 - F. Extend shingle starter course and succeeding courses 1 inch over fasciae at rakes.
 - G. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.
 - H. Hang slate with two slating nails for each shingle with nail heads lightly touching slate. Do not drive nails home drawing slates downward or leave nail head protruding enough to interfere with overlapping shingle above.
 - I. Ridges: Install ridge slate in saddle configuration.
 1. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip 3 to 4 inches from the eave. Cover with felt underlayment strip, extending to underlying slate but concealed by ridge slate.
 2. Anchor ridge slate to supporting wood nailer strip with two nails for each slate shingle without nails penetrating underlying slate.
 3. Cover heads of exposed nails at final ridge shingle with butyl sealant.
 - J. Hips: Install and anchor slate hips in saddle configuration.
 1. Install and anchor wood nailer strips of thickness to match abutting courses of slate shingles. Cover nailer strip with felt underlayment strip, extending on to underlying slate but concealed by hip slate. Anchor hip slate to nailer strip with two nails located in upper third of hip-slate length.
 2. Notch starter shingle and first shingle course at hip to fit around nailer strips so no wood is exposed at ridge eave.
 3. Lay hip slate in bed of butyl sealant.
 - K. Closed Valleys: Cut slate shingles to form straight lines at closed valleys, trimming upper concealed corners of shingles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch.
 1. Do not nail shingles to valley metal flashings.
- 3.6 SNOW-GUARD INSTALLATION
- A. Snow-Guard Pads: Install snow-guard pads at locations indicated according to manufacturer's written installation instructions.
 - B. Snow-Guard Rails: Install snow-guard rails at locations indicated according to manufacturer's written installation instructions.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace damaged or broken slate shingles.
- B. Remove excess slate and debris from Project site.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roof-edge drainage systems.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the Enterprise Green Communities Criteria. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
 - 2. Section 079200 - JOINT SEALANTS for sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations 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.

1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. **Shop Drawings:** For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. **Samples for Verification:** For roof-edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 QUALITY ASSURANCE

- A. **Mockups:** Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including gutter and downspout approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. **Preinstallation Conference:** Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 - 1. Pre-Patinated Exposed Finish.

2.2 CONCEALED METALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated Copper Sheet: Series 300 stainless steel.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ATAS International, Inc.
 - 2. Berger Building Products, Inc.
 - 3. Cheney Flashing Company.
 - 4. Hickman Company, W. P.
 - 5. Merchant & Evans, Inc.
 - 6. Metal-Era, Inc.
 - 7. Metal-Fab Manufacturing, LLC.
 - 8. MM Systems Corporation.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:

- a. Copper: 16 oz. thick.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and soldered.
4. Gutter Supports: As indicated with finish matching the gutters.
5. Gutter Accessories: Bronze wire ball downspout strainer,

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

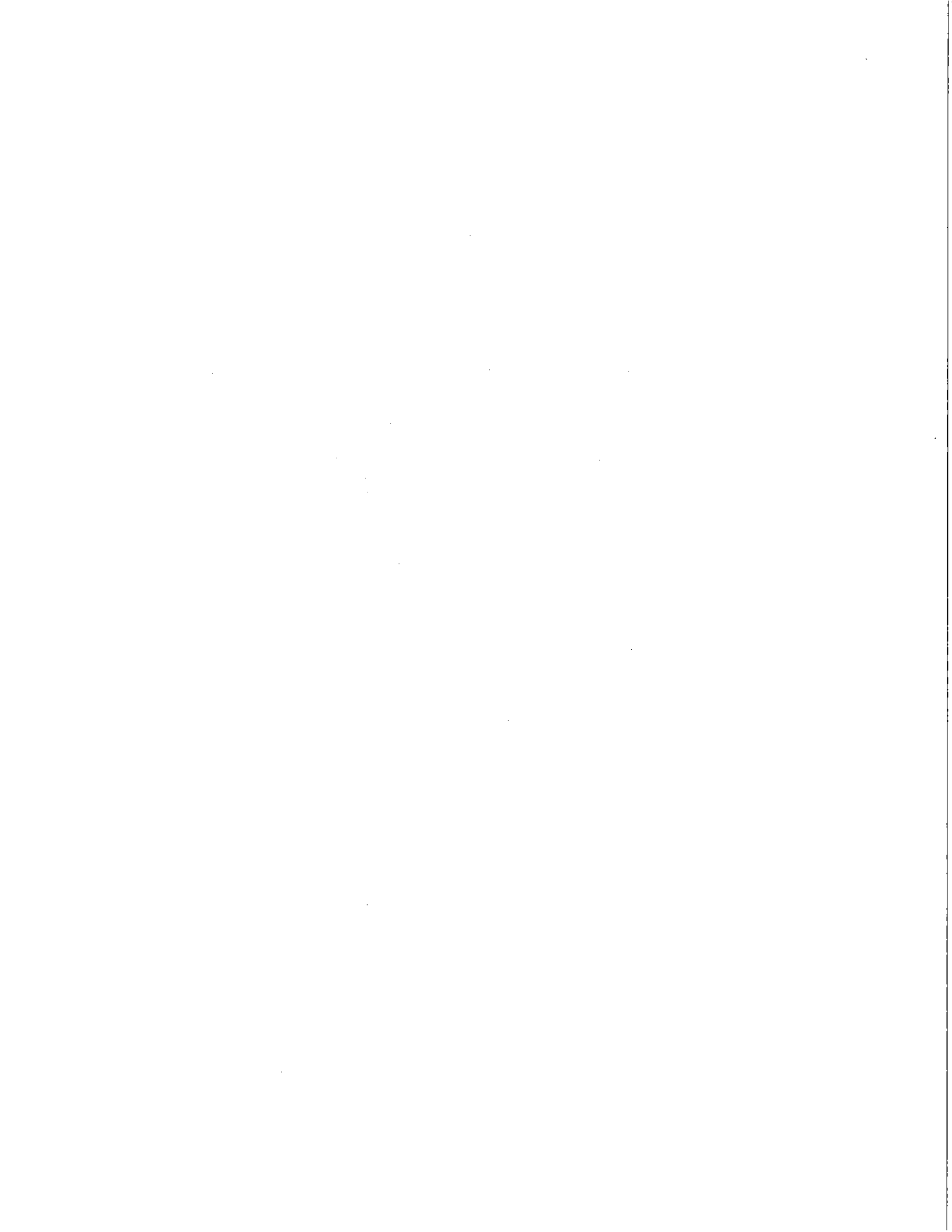
- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - E. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F
 - F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- 3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION
- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
 - B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- 3.4 CLEANING AND PROTECTION
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - B. Clean and neutralize flux materials. Clean off excess solder and sealants.
 - C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
 - D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION



SECTION 085200

WOOD WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed and operable aluminum-clad wood-framed windows with factory-installed glass and glazing, and with primed wood interior finish.
- B. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the Enterprise Green Communities Criteria. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 088000 - GLAZING for glazing requirements for wood windows, except those specified to be factory glazed.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
 - 1. Minimum size required by AAMA/NWWDA 101/I.S.2.
- B. AAMA/NWWDA Performance Requirements: Provide wood windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
 - 1. Performance Class: C - Commercial.
 - 2. Performance Grade: Minimum for performance class indicated.
 - 3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, 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 Code requirements.

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- C. **Structural Performance:** Provide wood windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated:
 - 1. Deflection: Based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Deflection Test.
 - 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 structural computations.
 - 3. Wind Speed: As required by Code.
- D. **Air Infiltration:** Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
 - 1. Maximum Rate: As required by Code.
- E. **Water Resistance:** No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
 - 1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft..
- F. **Thermal Transmittance:** Provide wood windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
 - 1. U-Value: As required by Code.
- G. **Solar Heat-Gain Coefficient:** Provide wood windows with a whole-window SHGC maximum as required by Code determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

1.4 SUBMITTALS

- A. **Product Data:** Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.
- B. **Shop Drawings:** Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:
 - 1. Mullion details, including reinforcement and stiffeners.
 - 2. Joinery details.
 - 3. Expansion provisions.
 - 4. Flashing and drainage details.
 - 5. Weather-stripping details.
 - 6. Glazing details.
 - 7. Window cleaning provisions.
 - 8. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:

- a. Structural test pressures and design pressures from basic wind speeds indicated.
 - b. Deflection limitations of glass framing systems.
- C. Samples for Verification: For wood window components required, prepared on Samples of size indicated below.
- 1. Main Framing Member: 12-inch-long, full-size sections of extrusions with factory-applied color finish.
 - 2. Hardware: Full-size units with factory-applied finish.
 - 3. Weather Stripping: 12-inch-long sections.
- D. Qualification Data: For installer and professional engineer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of wood window. Test results based on use of downsized test units will not be accepted.
- F. Maintenance Data: For operable window sash, operating hardware, weather-stripping and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain wood windows through one source from a single manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for wood windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- E. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA-certified wood windows with an attached label.
- F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify wood window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 1. Failure to meet performance requirements.
 2. Structural failures including excessive deflection.
 3. Water leakage, air infiltration, or condensation.
 4. Faulty operation of movable sash and hardware.
 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 6. Insulating glass failure.
- B. Warranty Period: Two years from date of Substantial Completion.
- C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.
- D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Aluminum-Clad Wood Windows:
 - a. Eagle Window & Door, Inc..
 - b. Kolbe & Kolbe Millwork Co., Inc.
 - c. Marvin Windows and Doors.
- B. Basis-of-Design: Marvin Clad Ultimate Single Hung.

2.2 MATERIALS

- A. Forest Certification: Provide wood windows produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC's "Principles and Criteria for Forest Stewardship."
- B. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
- C. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members.

Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, and not less than 16,000-psi minimum yield strength.

1. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight and complying with AAMA 2605. Color as selected by the Architect.
- D. Wood Trim and Glazing Stops: Material and finish to match frame members.
- E. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- F. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- G. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- H. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood window is closed.
1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
- I. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- J. Replaceable Weather Seals: Comply with AAMA 701/702.
- 2.3 GLAZING
- A. Insulating-Glass Units for Vertical Glazing: Minimum 3/4 inch thick insulating glass consisting of two equal lites with low-e coating on No. 2 surface and argon gas filled. Thickness sufficient to maintain DP rating on the window for each window size on the project.
- B. General: Comply with AAMA/NWWDA 101/I.S. 2.

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. Provide for each operable exterior sash or ventilator.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, 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: Baked-on organic coating in color selected by Designer from manufacturer's full range.
- C. Glass-Fiber Mesh Fabric: Manufacturer's standard mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color. Comply with ASTM D 3656.
- D. Wickets: Provide sliding wickets, framed and trimmed for a tight fit and durability during handling.

2.5 ACCESSORIES

- A. Grids: Removable grids and simulated divided lites as indicated on the Drawings. Color as selected by Designer.

2.6 FABRICATION

- A. General: Fabricate wood windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.
- B. Exterior Cladding: Minimum thickness 0.050 inch.
- C. Reglazing: Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.
- D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
 - 1. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
- E. Factory machine windows for openings and hardware that is not surface applied.
- F. 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.

- G. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches, glaze wood windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.
- H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.7 WOOD FINISHES

- A. Factory-Finished Windows: Provide fabricator's standard factory finish consisting of prime coat applied to interior wood surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- 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. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

- A. 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.

3.4 PROTECTION AND CLEANING

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. 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.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION