

PROJECT MANUAL for:

Volume 1:

Bidding Documents and Common Information

Volume 2:

Various Locations – Repair

Masonry Stair Towers at Hudson and Gillett

PROJECT NO: CP231031

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Volume 3:

Student Recreation Center –

East Elevation Masonry Repair

PROJECT NO.: CP231201

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**UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI**

For:

THE CURATORS OF THE UNIVERSITY OF MISSOURI

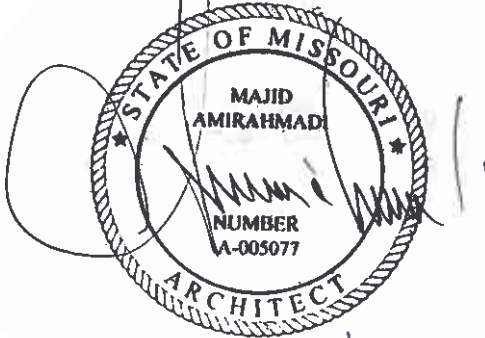
Issued for Bid: February 21, 2024

VOLUME 3

PROJECT MANUAL FOR: STUDENT RECREATION CENTER – EAST ELEVATION MASONRY REPAIR

PROJECT NUMBER: CP231201

I hereby certify that these Drawings and/or Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Drawings and/or Specifications are as required by and in compliance with Building Codes of the University of Missouri.



Signature: 2-21-2024

SECTION 00 0110

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SHOP DRAWING AND SUBMITTAL LOG

Project: Student Recreation Center – East Elevation Masonry Repair
 Project Number: CP231201
 Contractor:

Section	Description	Contractor	Date Rec'd	#	Date Sent to Cons.	Date Ret'd	Remarks	Date ret'd	Cont'r	Copies To Owner	File
024119	SELECTIVE DEMOLITION										
	Proposed Protection Measures										
	Schedule for Selective Demolition Activities										
	Inventory										
	Predemolition Photographs										
042000	UNIT MASONRY										
	Product Data										
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	Samples for Initial Selection										
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	Material Certificates										
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	Cold-Weather and Hot-Weather Procedures										
045000	EXTERIOR HISTORIC MASONRY RESTORATION										
	Product Data										
	Samples for Initial Selection										
	Samples for Verification										

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	Shop Drawings										
	Field Constructed Mockups										
	Preconstruction Photographs										
	Masonry Historic Treatment Program										
	Quality Control Program										
	Grout Mixing Plan										
051200	STRUCTURAL STEEL FRAMING										
	Product Data										
	Shop Drawings										
	Mill Test Reports										
	Source Quality Control Reports										
072726	FLUID-APPLIED MEMBRANE AIR BARRIERS										
	Product Data										
	Installer's Qualification Data										
	Product Certificates										
	Product Test Reports										

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Section	Description	Contractor	Date Rec'd	#	Date Sent to Cons.	Date Ret'd	Remarks	Date ret'd	Cont'r	Copies To Owner	File
075323	EPDM ROOFING										
	Product Data										
	Shop Drawings										
	Installer's Qualification Data										
	Manufacturer's Certificate										
	Product Test Reports										
076200	SHEET METAL FLASHING AND TRIM										
	Product Data										
	Shop Drawings										
	Samples for Initial Selection										
	Fabricator Qualification Data										
	Product Test Reports										
079200	JOINT SEALANTS										
	Product Data										
	Samples for Initial Selection										
	Joint Sealant Schedule										
	Product Test Reports										
	Sample Warranties										

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Project: Student Recreation Center – East Elevation Masonry Repair

Project Number: CP231201

Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
075323	EPDM Roofing							
	Maintenance Data							
076200	SHEET METAL FLASHING AND TRIM							
	Maintenance Data							

CLOSEOUT LOG

Project: Student Recreation Center – East Elevation Masonry Repair
 Project Number: CP231201
 Contractor:

Section	Description	Contractor/ Subcontractor	Date Rec'd	# of Copies	CPM Initials	Remarks
GC /3.11	As-built drawings					
GC /13.5.6	Final Affidavit of Supplier Diversity Participation for each Diverse firm					
075323	EPDM Roofing					
	Field Quality Control Reports					
	Manufacturer's Warranty					
	Installer's Warranty					
076200	SHEET METAL FLASHING AND TRIM					
	Warranty on Finishes					
079200	JOINT SEALANTS					
	Manufacturer's Warranty					
	Installer's Warranty					

SECTION 1.F

INDEX OF DRAWINGS

Drawings referred to in and accompanying Project Manual consist of following sheets June 08, 2023.

G000	COVER SHEET
G001	GENERAL INFORMATION
D200	EAST DEMOLITION ELEVATIONS
D500	DEMOLITION WALL SECTIONS & DETAILS
D501	OUTDOOR REC WALL DEMOLITION DETAILS
A200	EXTERIOR ELEVATIONS
A201	EXTERIOR ELEVATIONS
A202	EXTERIOR ELEVATIONS
A203	RETAINING WALL – ALT. 1
A500	WALL SECTION AND DETAILS
A501	SECTION DETAILS
A502	TYPICAL MASONRY RESTORATION DETAILS
A800	MASONRY RESTORATION PHOTOS

END OF SECTION

SECTION 1.H

ALTERNATES

Base Bid may be increased in accordance with the following Additive Alternate proposal(s) as Owner may elect:

1. Additive Alternate No. 1: Masonry repairs, removal and reinstallation of the guardrail, and 100% tuckpointing & cleaning shall be done for the retaining wall and site walls at the service entry. Refer to drawing sheet A203 for wall locations and details.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Removal of selected portions of building.
 - 2. Salvage of existing items.
 - 3. Removal of existing roofing system.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and catalog items to be salvaged.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants' on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.8 QUALITY ASSURANCE

- A. Contractor shall comply with all Occupational Safety and Health Administration (OSHA) requirements during selective demolition and construction.
- B. Contractor shall engage a qualified construction safety representative to be present at the project site and to ensure all OSHA regulations and requirements are being met during selective demolition and construction.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Perform an engineering survey condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required. Contractors are required to visit the site and inform themselves of all conditions presently existing prior to bidding on the Work. Failure to visit the site will not relieve the Contractor from the necessity of furnishing all materials and equipment necessary to perform all work required in accordance with the Drawings and Specifications.

- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems are to Remain unless noted otherwise: Maintain services/systems and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove plumbing, HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Coordinate any street closures and location of temporary dump trucks with owner's representative.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect equipment that have not been removed.

- C. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches.
 - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 7. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse
 - 2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's representative, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
1. Remove existing roof membrane and flashings as shown per Drawings.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts. Refer to Drawings for additional information.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations on a daily basis. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Mortar and grout.
 - 2. Ties and anchors.
 - 3. Embedded flashing.
 - 4. Miscellaneous masonry accessories.
- B. Related Sections:
 - 1. Section 045000 "Masonry Restoration and Cleaning" for products and techniques to clean and repair masonry and stone.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing, drip edges and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Weep holes/vents.
- D. Samples for Verification: For each type and color of the following:
 - 1. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - 2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
- B. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform coping load for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. CMUs: ASTM C 90.
 - 1. Strength: Provide units with minimum average net-area compressive strength of 2200 psi.
 - 2. Density Classification: Lightweight unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.
- H. Refer to Section 045000 "Masonry Restoration and Cleaning" for pre-mix pointing mortar. Historic pointing mortar to be used for final pointing of all affected joints.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Exterior Walls: Stainless steel.
 - 2. Wire Size for Side Rods: 0.187-inch diameter.
 - 3. Wire Size for Cross Rods: 0.187-inch diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
 - 2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
 3. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.062-inch- thick, stainless-steel sheet.
- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.
- E. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213.
 - 2) Heckmann Building Products Inc.; 213 with 282.
 - 3) Hohmann & Barnard, Inc.; HB-200.
 - 4) Wire-Bond; RJ-711.
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 - c. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- thick, steel sheet, galvanized after fabrication.
 - d. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized steel wire.
 3. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A 240, Type 304, 0.016 inch thick.
 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

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- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: Use 5-oz./sq. ft. for thru-wall flashing and 7 oz./sq. ft. for under coping flashing copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Copper Sealtite 2000.
 - 2) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing NA.
 - 3) York Manufacturing, Inc.; Multi-Flash 500.
- C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use fabric flashing with a stainless steel drip edge.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing flexible flashing with a stainless steel drip edge.
 4. Where flashing is fully concealed, use flexible flashing.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. 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:
1. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
 2. Karnak Corporation.
 3. Meadows, W. R., Inc.
- B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- C. VOC Content: 30 g/L or less.
- D. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- E. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps on stone copings.
 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type N.
 3. For mortar parge coats, use Type N.
 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 3. Provide grout with a slump of 10 to 11 inches as measured according to ASTM C 143.
- E. Refer to Section 045000 "Masonry Restoration and Cleaning" for pre-mix pointing mortar. Historic pointing mortar to be used for final pointing of all affected joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that reinforcing dowels are properly placed.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Keep new mortar to minimum 1" of exposed face of masonry. Historic pointing mortar to be used for final pointing of all affected joints. Refer to Section 045000 "Masonry Restoration and Cleaning" for additional information.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.

- B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
 - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - 1. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
 1. Build in compressible joint fillers where indicated.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

4. **Install stainless steel drip edges with fabric flashing by interlocking hemmed edges to form hooked seam.**
 5. Install all thru-wall and under coping flashings with positive slope to allow water to drain out, and avoid any ponding of water over flashings.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Use wicking material to form weep holes above flashing under masonry sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes formed from wicking material 16 inches o.c.
 4. Trim wicking material flush with outside face of wall after mortar has set.

3.13 FIELD QUALITY CONTROL

- A. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean masonry to receive fluid applied air barrier as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 045000 – EXTERIOR HISTORIC MASONRY RESTORATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Masonry restoration including stone patching, pinning, resetting limestone, crack injection, void grout injection, and dutchman repairs.
 - 2. Historic treatment work consisting of raking and repointing masonry joints with historic mortar mix.
 - 3. Removal and resetting of bricks.
 - 4. Removal of stone copings, installing new flashing and resetting the stone coping.
 - 5. Removal and replacement of steel lintels.
 - 6. Severe Soiling and Algae Growth Cleaning.
 - 7. Masonry cleaning of all stone surfaces.
- B. Related Requirements:
 - 1. Section "051200 Structural Steel Framing."
 - 2. Section "076200 Sheet Metal Flashing and Trim."
 - 3. Section "079200 Joint Sealants."

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in 1.A Bid Lump Sum Contract, Section 3. Bid Pricing, Subsection C. Unit Prices.
 - 1. Unit prices apply to authorized work covered by estimated quantities.
 - 2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Face Bedding: Setting of stone with the rift or natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.
- B. Rift: The most pronounced direction of splitting or cleavage of a stone.
- C. "Dutchman" as used herein refers to a portion of new or salvaged stone fitted into an existing stone to produce an intact contiguous surface.
- D. "Stone-to-Stone" repairs refer to conditions where the original stone piece still exists and can be pinned directly back to its original location or to its mated portion.

- E. “Hot Weather Stone Masonry Restoration” as used herein refers to work of this Section when temperature is above 100 deg F or when temperature is above 90 deg F and wind is above 8 mpg or when either of these conditions is predicted within 48 hours of use of mortar.
- F. Saturated, surface dry: Wet surfaces to receive mortar to ensure that surfaces are damp but free of standing water.
- G. Repointing: The process of raking out (removing) mortar and replacing it with new mortar.
- H. Low-Pressure Spray: 100 to 400 psi; 4 – 6 gpm per spray head.
- I. Medium-Pressure Warm Water Wash: 400 to 800 psi; 4 – 6 gpm at 180 deg. F.

1.5 PRE-RESTORATION MEETINGS

- A. Pre-restoration Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to repairing historic stone and masonry including, but not limited to, the following:
 - a. Verify historic treatment specialist’s personnel and equipment needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Quality-control program
 - d. Stone historic treatment program.

1.6 SEQUENCING AND SCHEDULING

- A. Order pointing mortar immediately after approval of mockups. Take delivery of and store at project site a sufficient quantity to complete Project.
- B. Work Sequence: Perform stone historic treatment work in the following sequence, which includes work specified in this and other Sections:
 - 1. Repair existing masonry including replacing existing masonry with new masonry materials and any reconstructing or resetting.
 - 2. Rake all mortar joints and repoint before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - 3. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

1.7 QUALITY ASSURANCE

- A. Restoration Specialist: The restoration and pointing shall be carried out by a firm having not less than fifteen (15) years successful experience in the cleaning, repair, joint raking and pointing of masonry similar to the work described in this Section.

1. The Contractor shall submit all the following information demonstrating the masonry contractor's qualifications and experience for approval by the Architect and Owner. **Contractors not submitting the required information or failing to meet the minimum requirements will be disqualified and will not be allowed to perform the work of this Section.**
 - a. Provide written description of a minimum of five projects completed within the past five years for which the masonry contractor has performed the masonry cleaning, pointing and stone repair. Projects must have been performed on properties 50 years old or older. Provide the name and address of the project, the name and telephone number of the Owner and Architect, dates work was performed, and a description of the materials and methods used to perform the work for each project.
 - b. Submit a resume for each of the persons who will be supervising and performing the work of this Section demonstrating a minimum of 3 years experience working in their trades, list of three example projects describing the work the person has performed. Only individuals whose resumes have been submitted, reviewed and accepted will be allowed to perform the work of this Section.
- B. Restoration Specialist Qualifications: A qualified historic masonry restoration specialist. Experience installing standard unit masonry or new stone masonry is insufficient experience for masonry historic treatment work.
 1. Historic Treatment Worker Qualifications: When masonry units are being patched, assign at least one worker per crew who is trained and certified by Manufacturer to apply its products.
- C. Table One generally itemizes the scope and work tasks to be performed by the masonry restoration subcontractors. Table One is not intended to encompass all work required by the masonry restoration subcontractor for a complete project, but it does delineate the major tasks for which the respective subcontractors have been approved to perform. It is the Contractor's responsibility to ensure all work is sufficiently complete regardless of the delineation in Table One.

Table One – Scope Description for Masonry Restoration Subcontractors:

1. Masonry Restoration Scope
 - Raking existing mortar joints.
 - Pointing mortar joints.
 - Pointing and plugging all holes and openings prior to grout injection.
 - Cleaning and removing immediately grout-injection stains.
 - Patching of all damaged exterior stones and bricks.
 - Replacement of cracked or damaged stones and bricks.
 - Removal and tooth-in of masonry at areas damaged during lintel repair.
 - 100% cleaning of all exterior stone and brick building surfaces.
 - Patching, restoring, pinning damaged stones.
 - Removal of stone copings, replacing flashing and resetting the stone copings.
 - Replacement of all damaged steel lintels & associated masonry work.

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- Any other masonry restoration work called for on the drawings.
- D. Quality Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising worker performance and preventing damage.
- E. Masonry Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used to for each phase of the historic treatment work including protection of surrounding materials and Project site.
1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add to the quality control program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
 2. Do not begin work on site until Architect has approved Masonry Historic Treatment Program in writing. Photocopies of Contract Documents, excerpts from Contract Documents and/or duplication of text in Contract Documents will not be accepted for Work Description. Description for each type of restoration on each material shall include, but not be limited to:
 - a. Materials and Procedures: Materials, methods, tools, and equipment to be used for each phase and task of stone masonry restoration work.
 1. Include methods for keeping exposed mortar damp during curing period.
 - b. Protection: Description, including drawings, and diagrams, of proposed materials and methods of protection for preventing harm, damage, and deterioration caused by work of this Section to persons (whether involved in the Work or not); building elements, materials, and finishes, surrounding landscape and site, and the environment (including air and water).
 1. Include procedures for controlling noise and dust.
- F. Testing of Workers: Technicians proposed for raking and cutting joints in historic masonry of this Project shall be required to successfully complete six square feet of raking and cutting mortar joints in presence of Architect prior to working on Project. Unsuccessful performance in this test area will be grounds for rejection of this technician for joint preparation and pointing work on this Project.
- G. Architect may randomly select areas of tuck-pointing to be raked for verification of the appropriate depth of pointing and void filling. Contractor shall bear the cost of repointing these areas of selected destructive testing in their base bid.
- H. Manufacturer's Technical Representatives: Technical representatives whose products have been selected for use shall visit site at request of Contractor, Architect, or other Owner's Representative to advise on proper use and installation of products at no additional cost to Owner.

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- I. Source of Materials: Obtain materials for masonry restoration from a single source for each type of material required to ensure match of quality, color, pattern, and texture.
 - J. Documentation of Existing Conditions: Document configurations and conditions of stone masonry units indicated to be restored before beginning restoration with photographs showing overall units and with additional detail photographs showing areas of damage and deterioration to be repaired if such areas are not clearly visible and understandable in the overall photographs of the stone units.
 1. Images: Clear, sharp, high-resolution, color images. Unclear images, out-of-focus images, underexposed images, and overexposed images will not be accepted.
 2. Format: One of the following:
 - a. Digital images: High-resolution JPEG (.jpg) color images (minimum 6 megapixel images with color information yielding files of at least 1 megabyte each).
 3. Identification and Keying: Label each photograph with project name, date, and time photograph was taken, and location. Key detailed photographs to overall photographs and to drawings. Clearly show all existing conditions, including conditions that might be misconstrued as damage resulting from work of this Section.
 - a. Digital Images: Provide identification and keying information, including text description and images of drawings and key photographs, for all photographs on a flash drive in text file (Word) or in PDF file on same flash drive as images. In addition, submit printed black and white copies of key drawings and key photographs together with the flash drives.
 4. Labeling: Label each salvaged masonry unit using approved method that will identify unit until completion of the work and that will not be visible when masonry unit is reinstalled in finished work.

1.8 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Submit manufacturers' technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportion), physical properties, recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets.
 - a. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Section 079200 "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

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2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For the Following:
1. Custom Patching Mortar: Submit sets of each type of patching mortar samples in the form of plugs (patches in drilled holes) in sample units of stone representative of the range of stone colors on the building.
 - a. Have each set contain a close color range of at least three samples of different mixes of patching mortar that matches the variations in existing stone when cured and dry.
 2. Pointing Mortar: Submit sets of each type of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by ½ inch (13 mm) wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three samples of different mixes of colored sands and cements that produce a mortar matching the existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each sample was made.
 4. Limestone to Match Existing Limestone. Include sample to show color, texture, grain, veining, and finish to be expected. Provide set of at least two 12-by-12-inch-by 1-inch (300-by-300-mm) samples, finished to match existing.
 5. Each type of Dutchman stone. Include sample to show color, texture, grain, veining, and finish to be expected. Provide set of at least two 12-by-12-inch-by 1-inch (300-by-300-mm) samples, finished to match existing.
- C. Samples for Verification: For the following:
1. Each type of patching mortar in form of briquettes, at least 3 inches (75 mm) long by 1-1/2 inches (38 mm) wide. Document each sample with manufacturer and stock number or other information necessary to order additional material.
 2. Each type of adhesive.
 3. Accessories: Each type of anchor, accessory, and miscellaneous support including but not limited to masonry anchors, weeps, and each type of threaded rod and micro-pins, and other accessories embedded in masonry.
 4. Copper laminated flashing.
 5. Stainless steel flashing, including drip edge and termination bar.
 6. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by ½ inch (13 mm) wide, set in aluminum or plastic channels.
 - a. Include with each sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
 7. Custom Dispersed Hydrated Lime Grout for Crack Injection: 4-inch x 4-inch x 1-inch cured samples.

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8. Stone Samples for Verification: Sets for dimension stone coping and ashlar veneer, color, and finish of stone required; not less than 12 inches square.
 - a. Sets shall consist of at least four Samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.

 - D. Shop Drawings: Dimensioned detailed scale drawings appropriate scales to clearly describe stone masonry restoration; details of anchors and fasteners, 3-inches equals 1-foot scale, minimum. Submit newly prepared drawings showing site-verified conditions and materials. Photocopies of Contract Documents and/or electronic scans of Contract Documents will not be accepted for Shop Drawing submittals.
 1. Fabricated Flashing: Detail corner units, end-dam units, and other special applications for copper laminated flashing and stainless steel flashing.

 - E. Field-Constructed Mock-Ups
 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 3. Prior to start of general masonry restoration, prepare the following sample panels on the building where directed by the Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitable marked, during construction as a standard for judging completed work. All costs associated with producing multiple samples shall be included in the base bid.
 4. Cleaning: Demonstrate materials & methods to be used for each type of cleaning required, of masonry surface and condition of sample panels of approximately 25 sq. ft.
 - a. Test adjacent non-masonry materials for possible reaction with cleaning materials.
 - b. Allow waiting period of duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit study of sample panels for negative reactions.
 5. Repointing: Prepare 2 separate sample areas of approximately 3'-0" high by 6'-0" wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.

6. Provide approximately 4'-0" linear feet of soft joint consisting of selected sealant with masonry sand rubbed on fresh sealant to simulate and match adjacent mortar units.
7. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - a. Partial Stone Replacement: One partial stone replacement.
 - b. Crack Injection: Apply crack injection in two separate areas as directed.
 - c. Patching: Up to three small areas for limestone as directed by Architect.
 - d. Delamination to be Pinned and Patched: Two areas as directed.
 - e. Major Crack Repairs: Apply major crack repairs in two separate areas.

1.9 INFORMATIONAL SUBMITTALS

- A. Preconstruction Photographs: Before commencement of restoration of Neff Hall, Contractor shall take photographs of Project site and surrounding properties, including detailed documentation of the existing masonry conditions within the project scope. Refer to Quality Assurance Article above.
- B. Preconstruction Test Reports: For existing stone and mortar.
- C. Masonry Historic Treatment Program. Refer to Quality Assurance Article above.
- D. Quality-Control Program
- E. Grout Mixing Plan:
 1. Proposed grout material and reports of appropriate laboratory qualification test or evidence to show it meets a pre-qualified or approved product list.
 2. Storage and protection of all grout material and any additives with procedures to ensure they remain usable or when they must be discarded.
 3. A source of potable water.
 4. Equipment for mixing and testing daily grout production – e.g. type of mixer, pump, storage hoppers. Flow-cone, or viscosity meter, samples for strength test, etc.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on stone units as follows:

1. Provide test specimens as indicated and representative of proposed materials and existing construction.
 2. Replacement Stone: Test each proposed type of replacement stone, according to ASTM C170/C170M for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C99/C99M for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C97/C97M for absorption and bulk specific gravity.
 3. Existing Stone: Test each type of existing stone indicated for replacement, according to ASTM C170/C170M for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C99/C99M for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C97/C97M for absorption and bulk specific gravity. Carefully remove three existing stones from locations designated by Architect. Take testing samples from these stones.
 5. Existing Mortar: Test according to ASTM C1324, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use x-ray diffraction, infrared spectroscopy, and differential thermal analysis to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by Architect.
 6. Temporary Patch: As directed by Architect, provide temporary materials at locations from which existing samples were taken.
- B. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver stone units to Project site strapped together in suitable packs or pallets or in heavy-duty crates and protected against impact and chipping.
- B. Deliver each piece of stone with code mark or setting number on unexposed face using non-staining paint.
- C. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- F. Store lime putty covered with water in sealed containers.
- G. Handle stone to prevent overstressing, chipping, defacement, and other damage.

- H. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- I. Protect masonry restoration materials during storage and construction from wetting by rain, snow, or ground water, and from staining or intermixture with earth or other types of materials.
- J. Protect materials from deterioration by moisture and temperature. Store in a dry location or 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.

1.12 FIELD CONDITIONS

A. General

1. Weather Requirements:
Manufacturer's Recommendations: Perform work only when temperature of products being used, temperatures of existing and new materials and surfaces, and temperature and humidity of air at Project site comply with manufacturer's written instructions and specified requirements.
 - a. Clean masonry surfaces only when air temperatures are 40 deg. F and above and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.
 - b. Repair stone units only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
 - c. Proprietary Mortars and Masonry Adhesives and Fillers: Perform work of this Section requiring proprietary patching materials and masonry adhesives and fillers only when surface and air temperatures are between 50 deg F and 85 deg F.
 - d. Hot-Weather Stone Masonry Restoration: Protect stone repair when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
 1. Protect fresh mortar from premature drying when temperature, humidity, and wind conditions result in rapid drying of mortar. Provide and maintain tarps against wind, direct sun, and rain for specified minimum periods.
 2. NHL-2 must be protected from drying for a minimum of two (2) weeks after installation. NHL 3.5 mortars must be protected from

drying for a minimum of 72 hours after using mortar by the following procedure:

- a. Water-soaked cover: Provide and maintain damp burlap or other damp cloths over masonry to protect mortars from premature drying. Install, maintain, and remove coverings using materials and methods that do not damage or alter masonry.
 - e. Damage from Work in Cold or in Hot Weather: Remove work of this Section damaged by freezing during cold weather masonry work and/or damaged by premature or too-rapid drying during hot weather masonry work and replace with new masonry work complying with requirements of this Section at no additional cost to Owner.
 - f. Requirements of Referenced Standard: Perform work of this Section in compliance with the requirements and recommendations of Brick Industry Association Technical Notes 1, *Cold and Hot Weather Construction*, Latest Edition.
2. Conflicting Requirements: In each case in which there is a conflict between manufacturer's recommendations, recommendations of referenced standards, and other requirements specified in this Section, the most stringent and restrictive requirement shall govern.
 3. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
 4. Safety: Protect all persons, whether or not involved in work of this Section, from harm caused by or resulting from work of this Section
 - a. Protection from Hazardous Materials: Protect workers and other persons from contact with hazardous materials resulting from work of this Section.
 - b. Protection from Noise: Limit noise generated by work of this Section to an absolute minimum. Prevent all persons, whether or not involved with the work of this Section, from noise that might adversely affect them.
 5. Prevent mortar used in repointing repair work and injection grout from staining face of surrounding masonry and other surfaces. Remove immediately mortar in contact with exposed masonry and other surfaces.
 6. Protect sills, ledges, and projections from mortar and sealant droppings.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source limitations: Obtain each type of material for repairing and repointing historic masonry (stone, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.
- B. Adding mineral pigments to any masonry restoration materials is prohibited for this project.

2.2 STONE

- A. Stone Matching Existing: Provide natural building stone of variety, color, texture, grain, veining, finish, size, and shape to match existing stone and with physical properties.
 1. For existing stone that exhibits a range of colors, textures, grains, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches and individual color, texture, grain, veining, finish, size or shape within that range.
 2. Quarry: Subject to compliance with requirements, if it is possible to obtain, provide stone from original quarry where stone was sourced.
 3. Salvaged Limestone: Salvaged sound stone cleaned free of mortar, grout, dirt, and other contaminants and matching existing cleaned limestone in physical and chemical properties and in color, texture, and other surface characteristics.
 4. New Limestone: New sound limestone complying with ASTM C 616 and matching existing clean limestone in physical and chemical properties and in color, texture, and other characteristics.
- B. New Natural Dimension Stone Coping
 1. Source Limitations for Stone: Obtain stone from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
 2. Natural Indiana Limestone:
 - a. Material Standard: Comply with ASTM C 568.
 - i. Classification: II Medium- Density.
 - b. Smooth Finish.
 - c. Color: Buff to match existing stone.
 - d. Size: Match existing cast stone coping profiles and size to be replaced with new natural stone coping.

2.4 MORTAR AND GROUT MIXES

- A. General
 1. Mortars specified hereinafter shall comply with ASTM C 1713, Standard Specification for Mortars for the Repair of Historic Masonry.
 2. Mix mortars using proportions specified herein as adjusted, if necessary, by the amount of moisture in the ingredients. The proportions specified are for dry cements and limes and damp, loose (saturated, surface-dry) sand. If ingredients with different moisture contents are used (for example, lime putty is used in place of lime or dry sand is used in place of damp, loose sand), adjust quantities so

that the proportions of ingredients in the mixes equal the proportions specified as approved by Architect.

- B. Mortar for Setting Dutchmen: Provide the following natural hydraulic lime mortar. Mortar mixes may change and may require adjustment before and during construction in accordance with pre-construction conformance testing, field testing, and Architect's evaluation of testing and test results.
 - 1. Natural Hydraulic Lime to Match Adjacent Stone
 - a. Natural hydraulic lime, NHL-5
- C. Mortar for Setting Stone: Provide the following natural hydraulic lime mortar. Mortar mixes may change and may require adjustment before and during construction in accordance with pre-construction conformance testing, field testing, and Architect's evaluation of testing and test results.
 - 1. Natural Hydraulic Lime to Match Adjacent Stone
 - a. Natural hydraulic lime, NHL-5
- D. Custom Patching Mortar for Topping Fissures, Open Veins, Open Joints, and Losses Filled with Dispersed Hydraulic Lime Putty
 - 1. 2 parts NHL-2 natural hydraulic lime.
 - 2. 5 parts washed, sieved, and graded fine sand, combination of sands, or combination of sands and crushed marble selected to provide mortar with color matching color of adjacent marble.
- E. Grout for Injecting Cracks – Dispersed hydrated lime with up to five percent water by weight. Mix with an electrically powered mixer for two to three minutes.
- F. Grout for Natural Hydraulic Lime Injection Repairs: Mix by volume 7 parts natural hydraulic lime 5.0 with 3 parts water. Mix with an electrically powered mixer for two to three minutes.

2.5 MIXING OF MORTARS AND GROUTS

- A. Measuring: Measure mortar and grout ingredients carefully using containers with fixed volumes so that proportions are controlled and maintained throughout the work of this Section.
- B. Mixing Lime Mortars and Grouts: Mix lime mortars and grouts using a helical paddle mixer, a pan mixer (in which the mortar is mixed by rotating paddles), or a traditional roller mixer as approved by lime supplier and Architect.
- C. Water: Use minimum amount of water to produce a workable consistency for mortar's intended purpose.
 - 1. Mortar for Pointing: As dry a consistency as will produce a mortar sufficiently plastic to be worked into joints.

2. Grout for Injection: Consistency that can be injected to fill voids and losses.
- D. Small Batches: Where mortar or grout is required in small batches of less than one cubic yard and Architect specifically approves, mortar may be mixed by hand in clean wooden or metal boxes prepared for that purpose provided that Architect approves mixing boxes and methods of mixing and transferring Portland cement and lime mortars.
- E. After mixing, mortars for pointing or setting shall sit for 20 minute prior to use to allow for initial shrinkage. Mortar shall be placed in final position within two hours of mixing. Retempering of partially hardened material is not permitted.
- F. Mortar for grout shall be placed in final position within two hours of mixing or within period recommended by manufacturer of custom products, whichever is less. Retempering of partially hardened material is not permitted.
- G. Custom Patching Mortars and Grouts: Mix in accordance with manufacturer's written instructions.

2.6 PRE-MIXED MORTAR

- A. Portland Cement: ASTM C150/C150M, Type I or Type II; white or gray, where required for color matching of mortar.
 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C207, Type S
- C. Mortar Sand: ASTM C144 unless otherwise indicated.
 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 2. Colored Mortar: Provide natural sand or other sound stone of color necessary to produce required mortar color.
 3. For exposed mortar, provide sand with rounded edges.
- D. Water: Potable

2.7 HISTORIC POINTING MORTAR

- A. A custom factory mixed Historic Pointing Mortar to be formulated for tuck-pointing **limestone**, which shall match existing mortar in color, texture, and mix.
 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Cathedral Stone; Jahn M110 JL Historic Pointing Mortar.
 2. Any additional mortar samples that may be required shall be taken from selected areas as directed by Architect and sent to pointing mortar manufacturer for custom color matching and mortar proportions.

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- B. Surface Preparation: Joints to receive pointing mortar must be sound and free of all dust, dirt, grease, laitance, and/or any other coating or foreign substance which may prevent proper adhesion. Remove all loose and deteriorated mortar. The minimum depth of mortar application is 1-1/2 times the width of the mortar joint or 1 inch, whichever is greater. Rinse joints with clean water.
- C. Mixing: The mixing ratio is approximately 4 to 5 parts replication mix to 1 part water by volume, depending on temperature and humidity. Place clean water in a clean, rust free mixing container and add the powder. Mix manually until the mortar is thoroughly mixed. The mortar shall be the consistency of damp sand. Follow manufacturer's recommendation.
- a. Add aggregate as required to match the color and texture of the existing stone mortar. Do not exceed the allowable ratio mix of aggregate to mortar per the manufacturer's requirements. Adding mineral pigments is not allowed for this project. Color and texture shall be adjusted using aggregates to the replication mix.
- D. Pointing: Moisten the joint using clean water. If the surface is allowed to dry out before applying pointing mortar, this step must be repeated. The mortar shall be applied using appropriate pointing tools. Place the mortar into the joint so that it matches the original joint profile.
- E. Curing: Periodically mist mortar joints using clean water for at least a 72 hour period.
- F. Clean Up: Remove uncured mortar from the substrate before it dries using clean water and a rubber sponge. Cured mortar may only be removed chemically.
- G. Safety Requirements: It is recommended that safety goggles, gloves, and a dusk mask equipped with P-2 filters (or Equivalent) be worn for protection when mixing.
- H. Limitations:
1. Never apply pointing mortar to a frosted or exceedingly hot substrate. The applied mortar must be protected from extreme heat, freezing, excessive wind, direct sunlight, and rain. Ambient temperature range shall be 40 deg. F to 90 deg. F with low to average humidity.
 2. Never add bonding agents to pointing mortar or use them as surface preparation materials.
 3. Minimum thickness of mortar application is 1" or 1-1/2 times the existing mortar width, whichever is greater.
- I. As directed by Architect, mortar sample shall be taken from selected areas and sent to pointing mortar manufacturer for custom color matching, custom aggregate, and mortar proportions.

2.8 MANUFACTURED REPAIR MATERIALS

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- A. Patching Mortar for Limestone: Factory-mixed cementitious product that is custom manufactured for patching stone.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cathedral Stone Products, Inc.; Jahn M70
 - b. If a proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Specifier and paid for by the submitting party.
 2. Use formulation that is vapor and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all stone types.
 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 4. Formulate patching mortar in colors, textures, and grain to match stone being patched. Provide no fewer than three colors to enable matching each piece of stone.
- B. Cementitious Injection Grout for Stone: An ultrafine super plasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all stone types.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cathedral Stone Products, Inc.; Jahn M40 Crack Injection Grout.
- C. Epoxy Injection Grout for Concrete: 2-component, 100% solids, moisture-tolerant, high strength epoxy resin adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sika: Sikadur-35 Hi-Mod LV epoxy grout with Sikadur-31 Hi-Mod Gel to be used as the cap seal and to set the ports.
- D. Masonry Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15-to-45-minute cure at 70 deg. F (21 deg. C), recommended in writing by adhesive manufacturer for type of stone repair indicated, and matching stone color.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Cathedral Stone Products, Inc.; masonRE Adhesive
 - b. Edison Coatings, Inc.; Pump-x53i
- E. Dispersed Hydrated Lime: Non-hydraulic dispersed hydrated lime (DHL) for use in injecting narrow cracks. Provide non-hydraulic Dispersed Hydrated Lime (DHL), (U.S. Heritage Group, 3516 North Kostner Avenue, Chicago, IL 60641 (773-286-2100).
- F. Dispersed Hydrated Lime Injection Mortar for Wide Cracks: Non-hydraulic dispersed hydrated lime putty consisting of dispersed hydrated lime, marble powders, and

dispersing aids for use in injecting cracks up to 1/8-inch wide. (U.S. Heritage Grout, 3516 North Kostner Avenue, Chicago, IL 60641 (773-286-2100).

- G. Injection Grout at voids in retaining wall stone: Jahn M31 Injection Grout.

2.9 VOID INJECTION GROUT

- A. Void Injection Grout: Suitable for application to wet or dry joints, exhibits low shrinkage, and develops high bond strength to all types of stone. No polymers, acrylics, or epoxies will be accepted in the final material. Grout injection material shall be non-chloride and non-corrosive. Injection material shall match the properties of the host, including vapor transmissions and compressive strength.
 - 1. Mix Design: One part Portland cement, one part lime; six (6) parts silica sand. Sieve size of minus 30 to achieve a fine viscosity and pumpable mix, and shall meet requirements of ASTM 476.

2.10 ACCESSORY MATERIALS

- A. Masonry Anchors and Pins: Type and size indicated. Fabricate anchors and pins from Type 316 stainless steel.
- B. Setting Buttons and Shims: Resilient plastic, non-staining to stone, sized to suite joint thicknesses and bed depths of stone units, less the required depth of pointing materials unless removed before pointing.
- C. Masking Tape: Non-staining, non-absorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- D. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 or 3/8 inch in diameter, in length required to product 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps where indicated on drawings.
 - 2. Cell Vent.
- E. Micro-Pins: Orthopedic surgical bone screws of ASTM A 276 or ASTM A 666 Type 316 stainless steel or titanium (grade 2), 4 mm diameter, head no larger than 6 mm diameter with a recessed hex mortise (Diverse Surgical Supply, 7033 N. Fresno Street, Fresno, CA 93720 (866-800-9414) (or approved equal)
- F. Pins: 1/8-inch-, 1/4-inch-, 3/8-inch-, or 1/2-inch-diameter threaded stainless steel rod.
- G. Temporary Crack Sealer: Two-component, non-sag, polyurea paste designed for sealing surfaces of cracks and delaminations in masonry to allow pressure injection of adhesives and grouts. Test crack sealer to ensure that it can be removed without damaging or staining stone. (StripSEAL” manufactured by ChemCo Systems, 2800 Bay Road, Redwood City, CA 94063 or approved equal)

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- H. Sealants for Pointing Joints in Stone: Manufacturer's standard chemically curing, elastomeric sealants of base polymer that comply with applicable requirements in Section 079200 "Joint Sealants" and do not stain stone.
- I. Syringe for Injection of Dispersed Hydrated Lime:
1. Syringe with 12 gage stainless steel needle.
 2. Plastic Injection Syringes Manufacturer: Cathedral Stone Products, Inc. or approved equal.
- J. Air Compressor and Related Equipment: Air compressor, hoses, nozzles, valves, oil and water filters, storage tank, and accessories as necessary to provide clean, oil- and water-free, filtered compressed air at a pressure of 100 psi and a flow rate of 6 cfm. Maintain equipment in optimum condition to ensure that clean, dry, oil-free air is consistently available at required pressure and flow rate.
- K. Brushes for Cleaning Anchor Holes: Stiff wire bristle or nylon bristle brushes of diameter to ensure full cleaning of dust and debris from masonry substrate at sides and bottom of hole. Furnish brushes specifically manufactured for cleaning anchor holes in masonry substrates. Brushes shall be sized appropriately for holes in which they are to be used so that they firmly contact entire circumference of hole at the same time. Use sizes recommended by anchor manufacturer and approved by Architect. (Hilti, Inc., PO Box 21148, Tulsa, OK 74121 (800-879-8000), Powers Fasteners, Inc., 2 Powers Lane, Brewster, NY 10509 (914-235-6300), Simpson Strong-Tie, 26 International Street, Columbus, OH 43228 (614-876-8060), or approved equal).
- L. Brushes for Cleaning Cracks and Losses: Stiff nylon bristle brushes of shape and dimension to provide optimum removal of contaminants from stone surface and approved by Architect.
- M. Air Nozzle for Cleaning Anchor Holes: Nozzle specifically manufactured and sold for use in removing dirt and debris loosened by use of brushes in anchor holes and of length capable of reaching bottom of deepest anchor holes so that debris is blown free from bottom of holes outward. Provide 24-inch-long air nozzle by Hilti, Inc., PO Box 21148, Tulsa, OK 74121 (800-879-8000), or approved equal.
- N. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing work involved.
 2. Minimal possibility of damaging exposed surfaces.
 3. Consistency of each application.
 4. Uniformity of the resulting overall appearance.
 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave residue on surfaces.

2.11 TOOLS FOR JOINT PREPARATION

- A. Hand Tools for Joint Preparation: Chisels, hammers, and mallets.

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1. Thickness of Chisels: Maximum thickness of 5/8 times joint width extending from tip at least three times depth at which chisel will be inserted into joint.
 - a. Chisels for Use in Narrow Joints: Use custom ground thin carbide-tipped chisels for mortar removal from narrow joints.
 2. Brushes for Removing Dust and Dirt from Joints: Stiff, natural- or synthetic-fiber bristle brushes. No metal bristle brushes are acceptable.
 3. Pointing Trowels: Long, thin pointing trowels narrower than joints being pointed.
 - a. Custom fabricate special trowels for masonry pointing if necessary to ensure proper insertion and optimum compaction of mortar in thin joints.
 4. Special Tools: Provide special knives or special thin cutter blades for use in joints less than 1/8-inch wide.
- B. Air Compressor and Equipment for Cleaning Debris from Joints: Air compressor together with hoses, nozzles, valves, pressure gauges, oil filters, water filters, and other accessories as required to provide a complete system capable of producing clean, filtered compressed air without contaminants at a pressure of 100 psi and rate of 6 cfm.
- C. Small Power Tool:
1. General
 - a. If successful use of the power tool is reviewed and approved by Architect, contractor may use the following tool for removal of the existing mortar joints:
 1. The custom-made, 22-milimeter diameter, 1/8-inch thick, diamond tipped Dremel blades specially produce by Wagner Precision Rotary Instruments, LLC or approved qual.

2.12 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: Provide metal flashing complying with ASTM B370. Use 5-oz./sq. f. for thru-wall flashing and 7 oz./sq. ft. for under coping flashing, copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 1. Advanced Building Products Inc; Copper Sealtite 2000
 2. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing NA.
 3. York Manufacturing, Inc.; Multi-Flash 500.
 2. Refer to drawings for locations of embedded flashing materials.

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- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard product or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
 - C. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M, Type 316, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and ½ inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - D. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond wall face, use flexible flashing with a stainless steel drip edge.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use flexible flashing with a stainless steel drip edge.
 - 4. Where flashing is fully concealed, use flexible flashing.
 - E. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.13 CLEANING MATERIALS AND EQUIPMENT:

- A. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
- B. Brushes: Fiber bristle only.
- C. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume.
 - 1. For spray application of chemical cleaners, provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray-tip.
 - 2. For spray application of water, provide fan-shaped spray-tip which disperses water at angle of not less than 40 degrees.
- D. Masonry Cleaner: Refer to PART 3 – EXECUTION for masonry cleaner products and solutions to be applied to stone areas.
- E. Mild Acidic Cleaner for Pointed Joints: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

1. Products: Subject to compliance with requirements, provide basis of design: Prosoco Vana Trol or approved equal.
2. All newly pointed mortar joints shall be 100% cleaned.

2.14 CAST-IRON AREA DRAIN DOME STRAINER

- A. Provide cast-iron dome strainers at all area well drain locations indicated on the Drawings.
- B. Size: 6-1/2" High minimum, outside diameter sized to fit over existing drain body. Contractor shall field verify size of drain body.
- C. Products: Subject to compliance with requirements, provide one of the following:
 1. Zurn: Engineered Water Solutions
 2. Jay R Smith Manufacturing Co.
 3. Wade Drains

PART 3 – EXECUTION

3.1 GENERAL PREPARATION

- A. Examination: Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Protection: Erect dust impervious barriers and take other measures necessary to prevent dust from traveling beyond work platform before using power grinders, pneumatic chisels, other power tools, or hand methods that generate airborne dust.

3.2 PROTECTION

- A. Prevent mortar from staining face of surrounding stone and other surfaces.
 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.3 STONE REPAIR, GENERAL

- A. Repair Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 6 feet (2 m) away by Architect.

3.4 STONE DUTCHMAN REPAIR

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- A. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully remove portion of damaged stone without damaging surrounding masonry, in a manner that permits replacement.
 - B. Support and protect remaining masonry that was supported by removed stone.
 - C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.
 - D. Remove in an undamaged condition as many whole stone units as possible.
 - 1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
 - E. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for stone replacement.
 - F. Replace removed damaged stone with other removed stone and salvaged stone in good condition, where possible, or with new stone matching existing stone. Do not use broken units unless they can be cut to usable size.
 - G. Dutchman Preparation: Dress stone dutchman on all sides and carefully fit to opening in stone, with an allowance of not more than 1/16-inch-wide buttered joints at face. Dress surface of dutchman to match appearance, tooling, and texture of adjacent stone using an approved method. Complete surface dressing of dutchman before installing dutchman.
 - H. Cleaning Anchor Holes and Substrate: Use stiff bristle brushes and filtered, oil-free compressed air to thoroughly remove dust and debris from anchor holes and from stone surfaces to receive mortar.
 - I. Wetting Stone Surfaces: Wet surfaces to receive mortar to ensure that surfaces are damp but free of standing water at time of mortar application (saturated, surface dry).
 - J. Rift: Do not allow face bedding of stone. Before setting, inspect to verify that each stone has been cut so that, when it is set in final position, the rift or natural bedding planes are predominantly horizontal. Reject stone with vertical bedding planes.
 - K. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
 - 1. Maintain joint width for replacement stone to match existing joints.
 - 2. Use setting buttons or shims to set stone accurately spaced with uniform joints.
 - L. Set replacement stone with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated.

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1. Rake out mortar used for laying stone before mortar sets according to Section 040343 "Historic Stone Masonry Repointing. Point at same time as repointing of surrounding area.
 2. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- M. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
- N. Metal attachments for setting stone Dutchman:
1. All wire, pins, anchors, and bars shall be stainless steel, Type 316.
 2. Provide anchors as follows:
 - a. 1/8" diameter round stock, stainless steel wire with turned-up ends for small veneers.
 - b. 1/4" or 3/8" diameter round stock, stainless steel rod for direct pinning and drop dowels.
 - c. 1" wide, 1/8" thick, stainless steel, flat strap anchors for larger panels.
 3. The quality of individual attachments shall not be less than two attachments for small Dutchman, and one attachment every two square feet for larger panels. Fasten dutchman with stainless steel wire, pins, and anchors as necessary to provide mechanical locking and to prevent possible slippage of stone. Position metal anchors without weakening stone in any way.
 4. All attachments shall be fastened by mechanical locking, in addition to appropriate adhesives and mortars.
- O. Adhesives for attaching anchors and for direct pinning: Where permitted, anchors may be held in place with high modulus, high strength, moisture insensitive, epoxy adhesive. Adhesive shall be two-component 100% solids, epoxy resin system with a viscosity similar to petroleum jelly "Sikadur 31 Hi-Mod Gel" (Sika corporation), or approval equal.
- 3.5 STONE REPAIR
- A. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.
 - B. Remove soil, loose particles, mortar, and other debris or foreign material, from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.
 - C. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, threaded stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone. Center and space pins 3 to 5 inches (75 to 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) in parent stone and 2 inches (50 mm) in fragment with end countersunk at least 3/4 inch (19 mm) from exposed face of fragment.

- D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, threaded stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment. Center and space pins 3 to 5 inches (75 to 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) in parent stone and 2 inches (50 mm) in fragment, but no closer than 3/4 inch (19 mm) from exposed face of fragment.
- E. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.
- F. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.
- G. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes.

3.7 CRACK INJECTION FOR STONE

- A. Preparation for Grouting Cracks: Drill 1/8-inch-diameter injection ports into each crack approximately 6 inches on center. Remove dust, dirt, loose particles, and other contaminants that might adversely affect adhesion of grout or durability of grout from crack using mechanical means followed by clean, oil-free compressed air. Protect adjacent masonry surfaces from contact with grout using approved methods.
- B. Prewetting Substrates: Immediately before injecting grout, flush crack with clean water. If grout is not installed immediately, flush crack again with water to ensure that stone surfaces at sides of crack are wet at time of grout injection.
- C. Grout Injection: Inject cementitious grout using gravity flow or other approved equipment and methods to ensure that crack is filled as approved by Architect.
- D. Application of Patching Mortar to Injection Ports: Fill holes with specified patching mortar matching color of adjacent cleaned stone.
- E. Finishing: Strike surface flush with face of adjacent stone.
- F. Curing: Protect grout and mortar from too rapid drying and from contact with water that might wash binder from surface.

3.8 CRACK INJECTION FOR CONCRETE

- A. Route existing concrete crack to size requirements from crack injection manufacturer.
- B. Set and space the porting devices as required by the crack injection manufacturer, but no more than 6". Spacing of the ports shall be accomplished as required to achieve the travel of the epoxy resin for the pressure injection grouting between ports and fill the cracks to the maximum.

- C. Apply the mixed epoxy resin adhesive for sealing over cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting.
- D. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting shall be removed. Clean the substrate in a manner to produce a finished appearance.

3.9 STONE PATCHING

- A. Removal of Material
 - 1. Remove to Sound Stone: Remove deteriorated stone to minimum depth necessary to reach sound material or substrate. Remove sound material to a depth of at least 1/2 inch behind finished surface of patch to provide for a minimum patch depth of 1/2 inch. Do not damage or disturb sound masonry further than 1/2 inch below the surface. Do not chip edges of masonry units.
 - 2. Edges: Cut edges of areas where stone has been removed straight and parallel or perpendicular to joints in facade.
 - 3. Dovetail Mechanical Bond: Where surface of damaged stone is greater than 1/2 inch behind plane of adjacent block, slightly undercut edges of area to be patched to provide a slight dovetail.
- B. Additional Mechanical Bond for Patches over 2 Inches Deep: Where the surface of sound stone is more than 2 inches below plane of facade, provide threaded rod anchors for mechanical bond of patching mortar.
 - 1. Drilling Anchor Holes: Drill holes 1 inch deep by 1/8 inch larger in diameter than threaded rods, 2 inches on center horizontally and vertically. Drill holes at slightly varying angles within 10 degrees of perpendicular to façade plane.
 - 2. Cleaning Anchor Holes: Clean anchor holes using stiff bristle brushes as recommended by adhesive manufacturer followed by blowing with clean, oil-free compressed air.
 - 3. Installing Threaded Rods: Anchor threaded rods in holes using epoxy adhesive. Rods should extend to a point 1 inch behind finished surface of patch.
- C. Preparation
 - 1. Cleaning: Clean surfaces to be patched and filled so that they are free from dust, dirt, oils, grease, and other substances and coatings that might adversely affect adhesion of filling and patching material. Brush surfaces with stiff fiber-bristle brushes and blow clean with clean, oil-free compressed air to make certain that loose materials have been removed. Wash surfaces of prepared stone with clean water and specified detergent. Rinse thoroughly with clean, clear water and soft, natural fiber bristle brushes.
 - 2. Wetting: Wet surface of prepared stone with clean water and soft fiber-bristle brushes to ensure that at time of patching vertical surfaces are glistening wet and horizontal surfaces are dampened without pooling water. If surfaces dry out before applying cementitious patching mortar, repeat the wetting process.
- D. Application of Patching Mortar: Prepare and apply patching mortar in strict accordance with manufacturer's directions.

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1. Application of “Peanut Butter” Coat: Apply patching mortar mixed with water to the consistency of wet putty to the wet substrate to a thickness of approximately 1/8 inch. Do not allow “Peanut Butter” coat to dry out before applying patching mortar of standard consistency with water content as recommended by manufacturer.
 2. Application of Patching Material: Apply patching mortar to fill voids. Trowel mortar onto wet “peanut butter” coat. Fill entire void in one steady lift, building material up slightly beyond the plane of the adjacent surfaces. Compress material as it is installed to ensure entire void is filled without gaps.
- E. Finishing: After initial set (dependent on wind, temperature, and humidity) scrape away excess mortar to provide the appropriate profile matching adjacent planes and profiles. Finish surface to match adjacent surface.
- F. Curing: Periodically mist cementitious patching mortar gently using clean water at intervals determined in accordance with the manufacturer’s written instructions but at least several times a day for a period of at least 72 hours following installation. Begin misting at appropriate time depending on temperature, humidity, and wind conditions as recommended by manufacturer. Should access to the repairs be impossible over a period of time, plastic may be used to cover them temporarily. The application of plastic, however, does not remove the need for normal curing techniques.
- 3.10 SECURING DETACHED SECTIONS OF STONE UNITS USING MICRO-PINS, PATCHING HOLES FOR PINS, AND GROUTING CRACKS
- A. General: Secure displaced and cracked stone by drilling holes and inserting thin stainless steel or titanium screws in locations indicated on Drawings. Grout cracks with cementitious grout to match color of adjacent cleaned stone surface.
- B. Spacing and Number of Screws: Install screws at spacing indicated on Drawings.
1. Minimum Spacing
 - a. Multiple Screws: Install multiple screws at least 6 times screw diameter apart.
 - b. Edge Clearance: Do not install screws less than 4 times screw diameter from the edge of stone unit or piece of unit.
- C. Drilling for Screws: Drill holes using a rotary drill with a masonry bit. A bit designed for glass or ceramic may be used to drill a starter hole. Drill 1/8-inch- or 9/16-inch-diameter holes for 4-mm-diameter screws, depending on the stone’s hardness as determined by testing to determine most appropriate hole size for screw attachment. Drill a 1/4-inch-diameter hole 1/2 inch deep to countersink screw head.
- D. Depth of Screw: Provide for insertion so that screw will extend into sound substrate at least 4 times the diameter of the screw and will extend into the section of loose stone at least 4 times the diameter of the screw.
- E. Inserting Screws: Insert screws by hand using a hex key. Do not use a power tool. During insertion, back screws out and remove stone debris from screws and holes as often as necessary to ensure complete insertion.

3.11 FILLING VEINS AND CRACKS IN LIMESTONE WITH DISPERSED HYDRATED LIME AND NATURAL HYDRAULIC LIME TOPCOAT

- A. General: Fill open veins as indicated on drawings using dispersed hydrated lime as specified herein. Protect fills in veins with topcoat of natural hydraulic lime mortar. Work shall match approved mock-up.
- B. Preparation of Open Veins: Clean all open veins free of dirt and debris using clean, oil-free compressed air. Flush veins with nonionic detergent (1% solution in distilled water) to remove residual dust and soiling. Allow to dry to condition recommended by manufacturer of dispersed hydrated lime. Seal surface with custom mixed NHL-2 lime putty as described in subparagraph “Protective Coating for Veins,” below.
- C. Dispersed Hydrated Lime Fill: Inject vein with dispersed hydrated lime injection mixture or dispersed hydrated lime injection mortar, depending on the width of the crack, using specified syringe.
 - 1. Vertical Cracks: Start at bottom of crack and inject until crack will not take any more material. Inject at higher locations along crack until crack is full.
 - 2. Horizontal Cracks: Start at one end of crack and inject until crack will not take any more material. Inject at further locations along crack until crack is full.
- D. Protective Coating for Veins: Top fill veins with custom-mixed NHL-2 lime putty. Mix lime and water following manufacturer’s recommended proportions and procedures to produce a putty of suitable workability. Lightly mist areas to be filled before application. Carefully fill cracks to meet adjacent stone surfaces. Press marble dust into surface during modeling. Maintain damp protection and allow to set at least 12 hours. Protect fills from premature drying from sun or wind and mist as needed to assure complete cure. Maintain protection and mist to keep damp for a minimum 2 weeks after installation.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install weep holes in exterior wythes in bed joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep products to form weep holes.
 - 2. Space weep holes formed from wicking material 24 inches o.c.

3.13 STONE-WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess stone materials are Contractor’s property.

- B. Stone Waste: Remove stone waste and legally dispose of off Owner's property.

3.14 STONE REPOINTING, GENERAL

- A. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 6 feet (2 m) away by Architect.

3.15 JOINT PREPARATION FOR JOINTS CONTAINING MORTAR

- A. General: Remove mortar from joints to a depth of 1 inch or to sound mortar, whichever is deepest. In all cases remove deteriorated, weathered, and loose material to sound mortar.
1. Completely remove mortar from surfaces of masonry units adjoining joint to allow new mortar to bond directly with masonry units.
 2. Cut surface of mortar at rear of joint at a uniform depth from and parallel to wall surface.
 3. Do not damage faces or arises of masonry units during joint preparation. Cease joint preparation work if, in Architect's judgment, masonry units are damaged by methods being used to prepare joints. Do not resume work until tools, workers, and methodology have been corrected to ensure that masonry units are not damaged and that work meets standard set by approved mock-up.
- B. Mortar Removal Using Hand Tools: Use hand tools for removal of mortar from head joints in brickwork, from other joints in stone and brick masonry that are less than 6 inches long, and from other joints in which use of power tools might damage masonry units. Use hand tools to complete mortar removal from joints where power tools have been used to partially remove mortar.
1. For narrow joints of 1/8-inch or less in width, rake mortar from joints manually with a sharp knife blade or cutter made for this purpose. Cutter may be used with or without aid of a hammer.
 2. Sharpen chisels as often as necessary to provide for optimum cutting of mortar and to minimize chipping but at least hourly.
- C. Cleaning: Remove loose mortar and foreign material from raked joints using a fine, stiff natural- or synthetic-fiber bristle brush. Remove remaining particles, dust, and dirt using clean, filtered, oil-free compressed air. Ensure that dust and dirt are not blown back into previously cleaned joints.

3.16 MORTAR APPLICATION

- A. Wetting: Thoroughly drench masonry with water 24 hours prior to pointing joints. Thoroughly wet masonry again immediately before pointing joints and allow surfaces to dry slightly. At time of masonry pointing, surfaces shall be damp, so that they do not rapidly absorb moisture, but free of standing water (saturated, surface dry).

1. Failure to Properly Wet Substrate: Evidence that masonry to be pointed has not been properly dampened to prevent water in the mortar from being too rapidly absorbed by the masonry will be cause for Architect to reject pointing work. Remove rejected pointing, properly prepare joints for pointing, and provide new mortar to meet requirements of this Section at no additional cost to Owner.
- B. Masonry Pointing: Point joints as follows.
1. Using a long, thin masonry pointing trowel, apply pointing mortar to a dampened surface, packing the mortar into the joint to ensure full depth compaction. The mortar should be brought flush with the face of the masonry unit, and left to set for final tooling. Pointing mortar can be applied in a single lift regardless of the depth. Successive lifts with waiting periods between lifts are not necessary.
 2. Do not spread mortar over edges onto exposed surfaces of masonry units. Do not featheredge mortar.
 3. When stopping work at end of each day or for other reasons, stagger layers of mortar so that there will be no through joints in mortar inserted into joints. Stagger joints in layers so that they are at least 3 inches from each other.
 4. Where applying new work to that of a prior day, dampen previous work to ensure good bond.

3.17 JOINT TOOLING

- A. Profile: After mortar joint has “set”, tool joints to profile to match original joint profiles as directed by Architect. Solidly compress mortar so that it adheres well to masonry on both sides and forms a dense surface. Premature or late tooling will result in unacceptable finishes, which will be rejected.

3.18 CURING

- A. Keep newly pointed joints damp for at least 72 hours after mortar has been inserted. Do not apply a direct stream of water to joints for at least 7 days after mortar has been placed.
- B. Ensure masonry temperature remains as required by specifications until mortar is thoroughly cured.

3.19 CLEANING AND REPAIR OF MORTAR JOINTS

- A. Water Washing: Wash pointed masonry with clean filtered water, mild acidic cleaner, and nonabrasive hand tools to remove mortar debris from masonry surfaces. Do not use chemical cleaners.
1. Wash within 72 hours after completion of masonry pointing.
 2. Use blunt-edged wood scrapers, soft natural bristle brushes, and rough towels along with water to remove mortar debris. Do not use wire brushes. Do not scratch joint surfaces.

3. Do not allow pointing mortar beyond the face of the masonry unit. All edges of masonry shall remain visible.
- B. Repair of Pointed Joints: As cleaning progresses, examine joints to locate cracks, holes, and other defects. Carefully point up and fill such defects with mortar. Where joints are defective in opinion of Architect cut out joints to minimum depth of 1 inch, or two-and-one-half times joint width, whichever is greater; properly prepare joint substrates; and provide new pointing mortar exercising extreme care to ensure that color matches that of adjacent masonry pointing work. Exposed joint surfaces shall be free from protruding mortar, holes, pits, depressions, and other defects.

3.20 STONE REPAIRS OF CRACKED STONES AND STRUCTURAL STONE LINTELS

- A. Carefully remove cracked stone to be repaired. Provide temporary shoring of the masonry at each location. Clearly mark on each piece the location and sequencing.
- B. Remove soil, loose stone particles, mortar, and other debris or foreign material from the surfaces to be bonded on both the fragment and the building stone from which fragment was removed by cleaning with stiff brush.
- C. After adhesive has fully cured, anchor stone fragments further with 3/4 inch diameter threaded stainless steel rods set into 1 inch diameter holes drilled through the fractured ends of the stone. Center and space anchor rods between 3 and 5 inches apart and not less than 2 inches from any edge. Insert rods not less than 4 inches into segment of stone.
- D. Apply adhesive to comply with adhesive manufacturer's directions. Coat bonding surface of building stone with stone-to-stone adhesive completely filling all voids and covering all surfaces. Fit stone fragments together while adhesive is still tacky and hold fragments securely in place until adhesive has cured.
- E. Clean residual adhesive from edges. Wet stone and fill chipped areas and drill holes with patching mortar as called out under Stone Patching. Avoid feather edging. Finish patched areas to match texture of and be level with adjoining surrounding stone surfaces. Keep patching mortar damp for 72 hours.

3.21 CORRECTIVE MEASURES

- A. Correcting Unacceptable Joints: Should a crack occur in any joint surface, should mortar separate from a masonry unit, indicating that it did not form a strong mechanical and chemical bond with the unit, or should Architect determine that for another reason masonry pointing work does not equal or exceed the minimum standard established by the approved mock-up, remove mortar to a minimum depth of 1 inch, properly prepare joint substrates, and repoint following requirements of this Section to Architect's satisfaction at no additional cost. At completion of work of this Section, joints shall be full of mortar soundly adhered to surfaces of masonry units at sides of joints and without defects.

3.22 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- B. Notify Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.
- C. Testing Agency: Owner will engage qualified testing agencies to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

3.23 INSTALLATION OF JOINT SEALANTS

- A. Refer to drawings to receive sealant-pointed joints at stone.
- B. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1 inch. Rake joints to uniform depths with square bottoms and clean sides. Rub masonry sand to fresh sealant joint to simulate adjacent mortar joint appearance.
- C. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants".
- D. Remove excess sealant and smears as sealant is installed.

3.24 CLEANING STONE WORK

- A. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
- B. Limestone Cleaner: Severe Soiling and Algae Growth Cleaner:
 - 1. Refer to drawings for stone surfaces to receive this method of cleaning.
 - a. Step One: Apply mix for 5-gallons of following solution to dry surface:
 - 3 gallons clean water
 - 1 gallon of ReKlaim Cleaner, manufactured by ProSoCo, Inc.
 - 1 gallon of ReKlaim Activator, manufactured by ProSoCo, Inc.
 - b. Step Two: Allow about 10 to 20 minutes for mix to work on the soil. If solution begins to dry, reapply.
 - c. Step Three: Gently scrub heavily soiled areas.

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- d. Step Four: Rinse thoroughly with clean water. If using a sponge or string mop to rinse, change rinse water often. Pressure-rinse porous surfaces to remove heavy soiling.
 - e. Step Five: Immediately after rinsing, apply the following mix of Limestone & Masonry Afterwash to the wet surface:
 - 1-part clean water.
 - 1-part Sure Klean Limestone & Masonry Afterwash, manufactured by ProSoCo Inc.
 - f. Let the Afterwash stay on the surface for 3 to 5 minutes.
 - g. Pressure rinse from the bottom of the treated area to the top. Make sure to cover each portion of the masonry surface with a concentrated stream of water. To avoid streaking, keep wall surfaces immediately below area being cleaned wet and free of cleaner rundown and residues.
2. Note: After severe soiling and algae growth has been cleaned from areas called out on the drawings, use cleaning method for Limestone general cleaning application.
- C. Limestone Cleaner - Soil and Weathering Cleaning:
1. This method shall be used on all stone surfaces.
 - a. Step One: Apply ReVive, by ProSoCo, Inc. to dry surface until surface is thoroughly wet.
 - Refer to manufacturer's Dilution & Mixing rates for cleaning solution.
 - b. Step Two: Leave on surface for 2 to 3 minutes. If needed, apply more to keep surface wet.
 - c. Step Three: Mist treated surfaces with water and gently scrub with a non-metallic, short-fibered scrub brush to loosen biological soiling.
 - d. Step Four: Working from the bottom to the top, rinse thoroughly with clean water. Reduce rinsing pressure as needed for fragile or deteriorated stone.
- D. General:
1. The Contractor shall provide access to the entire building exterior for cleaning operations. This may involve multiple types of staging, scaffolding, etc. for access to various areas.
 2. Proceed with cleaning in an orderly manner; Work from top to bottom of each scaffold width and from one end of each elevation to the other.
 3. Use only those cleaning methods indicated for each stone material and location.
 - a. Use natural-fiber brushes only.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated and measured at spray tip. Adjust pressure and

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- volume to ensure that cleaning methods do not damage stonework.
 - c. Equipment units with pressure gages.
 - d. For water saturation spray application, use a fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees. Position tips with 6” to 8” from soiled surfaces. Use 45-degree nozzles for power washing.
 - e. Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, moldings, interstices, and that produces an even effect without streaking or damaging stone surfaces.
 - f. Pre-wet all surfaces to be cleaned with ionized water to avoid streaking.

3.25 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent non-stone surfaces. Use detergent and soft brushes or cloths.
- C. Remove masking materials, leaving no residues that could trap dirt.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

END OF SECTION 045000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural Steel Lintel.
2. Structural Stainless Steel Plates and Tube Sleeves for Existing Railing Posts.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill test reports for structural steel, including chemical and physical properties.
- B. Source quality-control reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
 2. AISC 360.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Construction: Type 2, simple framing.

2.2 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

2.3 STRUCTURAL-STEEL MATERIALS

- A. Channels, Angles: ASTM A 36/A 36M.
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- B. Stainless Steel
 - 1. Tubing: ASTM A554, Grade MT 304.
 - 2. Plate: ASTM A240 or A666, Type 316.

2.4 PRIMER

- A. Primer: Galvanizing Repair Paint: MPI #18, MPI#19, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Finishing: Accurately finish ends of lintels and other members transmitting bearing loads.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process of structural steel according to ASTM A 123 / A 123M.
1. Galvanize lintels and shelf angles located in exterior walls.

2.8 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Stainless-Steel Components: Type 304 stainless-steel fasteners.
 2. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports of existing masonry above during erection of new lintels/shelf angles to keep existing masonry secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel and bracing are in place, unless otherwise indicated.

3.3 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.4 ANCHORING POSTS

- A. Anchor sleeves to stainless steel plates as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For stainless steel railing sleeves, weld plates to posts and bolt to metal-supporting surfaces.

END OF SECTION 051200

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Fluid-applied, vapor-permeable membrane air barriers.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; Barritech VP.
 - b. DuPont; Tyvek Fluid-Applied Air Barrier.
 - c. Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier VP.

- d. Tremco Incorporated; ExoAir 230.
- e. BASF Wall Systems; Enershield-HP.
2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E 96.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Location: Install at all locations indicated on Drawings.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- D. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- E. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- F. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- G. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.
- H. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated. Comply with Section 079200 "Joint Sealants."
- I. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete masonry unit has cured and aged for minimum time period recommended by air-barrier manufacturer.
3. Verify that concrete masonry unit is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

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- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
 - F. Fill gaps in perimeter frame surfaces of windows, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
 - G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
 - H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.
 - I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
 - J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one coat.
- C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Adhered EPDM elastic sheet single ply membrane roofing.
 - 2. Bonding Adhesive.
 - 3. Cover Boards.
 - 4. Flashing, primer, splice tape, fasteners, flashing plate, mastic, lap sealant, sealer.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Certification is required with bid submittal indicating the Manufacturer has reviewed and agreed to such wind coverage.
- D. National Roofing Contractors Association (NRCA), Roofing and Waterproofing Manual, 5th Edition – 2006.

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- E. Sheet Metal and Air Conditioning Contractor's Association International (SMACNA), Architectural Sheet Metal Manual, 7th Edition – 2012.
 - F. Solar Reflectance Index (SRI): Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
 - G. Physical Properties:
 - 1. Tolerance on Nominal Thickness (%), per ASTM D412: +/-10.
 - 2. Minimum Tensile Strength, psi (mpa), per ASTM D412: 1305 (9).
 - 3. Elongation, Ultimate (min. %), per ASTM D412: 300.
 - 4. Minimum Tearing Strength, lbf (kN/m), per ASTM D624 Die C: 150 (26.3).
 - 5. Minimum Factory Seam Strength, per ASTM D816 Modified: Membrane Rupture.
 - 6. Brittleness Point, maximum degree (F) (deg. C), per ASTM D746: -49 (-45).
 - 7. Resistance to Heat Aging, per ASTM D573: 1 week @ 240 degrees (F) (116 degrees C).
 - a. Tensile Strength, min., psi (mpa), per ASTM D412: 1205.
 - b. Elongation, Ultimate, min. %, per ASTM D412: 200.
 - c. Tear Strength, min., lbf/in. (kN/m), per ASTM D624 Die C: 125 (21.9).
 - d. Linear Dimensional Change, max., %, per ASTM D1204: +/-1.
 - 8. Ozone Resistance, per ASTM D1149: No Cracks.
 - 9. Resistance to Water Absorption, per ASTM D471 after 7 days immersion @ 158 degrees (F) (70 degrees C): +8-2.
 - 10. Water Vapor Permeance maximum perms, per ASTM E96 (proc B or BW): 0.10.
 - 11. Resistance to Outdoor (Ultraviolet) Weathering, per ASTM D4637 Conditions: No Cracks, No Crazing.
 - a. Approximately equivalent to 3000 hours exposure at 158 degrees (F) black panel temperature, using xenon-arc apparatus operated at .07 W/m² irradiance.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work of similar scale as Contract Documents.
 - 1. Pertinent details at all penetrations.
 - 2. Perimeter and penetration details.
 - 3. Base flashings and membrane terminations.
 - 4. Attachment locations and methods.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, workers, and manufacturer.
- B. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.
 - 2. Fire/Windstorm Classification Certification is required with bid submittal indicating the Manufacturer has reviewed and agreed to such wind coverage.
 - 3. Submit compliance from insulation manufacturer that insulation furnished conforms to specified product.

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- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
 - D. Field quality-control reports.
 - E. Warranties: Submit two copies of manufacturer's warranty.
 - 1. The Contractor shall coordinate all necessary inspections, corrections, and re-inspections (if any), and certifications with the roofing Manufacturer as required, and the roofing Manufacturer shall issue an executed copy of the Roofing System Manufacturer's Warranty and amendment to the Owner upon completion of the work and final inspection by Architect and Manufacturer's representative. Submit a copy of the Manufacturer's Warranty and the Contractor's qualifications for Architect's review prior to commencing with the work.
 - G. Deviation to Details: If deviations to indicated details are desired, submit proposed detail changes no later than 10 days prior to bid date.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For membrane roofing system to include in maintenance manuals.
 - 1. Prior to final acceptance by Owner, deliver to Architect for approval, three (3) written copies of Manufacturer's maintenance and repair instructions for material installed. Upon approval, the Architect will submit to the Owner for record.
 - 2. Maintenance instructions shall be submitted in a spiral bound binder appropriately indexed and labeled on both the front cover and end bindings.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM Approvals approved for membrane roofing system identical to that used for this Project.
 - 1. The manufacturer must have a minimum of twenty (20) years experience in the manufacturing of vulcanized thermal set sheeting.
- B. Installer Qualifications: A qualified firm that is certified by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least five (5) years successful experience installing warranted single-ply EPDM roofing systems and having installed at least one (1) roofing application or several similar systems of equal or greater size within one year.
 - a. Applicator shall be certified in writing by manufacturer as a licensed or approved applicator.
 - 2. Provide adequate number of experienced workmen, 50% of installing crew minimum, regularly engaged in this type of work who are skilled in the application techniques of the materials specified and certified by the roofing system manufacturer. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.
 - a. Contractor shall submit work history data sheets for each worker on the project showing evidence of successful experience installing the specific type of warranted roofing system proposed for use.
 - b. Contractor shall have an experienced, pre-qualified, thoroughly trained superintendent with five (5) years experience with roof systems specified who is

familiar with the requirements of this project, on the job at all times when roofing system work is in progress. Training for Superintendent shall include certification of completion of manufacturer's in-house training course or on-site training. On-site training shall consist of at least eighty (80) hours of on-site application monitored by a manufacturer's representative.

- C. Source Limitations: Obtain components including roof insulation, recovery board, fasteners, etc. for membrane roofing system from same manufacturer as membrane roofing manufacturer.
- D. Fire-Resistance Ratings:
 - 1. Underwriters laboratories Class A approval as fire-retardant for membranes at slopes over ¼ inch per foot and UL Design No. P512 for one hour roof/ceiling assembly as indicated.
- E. Pre-Roofing Conference: Prior to bid submittal, the roofing contractor should schedule a job site inspection to observe actual conditions and verify all dimensions of the roof. The job site inspection may occur on the day of the pre-bid meeting or prior to such a meeting. Should access to the roof be necessary before or after the pre-bid meeting, the contractor must contact the owner's representative to coordinate an appropriate time.
 - 1. Any conditions which are not shown on the contract drawings should be indicated on a copy of the shop drawing and included with bid submittal if necessary to clarify any conditions not shown.
 - 2. Provide at least 72 hours advance notice to participants prior to convening pre-roofing conference.
- F. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing.
 - 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 base flashings, special roofing details, and condition of other construction that will affect roofing system.
 - 6. Review governing regulations and requirements for insurance and certificates if applicable.
 - 7. Review temporary protection requirements for roofing system during and after installation.
 - 8. Review roof observation and repair procedures after roofing installation.
- G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.
- H. Upon completion of the roof, the Owner's roofing inspector will review the installation to verify that the University's roofing standards have been met.

- I. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.
- J. Compatibility: Roofing components shall be compatible.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
 - 1. CAUTION: Do not store roofing materials on roof.
 - 2. Store materials on clean raised platforms with weather protective covering.
- E. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.
- F. Handle rolled goods to prevent damage.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
 - 1. Roof application shall not proceed if ambient temperature is below 40 degrees (F). In cool weather, special measures must be taken to insure proper performance of the roofing system.
 - 2. Any moisture that could cause poor adhesion, or entrapment within the system must be removed from the substrate.
 - 3. For further information concerning cold weather application, contact the Owner's representative.
 - 4. Do not install in rain or wet weather. Protect all roof area from moisture once work has begun.

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- B. Proceed with installation of elastic sheet single ply roofing only after substrate construction has been completed, and after penetrating components have been installed, so that membrane will not be penetrated or damaged by substrate.
 - C. If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.
 - D. Environmental Conditions: Roofing system shall not be applied when the surrounding air and surface temperature, relative humidity, or wind velocity is not within the range acceptable under the Manufacturer's recommendations.

1.11 WARRANTY

- A. Owner's Roofing Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 2. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, and other components of the roofing system.
 - 3. Indicate by letter that "All roofing components exclusive of the deck are approved and compatible with the warranty requirements of the roof system specified, and that the warranty specified will be issued at completion of the project is system is installed as designed."
 - 4. The Warranty shall be a 'no dollar' limit-type and provide for completion of repairs or total replacement of the 'roofing system' at the then current material and labor prices during the life of the Warranty.
 - 5. Warranty Period: 20 years from Date of Substantial Completion.
- B. Completed elastic sheet single ply roofing installation shall be warranted by sheet roofing manufacturer, in accordance with Owner's warranty, for period of 20 years from date of Substantial Completion.
- C. Special Project Warranty: Submit roofing Installer's warranty, on Owner's warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, and vapor retarders, and other components of membrane roofing system required to make the system watertight and complete, for the following warranty period:
 - 1. Warranty Period: Three (3) years from date of Substantial Completion.
 - 2. The roofing Contractor and roofing Manufacturer accompanied by a designated owner's representative shall perform, at no additional cost to the owner, an annual inspection of the complete roofing system installation through the three (3) year Contractor's Warranty period. This inspection shall include a written detailed evaluation of the roofing system including system failures and maintenance recommendations. All roofing system failures and defects shall be repaired/corrected by the Contractor at no additional cost to the Owner within thirty (30) days from date of annual inspection. These repairs/corrections

shall include replacing any and all wet insulation. All repairs shall be approved by, and made to the satisfaction of the owner's representative.

3. The Owner will promptly notify the roofing Contractor and Manufacturer, in writing, of the defects in the roofing system. Within eight (8) hours after receipt of written notice from the Owner, the roofing Contractor shall make emergency repairs, at its own expense, as required to render the facility watertight. Within five (5) days after receipt of such notice, the roofing Contractor shall, at its own expense, correct any faults or defects in material or workmanship. Should the roofing Contractor or roof Manufacturer fail or refuse to make the necessary repairs or replacements, when requested by the Owner, the Owner may perform, or cause the necessary work to be performed at the roofing Contractor's and Manufacturer's expense.
- D. Pro-rated System Warranties shall not be accepted.
- E. Evidence of the Manufacturer's warranty reserve shall be included as part of the project submittals for the specifier's approval.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

- A. Type and Manufacturer:
1. Rubber Gard adhered single ply membrane roofing by Firestone Building Products.
- B. Other Acceptable Manufacturers:
1. Carlisle SynTec Systems
 2. Versico Versiguard
 3. Gen Corp Genflex
- C. Sheet Membrane: EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet. Minimum 0.060 inch thick compounded elastomeric membrane, largest sheet size possible as determined by membrane manufacturer.
- D. Flashing: Minimum 0.060-inch-thick uncured EPDM membrane. Provide longest pieces of flashing practicable.
- E. Bonding adhesive, splice wash solvent splicing cement, lap sealant, water cut-off mastic, prefabricated pipe seals, seam tape, nite seal, and pourable sealer: As recommended by sheet roofing manufacturer.
- F. Splice Wash: Clear splice wash or splice primer wash.

2.2 MEMBRANE FASTENERS

- A. Fasteners: Corrosion-resistant, as recommended by manufacturer, of type, length, and strength required for intended use.
- B. Insulation Plates: Corrosion-resistant AZ55 Galvalume steel, as recommended by manufacturer.

- C. Coated screws of sufficient length to penetrate minimum one inch into wood or masonry substrate.
- D. Termination Bar: provide compression bar termination for all parapet flashing and conditions in conjunction with new metal flashings and counterflashings, as specified herein.
 - 1. Approximately 1 by 1/8 inch thick extruded stainless steel bar pre-punched 6 inches on center with anchors; incorporating a sealant ledge to support lap sealant and provide increased stability for membrane terminations.
 - 2. Allow ¼ inch minimum to ½ inch maximum spacing between consecutive lengths of termination bard.
 - 3. Apply on hard smooth surface only; not for use on wood.
 - 4. Do not wrap compression termination around corners.

2.3 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - d. Single-Ply Roof Membrane Sealants: 450 g/L.
 - e. Nonmembrane Roof Sealants: 300 g/L.
 - f. Sealant Primers for Nonporous Substrates: 250 g/L.
 - g. Sealant Primers for Porous Substrates: 775 g/L.
 - h. Other Adhesives and Sealants: 250 g/L.
- B. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- C. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- D. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- E. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

2.4 COVER BOARD

- A. Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate.
- B. Products: Subject to compliance with requirements, provide product by one of the following:
 - 1. CertainTeed Corporation; GlasRock Sheathing.
 - 2. Georgia-Pacific Building Products; Dens Deck Prime.

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- 3. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - 4. USG Corporation; Securock Glass Mat Roof Board.
- C. Thickness: As indicted on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Examine substrate under conditions under which elastic sheet roofing work is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE PREPARATION

- A. Comply with sheet membrane manufacturer's instructions for preparation of substrate to receive elastic sheet roofing. Clean substrate of dust, debris, and other substances detrimental to elastic sheet roofing work.

3.4 COVER BOARD INSTALLATION

- A. Install cover boards over existing conditions with long joints in continuous straight lines. Loosely butt cover boards together.
 - 1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere fabric-backed membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing without stretching and allow to relax approximately 1/2 hour before bonding, splicing, or attachment. Lap sides and ends of adjoining sheets minimum of 3 inches.

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- B. Evenly fold each sheet back onto itself so half the underside of the membrane. Apply bonding adhesive evenly to both substrate and membrane. Apply in sequence to allow equal drying time for both exposed membrane and substrate. Allow to dry until such time when adhesive will not stick or string when touched by dry finger. Starting at fold of sheet, slowly roll coated membrane onto coated substrate evenly in order to prevent wrinkles. Compress with stiff push broom to assure full contact.
 - C. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
 - D. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
 - E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
 - F. Air infiltration must be prevented along the roof edge by adhering the membrane over the perimeter and down the outside face of the building beneath the coping flashing.
 - G. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
 - H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - 1. Tape splices must be a minimum of 2-1/2-inch wide using 3-inch wide factory applied tape extending 1/8-inch minimum to 1/2-inch maximum beyond the spliced edge. Field splices at roof drains must be located outside the drain sump.
 - 2. Field splices located in areas where ponding water occurs or those that resist water flow, must be overlaid with 6-inch pressure-sensitive cured cover strip.
 - 3. All field splice intersections must be overlaid with a pressure-sensitive 'T' joint cover or 6-inch wide pressure-sensitive uncured elastoform flashing.
 - a. All 'T' joints must be overlaid with pressure-sensitive uncured elastoform flashing.
 - 4. Position membrane sheet to allow for required splice overlap. Mark the bottom sheets with an indelible marker approximately 1/4-inch to 1/2-inch from the top sheet edge. The pre-marked line on the membrane edge can also be used as a guide for positioning splice tape.
 - 5. Fold the top sheet back and clean the dry splice area (minimum 3-inch wide) of both membrane sheets by scrubbing with clean natural fiber rags saturated with manufacturer approved primer.
 - 6. Immediately roll the splice using positive pressure when using a 2-inch wide steel roller. Roll across the splice edge, not parallel to it.
 - 7. At all field splice intersections, apply lap sealant along the edge of the membrane splice to cover the exposed tape 2-inches in each direction from the splice intersection. Install manufacturer's 'T' joint cover or a 6-inch wide section of pressure-sensitive flashing over the field splice intersection.
 - I. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
 - J. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring. Fleece must be removed from back of membrane to allow direct contact of water cut off mastic with EPDM.
 - K. Adhere protection sheet over membrane roofing at locations indicated.

3.6 LAP SPLICE

- A. After membrane sheet has been positioned to provide minimum overlaps as specified, top sheet at overlap shall be folded back approximately 10 to 12 inches to allow for cleaning of membrane surfaces to be spliced. Clean mating surfaces with clear splice wash or splice primer wash and allow to dry.
- B. Evenly apply splice adhesive at manufacturer's recommended rate.
- C. Allow adhesive to dry until it does not stick or string when touched by dry finger. Roll top sheet towards lap area until two surfaces begin to meet, and then allow top sheet to fall freely onto bottom sheet so that stretching or wrinkling of membrane is prevented. Apply hand pressure along entire length of splice. Roll entire lap with hard rubber roller, applying firm and even pressure.
- D. Prime edge of completed seam with brush application of splice adhesive, and apply continuous bead of lap sealant along edge.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 - 1. Continue the deck membrane as wall flashing where practicable.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- F. Install flashing at roof interruptions (walls and curbs), roof penetrations, and roof perimeters, using longest flashing pieces possible. Flashing shall extend vertically minimum of 8 inches.
 - 1. Complete splice between flashing and roof membrane before bonding or attaching flashing to vertical surfaces.
 - 2. Install flashing at round penetrations, pipes, and conduits.

3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

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- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Protect adjacent surface, exterior walls, copings, parapets and roof penetrations from damage, staining or soiling resulting from the conduct of work under this section. Pay particular attention where material or workmen are hoisted or permitted access to the roofs. Adjacent roofing material, if installed, is to be protected from traffic and damage due to operations.
- C. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- E. On phased roofing, when the completion of flashings and terminations is not achieved, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- F. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- G. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all sealant.

3.10 PROTECTION OF ROOFING

- A. Upon completion of roofing including associated work, institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. Maintain roof free of nails, screws, scrap, and other foreign objects. At end of construction period, or at time when remaining construction will in no way affect or endanger roofing, make final inspection of roofing and prepare written report to Owner, describing nature and extent of deterioration or damage found.
- B. Repair or replace deteriorated or defective work found at time of final inspection to condition free of damage and deterioration at time of Substantial Completion and in accordance with requirements of specified warranty.

3.11 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work for EPDM System ("work") on the following project:
1. Owner: Curators of the University of Missouri.
 2. Address: 900 E Stadium Blvd., Columbia, MO 65201.
 3. Building Name/Type: Rothwell Gymnasium.
 4. Address: 1000 Rollins St, Columbia, MO, 65203.
 5. Area of Work: Patch EPDM Roofing Membrane at East Parapet Wall.
 6. Acceptance Date: _____.
 7. Warranty Period: Three (3) years.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 55 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said

work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous sheet metal flashing repairs.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Include details of special conditions.
 - 9. Include details of connections to adjoining work.
 - 10. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

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- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Recycled Content of Copper-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
- D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect from manufacturer's full range.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Base Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.
- B. Counterflashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 3. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that 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. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. 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. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed. Drip edge and flexible flashing should be interlocked with hemmed edges.
- C. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry" and Section 045000 "Exterior Historic Masonry Restoration."

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On

completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Nonstaining silicone joint sealants.
 - 2. Pre-compressed expansion joints.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section. Mockups shall be installed and approved prior to start of the work.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are **below 40 deg F**.
 2. When joint substrates are **wet**.
 3. Where joint widths are **less than those allowed** by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of **interfering with adhesion** have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Ten years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Master Builders; Master Seal NP100.
 - c. Pecora Corporation; 895NST.
 - d. Tremco Incorporated; Spectrem 3.

2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (Bi-cellular polyethylene foam backer rod), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Base of specification SOF Rod by Namaco Corporation or approved equal.
- C. Bond-Breaker Tape: Polyethylene recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 JOINT FILLERS

- A. Sponge Rubber Expansion and Partition Joint Filler: Provide units complying with AASHTO M 153, Type 1, Sponge Rubber.

2.5 PRE-COMPRESSED, EXPANSION JOINTS

- A. Provide watertight, energy-efficient exterior joints in vertical-plane walls (above-grade). Typical locations include, but are not limited to the following: applications in window perimeters, other façade penetrations such as doors, store fronts, vents, HVAC units, panel to panel joints, curtain walls, control joints, between dissimilar materials, high-movement and seismic structural expansion joints, acoustic partition barriers, and new-to-existing connections.

Basis of Design

- 1. All joints shall be designed to meet the specified performance criteria of the SEISMIC COLORSEAL product as manufactured by: (USA & International) EMSEAL JOINT SYSTEM, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365. (Canada) EMSEAL, LLC 120 Carrier Drive, Toronto, Ontario, Canada M9W 5R1 Toll Free: 800-526-8365. www.emseal.com

2. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories.
 - a. Acceptable Alternate Manufacturers:
 - 1) Erie Metal Specialties – CSS-Series (Seismic) Compression Seal.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 3. Remove laitance and form-release agents from concrete.

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4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
 - C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability and as recommended by manufacturer but with the following limitations.
 - a. For pavement, floor slabs and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8 inch nor less than 3/8 inch deep.
 - b. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2 inch deep or less than 1/4 inch deep.
 - c. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

4. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Clean the adjoining surfaces by whatever means necessary to eliminate evidence of spillage.
5. Do not overheat hot-applied sealants.
6. Recess exposed edges of gaskets and joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joint.
7. Bond ends of gaskets together with adhesive or by any other means as recommended by the manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends of corners unless molded corner units are provided.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 INSTALLATION OF PRE-COMPRESSED EXPANSION JOINTS

A. Preparation of the Work Area

1. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the SEISMIC COLORSEAL being installed plus at least ¼ inch (6mm) for the application of corner beads. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
2. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints in dimension stone cladding.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors and windows.
 - e. Joints at underside of metal flashing.
 - f. Joints between cast stone copings.
 - g. Joints in natural stone to natural stone.
 - h. Joints in metal frame to natural stone.
 - i. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200