
SECTION 04 01 40
MAINTENANCE OF STONE ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes stone assembly work including stone restoration and cleaning for stone sills, stone coursing, and as follows:
1. Identify existing stone type and inform Architect of findings. Materials and procedures for MAINTENANCE OF STONE ASSEMBLIES shall be done following best practices for identified stone type and provide materials designed for maintenance of identified stone type. Materials specified are based on limestone.
 2. Repairing stone masonry, including replacing whole units where indicated and when existing stone can not be repaired to match quality of existing undamaged stone coping. Repointing joints.
 3. Preliminary cleaning, including removing plant growth.
 4. Cleaning exposed stone surfaces, including removal of Graffiti.
 5. Visit site prior to bidding to understand scope of work required.
 6. Restore and clean existing stone coping to remain.
 7. Intent is to have a uniform finish and appearance that shows the natural beauty of the existing stone that is free of foreign matter.
 8. On the bid form provide a unit cost for additional work as follows:
 - a. CRACK INJECTION: Cost per linear foot to repair a crack in a stone unit in conformance with CRACK INJECTION in PART 3.
 - b. STONE-FRAGMENT REPAIR: Repair cracked or fallen stone fragment in a stone unit in conformance with STONE-FRAGMENT REPAIR in PART 3.
 - c. STONE PATCHING:
 - 1) Surface patch of a chip in stone face in conformance with STONE PATCHING in PART 3.
 - 2) Patch a small area of deep deterioration in a stone unit in conformance with STONE PATCHING in PART 3.
 - d. STONE REMOVAL AND REPLACEMENT: Remove and Replace a typical size stone unit in conformance with STONE REMOVAL AND REPLACEMENT in PART 3.
 - e. STONE PLUG REPAIR: Core out deep chip and replace using the existing stone called out to be replaced as the material use to plug cutouts, and in conformance with STONE PLUG REPAIR in PART 3.
- B. Related Sections:
1. Maintenance of Unit Masonry: Section 04 01 20 (Issued in WP-9A, and available through Construction Manager)
 2. Division 07 Section "Joint Sealants."

1.2 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi.

- B. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- C. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
- D. High-Pressure Spray: 800 to 2000 psi; 4 to 6 gpm.
- E. Stone Terminology: ASTM C 119.
- F. Face Bedding: Setting of stone with the natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: 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 construction.
 - 2. Existing Stone: Test each type of existing stone requiring replacement, according to ASTM C 170 for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C 99 for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C 97 for absorption and bulk specific gravity. Carefully remove four existing stones from locations designated by Architect. Take testing samples from these stones.
 - 3. Existing Mortar: Test according to ASTM C 295, 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 as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five different locations designated by Architect or testing service.
 - 4. Temporary Patch: As directed by Architect, provide temporary materials at locations from which existing samples were taken.
 - 5. Replacement Stone: Test each proposed type of replacement stone, according to ASTM C 170 for compressive strength, ASTM C 99 for modulus of rupture, and ASTM C 97 for absorption and bulk specific gravity. Provide with new stone to match appearance of existing stone.

1.4 REFERENCE STANDARDS (LATEST EDITION UNLESS OTHERWISE NOTED)

- A. American Society for Testing and Materials (ASTM):
 - 1. C 5 Specification for Quicklime for Structural Purposes
 - 2. C 97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
 - 3. C 99 Test Method for Modulus of Rupture of Dimension Stone
 - 4. C 114- Test Methods for Chemical Analysis of Hydraulic Cement
 - 5. C 119 Terminology Relating to Dimension Stone
 - 6. C 144 Specification for Aggregate for Masonry Mortar
 - 7. C 150a Specification for Portland Cement

8.	C 170	Test Method for Compressive Strength of Dimension Stone
9.	C 207	Specification for Hydrated Lime for Masonry Purposes
10.	C 212	Specification for Structural Clay Facing Tile
11.	C 270	Specification for Mortar for Unit Masonry
12.	C 295	Guide for Petrographic Examination of Aggregates for Concrete
13.	C 595	Standard Specification for Blended Hydraulic Cements
14.	C 780	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
15.	C 1324	Standard Test Method for Examination and Analysis of Hardened Masonry Mortar
16.	C 1330	Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
17.	C 1489	Specification for Lime Putty for Structural Purpose

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

- A. **Cleaning:** Existing stone shall not be damaged or marred in the process of cleaning. Open joints shall be temporarily caulked or otherwise protected to prevent water and cleaner intrusion into the interior of the structure from pressure spraying. Non-masonry materials and severely deteriorated stone masonry shall be protected by approved methods prior to initiation of cleaning operations. Stone masonry cleaning shall remove all organic and inorganic contaminants from the surface and pores of the substrate, returning the stone cladding system to its natural color. Surfaces shall be evenly cleaned with no evidence of streaking or bleaching. The cleaning process shall not affect the density, porosity, or color of the stone masonry or mortar. Cleaned stone masonry shall have a neutral pH. Methods used for cleaning stone shall be the gentlest possible to achieve the desired results. Test patches shall be made to determine a satisfactory cleaning result. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall be performed in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to stone masonry. The cleaning materials, equipment, and methods shall not result in staining, erosion, marring, or other damage to the surfaces of the stone or other building materials. Following an initial inspection and evaluation of the structure and surfaces, the structure shall be given a surface cleaning. The surface cleaning shall be completed prior to start of repair work, and sampling and testing of mortars. The cleaning shall provide for the complete cleaning of all exterior stone masonry surfaces of the structures, removing all traces of moss, dirt, and other contaminants. The cleaning shall provide a clean stone masonry surface to allow determination of the stone masonry's color and shades, finish and texture, and other properties. Following completion of the surface cleaning of the structure the stone masonry shall be dried prior to the start of any repair work.
- B. **Paint Removal:** Paint and other coatings shall be removed from stone and mortar joints prior to general cleaning. Stone masonry shall not be damaged or marred in the process of paint removal. Areas where paint is to be removed shall first be cleaned with water and detergent solution to remove surface dirt, rinsed, and allowed to dry. Chemical paint removers shall be applied in accordance with manufacturer's

instructions. Surrounding painted surfaces to remain intact shall be protected from exposure to chemical paint removers to avoid damage.

- C. Stone masonry Repair: Repaired surfaces shall match adjacent existing surfaces in all respects. Stone masonry repair shall proceed only after the cause of deterioration has been identified and corrected. Stone masonry repair shall proceed only after the area to be repaired has been cleaned. The materials, methods and equipment proposed for use in the repair work shall be demonstrated in test panels. The location, number, size and completed test panels shall be subject to approval. Products shall be used in accordance with the manufacturer's instructions.
- D. Finishes and Color of Stone Masonry and Mortar: The exposed surfaces of stone masonry and mortar repair shall match the finish, color, texture, and surface of the original surface. Mechanical finishing and texturing may be required to produce the required finish and appearance. The finishing and texturing shall conceal bond lines between the repaired area and adjacent surfaces. The texturing shall provide replication of all surface details, including tooling and machine marks. The equipment used in finishing and texturing shall be a low-impact energy type which will not weaken the patch or damage the patch bond and the adjacent concrete.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- B. Qualification Data: For restoration specialists including field supervisors and restoration workers chemical-cleaner manufacturer and testing service.
- C. Cleaning Program and Paint/Graffiti removal Program for the Dixie Building.
- D. Samples for Initial Selection: For the following:
 - 1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/4 inch (13 mm), set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three six Samples of different mixes of colored sands and cements that produce a mortar matching the 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.
 - 2. Sealant Materials: See Section 07 92 00, Joint Sealants.
 - 3. Include similar Samples of accessories involving color selection.
- E. Samples for Verification: For the following:
 - 1. Each type of sand used for pointing mortar; minimum 1 lb of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend.
 - b. Identify sources, both supplier and quarry, of each type of sand.

2. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches long by 1/4 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.
3. Flashing: As specified in Section 04 05 23, Masonry Accessories.
4. Sealant Materials: As specified in Section 07 92 00, Joint Sealants.
5. Accessories: Each type of accessory and miscellaneous support.

1.7 QUALITY ASSURANCE

- A. Restoration Specialist Qualifications: Engage an experienced stone restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
 1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
 3. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
- B. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing stone masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
 1. If materials and methods other than those indicated are proposed for any phase of restoration 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 and worker's ability to use such materials and methods properly.
- D. Cleaning and Repair Appearance Standard:
 1. Grade level up to Second Floor Slab Level: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 5 feet away by Architect. Perform additional repair, paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.

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2. Above Second Floor Level: Cleaned and repaired surfaces are to have a uniform appearance as viewed from **20 feet** away by Architect. Perform additional repair, paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- E. Sandblasting equipment will not be allowed for cleaning stone masonry surfaces.
- F. Cleaning Equipment: Cleaning equipment shall not cause staining, erosion, marring, or other damage or changes in the appearance of the surfaces to be cleaned.
- G. Water Blasting: The equipment shall not be operated at a pressure which will cause etching or other damage to the stone masonry surface or mortar joints. The water tank and auxiliary re-supply equipment shall be of sufficient capacity to permit continuous operations. The Contractor shall provide protective covers and barriers as required to prevent over-spray onto adjacent surfaces.
- H. Drilling Equipment: Equipment used to drill holes in stone masonry, for patch anchors and other applications, shall be standard handheld masonry drills, commonly used for drilling small holes in concrete and stone masonry. The drill shall be a small, powered, handheld type, using rotary drilling mode only. Impact and rotary impact type drills will not be allowed.
- I. Finishing and Texturing Equipment: Equipment and hand tools used for placing, finishing and texturing stone masonry and mortar shall be commercially available and commonly used in stone masonry construction and repair.
- J. Mortar Removal shall be done with hand tools. Power tools not permitted.
- K. Mixing, Transporting, and Placing Job Materials: Equipment used for mixing, transporting, placing, and confining stone masonry and mortar placements shall be capable of satisfactorily mixing material and supporting placement operations in an uninterrupted manner. Defects and deficiencies in operation or capacity shall be resolved prior to use in the work. Equipment used for mixing, conveying, and placing of materials shall be clean, free of old materials and contaminants, and shall conform to the material manufacturer's recommendations.
- L. Associated Equipment; Associated equipment such as mixer timing equipment, valves, pressure gauges, pressure hoses, other hardware, and tools shall be provided as required to ensure a continuous supply of material and operation control.
- M. Retain required mockups in first paragraph below; insert others to suit Project. Revise or delete paragraph if test areas were prepared or are required as part of a separate contract to evaluate and establish restoration and cleaning materials and processes.
- N. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation. Provide mockups as follows:
1. Provide separate mockups of stone sill, stone coursing, and stone coping.
 2. Stone Repair:

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- a. Patch a minimum of three small holes at least 1 inch in diameter.
 - b. Patch cracked stone to demonstrate largest crack contractor can repair with no visual sign of repair at a distance of ten feet from face of stone. Provide mockups for viewing at a distance of 5 feet and second at a distance of twenty feet.
 - c. Patch chipped stone to demonstrate largest chip contractor can repair with no visual sign of repair. Provide mockups for viewing at a distance of 5 feet and second at a distance of twenty feet.
3. Cleaning: Clean sample area.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - c. Provide mockups for viewing at a distance of 5 feet and second at a distance of twenty feet.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 5. Mockup Locations: As selected by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
- B. Cold-Weather Requirements: Comply with the following procedures for stone repair and mortar joint pointing otherwise indicated:
 1. When air temperature is below 40 deg F, repair materials and existing stone to produce temperatures between 40 and 120 deg F.
 2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.
- C. Hot-Weather Requirements: Protect stone repair and mortar joint pointing when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation.
- D. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

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- E. Clean stone surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.10 SEQUENCING AND SCHEDULING

- A. Perform stone restoration work in the following sequence:
 1. Work of this section to occur prior to installation of new finish materials at exterior of building.
 2. Remove plant growth.
 3. Inspect for open joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 4. Remove paint.
 5. Clean stone surfaces.
 6. Repair stonework.
 7. Rake out joints to be repointed.
 8. Point mortar joints.
 9. Inspect for open joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 10. Remove paint.
 11. Clean stone surfaces.

1.11 WARRANTY

- A. Cleaning Warranty: Cleaning procedures shall be warranted for a period of two years against harm to substrate (stone and mortar) or to adjacent materials including, but not limited to, discoloration of substrate from improper procedures or usage, chemical damage from inadequate rinse procedures, and abrasive damage from improper procedures.
- B. Repair Warranty: Repair procedures, including repointing, shall be warranted for a period of two years against: discoloration or mismatch of new mortar to adjacent original historic mortar, discoloration or damage to stone from improper mortar clean-up, loss of bond between stone and mortar, fracturing of stone edges from improper mortar joint preparation procedures or improper mortar formulation, and occurrence of efflorescence.

PART 2 - PRODUCTS

2.1 MATERIALS GENERAL

- A. Materials, physical and chemical properties, and composition of stone masonry and mortar used in renovation work shall match that of original existing stone masonry and mortar to be used, unless samples and testing determine that existing mixtures and materials are faulty or non-performing

2.2 STONE MATERIALS

- A. Stone: Provide natural building stone of variety, color, texture, grain, veining, finish, size, and shape to match existing stone.
 - 1. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
- B. Quarrying New Stone: Have quarry clearly label the direction of bedding planes when rough stone is quarried, to facilitate cutting stones so that natural bedding planes will be as required in "Cutting New Stone" Paragraph.
- C. Cutting New Stone: Regardless of how existing stone was cut and set, cut each new stone so that, when it is set in final position, natural bedding planes are essentially horizontal.
- D. Date Identification: Stamp with permanent ink on an interior surface of each new stone in easily read 1/4-inch- high characters, "MADE IN <Insert year stone was cut>."

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - 1. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - 2. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- D. Water: Potable water shall be obtained from a local source and shall be filtered to remove minerals resulting in a neutral pH, prior to application. Backflow prevention devices shall be provided at the point of connection to the water supply.

2.4 MANUFACTURED REPAIR MATERIALS

- A. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cathedral Stone Products, Inc.; Jahn Restoration Mortars.
 - b. Conproco Corporation; Mimic or Matrix, as required.
 - c. Edison Coatings, Inc.; Custom System 45.
 - 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 types of stone.

3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
4. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of colors to enable matching each piece of stone.
 - a. Match stone contained in the approved mockup.

B. Cementitious Crack Filler: An ultrafine superplasticized 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 types of stone.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
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 - a. Cathedral Stone Products, Inc.; Jahn Injection Grout.
 - b. Conproco Corporation; Terra Cotta Finish.
 - c. Edison Coatings, Inc.; Pump-X 53-Series.

2.5 PAINT REMOVERS

A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from stone masonry. Alkaline formula with organic solvents, removes multiple layers of paint and graffiti from stone masonry surfaces. Paint remover remains active for 24 hours. Following paint removal, the stone masonry must be neutralized with product recommended by the manufacturer. Contains no methanol or methylene chloride, and can be rinsed with water.

1. Chemical paint removers shall be effective for removal of paint on stone and mortar without altering, damaging, or discoloring the stone and mortar surface.
2. Gel consistency to adhere to vertical surfaces.
3. Dwell Time: Remains Active and can be rinsed successfully with water after 24 hours or more.
4. Do not use on wood.
5. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. PROSOCO; Sure Klean Heavy-Duty Paint Stripper D.
 - b. ABR Products, Inc.; 800 Brush Grade.
 - c. Diedrich Technologies Inc.; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover.

2.6 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gallons of solution required.

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- D. Mild Acidic Cleaner: 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; X-190 Limestone & Concrete Cleaner.
 - b. PROSOCO; Enviro Klean BioWash.
- E. Acidic Cleaner: Manufacturer's standard acidic limestone masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dumond Chemicals, Inc.; Safe n' Easy Heavy Duty Restoration Cleaner.
 - b. PROSOCO; EnviroKlean SafRestorer Cleaner, Enviro Klean Restoration Cleaner, Sure Klean Restoration Cleaner or Sure Klean Heavy-Duty Restoration Cleaner.
- F. One-Part Limestone Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; X-190 Limestone & Concrete Cleaner.
 - b. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean Limestone and Marble Cleaner and Brightener (HT-907).
 - c. Price Research, Ltd.; Price Limestone Restorer.
 - d. PROSOCO; Sure Klean Limestone Restorer.
- G. Two-Part Limestone Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; 500 Limestone Prewash Cleaner followed by 500 Limestone Afterwash.
 - b. Diedrich Technologies Inc.; Diedrich 707X Limestone Cleaner Pre-Rinse or Diedrich 808X Black Encrustation Remover - Super Strong followed by 707N Limestone Neutralizer After-Rinse.
 - c. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean Limestone and Marble Precleaner (HT-704) and Hydroclean Limestone and Marble Cleaner and Brightener (HT-907).
 - d. Price Research, Ltd.; Price Limestone Pre-Wash followed by Limestone After-Wash System.
 - e. PROSOCO; Enviro Klean BioKlean followed by Sure Klean Limestone & Masonry Afterwash or Sure Klean 766 Limestone Prewash followed by SureKlean Limestone & Masonry Afterwash.

2.7 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline stone masonry cleaners.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; Rubber Mask.
 - b. Price Research, Ltd.; Price Mask.
 - c. PROSOCO; Sure Klean Strippable Masking.
- B. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and pins from Type 304 or Type 316 stainless steel.
- C. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
- D. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- E. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little 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 in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave a residue on surfaces.

2.8 MORTAR MIXES

- A. Mortar Proportions: Mix mortar materials in accordance with restoration specialist recommendations to match existing.

2.9 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.
- B. Acidic Cleaner Solution for Unpolished Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical-cleaner manufacturer.

PART 3 - EXECUTION**3.1 PROTECTION**

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
- B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding stone and other surfaces.
 - 1. Cover sills, ledges, and projections to protect from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar in contact with exposed stone and other surfaces.

3.2 CRACK INJECTION

- A. General: Comply with cementitious crack-filler manufacturer's written instructions.
- B. Drill 1/4-inch- diameter injection holes as follows:
 - 1. Transverse Cracks Less Than 3/8 inch Wide: Drill holes through center of crack at 12 to 18 inches o.c.
 - 2. Transverse Cracks More Than 3/8 inch Wide: Drill holes through center of crack at 18 to 36 inches o.c.
 - 3. Delaminations: Drill holes at approximately 18 inches o.c. both vertically and horizontally.
 - 4. Drill holes 2 inches deep. Where possible drill holes in mortar joints.
- C. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.

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- D. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.
 - E. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.
 - F. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.
 - G. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

3.3 STONE PATCHING

- A. Patch the following stone units unless another type of replacement or repair is indicated:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners.
 - 4. Units with small areas of deep deterioration.
- B. Remove and replace existing patches unless otherwise indicated or approved by Architect.
- C. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
- D. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.
- E. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
- F. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
- G. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.

1. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
2. Build patch up 1/4 inch above surrounding stone and carve surface to match adjoining stone after patching compound has hardened.

H. Keep each layer damp for 72 hours or until patching compound has set.

I. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.4 UNUSED ANCHOR REMOVAL

A. Remove stone anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.

1. Remove items carefully to avoid spalling or cracking stone.
2. Where directed, if an item cannot be removed without damaging surrounding stone, do the following:
 - a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding stone as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
3. Plug the hole where each item was removed unless directed to remove and replace the stone unit.

3.5 STONE REMOVAL AND REPLACEMENT

A. Remove stone that has deteriorated or is damaged beyond repair. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.

B. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

E. 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, natural bedding planes are essentially horizontal. Reject and replace stone with vertical bedding planes except as required for arches, lintels, and copings.

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- F. 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.
- G. Set replacement stone 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. Replace existing anchors with new anchors of size and type indicated.
1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
 2. Rake out mortar used for laying stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing stone, and at same time as repointing of surrounding area.
 3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.6 STONE PLUG REPAIR

- A. Remove cylindrical piece of damaged stone by core-drilling perpendicular to stone surface.
- B. Prepare a replacement plug by core-drilling replacement stone. Use a drill sized to produce a core that will fit into hole drilled in damaged stone with only minimum gap necessary for adhesive. Cut and install plug so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.
- C. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and plug, completely filling all crevices and voids.
- D. Apply plug while adhesive is still tacky and hold securely in place until adhesive has cured.
- E. Clean adhesive residue from exposed surfaces.

3.7 STONE-FRAGMENT 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. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, 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 between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches into parent stone and 2 inches into fragment, but no closer than 3/4 inch from exposed face of fragment.

- D. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.
- E. 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.
- F. Clean adhesive residue from exposed surfaces and patch chipped areas as specified in "Stone Patching" Article.

3.8 CLEANING STONE, GENERAL

- A. Proceed with cleaning in an orderly manner and with one of the specified methods as recommended by restoration specialist. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each stone material and location.
 - 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
 - a. Equip units with pressure gages.
 - 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - 4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - 5. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - 6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 - 7. For steam application, use steam generator capable of delivering live steam at nozzle.
- C. 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 stone surfaces.
- D. Water Application Methods:
 - 1. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray

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- nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- E. Steam Cleaning: Apply steam to stone surfaces at the very low pressures, not exceeding 30 psi. Hold nozzle at least 6 inches from surface of stone and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- F. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- G. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
- H. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.9 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from stone surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil or debris from open joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, caulking, asphalt, and tar.
1. Carefully remove heavy accumulations of material from surface of stone with sharp chisel. Do not scratch or chip stone surface.
 2. Remove paint and caulking with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.

3.10 PAINT REMOVAL

- A. Paint Removal with Alkaline Paste Paint Remover:
1. Remove loose and peeling paint using stiff brushes. Let surface dry thoroughly.
 2. Apply paint remover to dry, painted stone with brushes.
 3. Allow paint remover to remain on surface for period recommended by manufacturer.
 4. Rinse with water in accordance with manufacturer's instructions.

5. Repeat process if necessary to remove all paint.
6. Apply acidic cleaner or manufacturer's recommended afterwash to stone, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
7. Rinse with water in accordance with manufacturer's instructions.

3.11 CLEANING STONE, GENERAL

- A. Proceed with cleaning in an orderly manner; work top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each stone material and location.
 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
 - a. Equip units with pressure gages.
 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 5. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 7. For steam application, use steam generator capable of delivering live steam at nozzle.
- C. 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 stone surfaces.
- D. Water Application Methods:
 1. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- E. Steam Cleaning: Apply steam to stone surfaces at the very low pressures, not exceeding 30 psi, for each type of stonework. Hold nozzle at least 6 inches from

surface of stone and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

- F. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- G. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - 1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- H. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.12 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, spray applied at low pressure.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. 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

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies mortar materials and mixes
 - 1. Colored mortar at face brick.
 - 2. Non-colored mortar for all remaining masonry.
- B. Provide parge coating at designated surfaces of Dixie Building.

1.2 RELATED WORK

- A. Testing Laboratory Services during Construction: Section 01 45 29.
- B. Mortar used in Section:
 - 1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
 - 2. Section 04 05 16, MASONRY GROUTING.
 - 3. Section 04 20 00, UNIT MASONRY.
- C. Mortar Color: Section 09 06 00, Schedule for Finishes.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

- A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

1.4 TESTS PROVIDED BY CONTRACTOR

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing Prior to Construction:

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1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 2. Mortar:
 - a. Test for compressive strength and water retention; ASTM C270.
 - b. Mortar compressive strengths 28 days as follows:
 - 1) Type M: Minimum 2500 psi at 28 days.
 - 2) Type S: Minimum 1800 psi at 28 days.
 - 3) Type N: Minimum 750 psi at 28 days.
 3. Cement:
 - a. Test for water soluble alkali (non-staining) when non-staining cement is specified.
 - b. Non-staining cement shall contain not more than 0.03 percent water soluble alkali.
 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.
 5. High Bond Mortar: Test for compressive strength, tensile strength, flexural strength, and brick bond strength.
- G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 1. Testing laboratory's facilities and qualifications of its technical personnel.
 2. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Mortar cement.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Color admixture.
- C. Laboratory Test Reports:
 1. Mortar, each type.
 2. Admixtures.
- D. Manufacturer's Literature and Data:
 1. Cement, each kind.
 2. Hydrated lime.
 3. Admixtures.
 4. Liquid acrylic resin.

- E. Samples:
1. Mortar Samples for Verification: For each color required make samples using same sand and mortar ingredients to be used on Project. Size shall be 3/8 inches wide by a minimum length of 2-1/2 inches.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect from damage from handling, dirt, stain, water and wind.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 1. C40-04 Organic Impurities in Fine Aggregates for Concrete
 2. C91-05 Masonry Cement
 3. C109-07 Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
 4. C144-04 Aggregate for Masonry Mortar
 5. C150-05 Portland Cement
 6. C207-06 Hydrated Lime for Masonry Purposes
 7. C270-07 Mortar for Unit Masonry
 8. C307-03 Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
 9. C321-00/R05 Bond Strength of Chemical-Resistant Mortars
 10. C348-02 Flexural Strength of Hydraulic Cement Mortars
 11. C595-08 Blended Hydraulic Cement
 12. C780-07 Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
 13. C979-05 Pigments for Integrally Colored Concrete
 14. C1329-05 Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

- A. ASTM C144 and as follows:
 1. Light colored sand for mortar for laying face brick.

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2. Typical: 5 to 15 percent shall pass No. 100 sieve.
 3. Pointing Mortar: White or light colored silica sand as approved; fine, pure silica, 100 percent passing the No. 16 sieve, not over 40 percent passing the No. 50 sieve.
 4. Colored Aggregates: White natural sand or ground granite, or other sound stone, color as required for mortar color, well graded and 100 percent passing the No. 16 sieve.

- B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 BLENDED HYDRAULIC CEMENT

- A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

- A. Mortars: ASTM C 91, containing hydrated lime. In general, proprietary masonry cements will not be accepted for the work unless laboratory data substantiating their conformance with structural requirements for mortars and grouts as specified, and that no adverse chemical reaction will occur with the specified masonry accessories and reinforcing, is submitted and approved by Architect. Suitable products are acceptable from the following manufacturers:
1. Southdown (Southwestern Portland Cement Co.), Fairborn, OH.
 2. LaFarge Corporation, Southfield, MI.

- B. Types: N, S, or M.

- C. Use white masonry cement whenever white mortar is specified.

2.5 MORTAR CEMENT

- A. ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

- A. ASTM C150, Type I.

- B. Use white Portland cement wherever white mortar is specified.

2.7 LIQUID ACRYLIC RESIN

- A. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.8 WATER

- A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.9 MASONRY MORTAR

A. Conform to ASTM C270.

B. Admixtures:

1. Do not use mortar admixtures unless approved by Resident Engineer.
2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
3. Do not use antifreeze compounds.

C. Colored Mortar:

1. Maintain uniform mortar color for exposed work throughout.
2. Match mortar color in approved mockup.
3. Color of mortar for exposed work in alteration work to match color of existing mortar unless specified otherwise in section 09 06 00, SCHEDULE FOR FINISHES.

D. Color Admixtures:

1. Proportion as specified by manufacturer.
2. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

2.10 HIGH BOND MORTAR

A. Mixture by volume, one-part Portland cement, 1/4-part hydrated lime, three-parts sand, water, and liquid acrylic resin.

B. Mortar properties when tested in accordance with referenced specifications.

1. Compressive Strength, ASTM C109: Minimum 2800 psi, using 2 inch cubes.
2. Tensile Strength, ASTM C307: 560 psi, using the 1 inch briquettes.
3. Flexural Strength, ASTM C348: Minimum 880 psi, using flexural bar.
4. Bond Strength, ASTM C321: Minimum 430 psi, using crossed brick.

2.11 COLOR ADMIXTURE

A. Pigments: ASTM C979.

B. Use mineral pigments only. Organic pigments are not acceptable.

C. Pigments inert, stable to atmospheric conditions, non-fading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

A. Mix in a mechanically operated mortar mixer.

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1. Mix mortar for at least three minutes but not more than five minutes.
 - B. Measure ingredients by volume. Measure by the use of a container of known capacity.
 - C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
 - D. Mortar that has stiffened because of loss of water through evaporations:
 1. Re-tempered by adding water to restore to proper consistency and workability.
 2. Discard mortar that has reached its initial set or has not been used within two hours.
 - E. Pointing Mortar:
 1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
 2. Allow mortar to stand in dampened condition for 1 to 1-1/2 hours.
 3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

- A. Use Type M mortar for precast concrete panels, and waterproof parging below grade.
- B. Use Type S mortar for masonry containing vertical reinforcing bars (non- engineered) masonry below grade and engineered reinforced unit masonry work.
- C. For brick veneer over frame back up walls, use Type N Portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- D. Use Type N mortar for other masonry work, except as otherwise specified.
- E. Use Type N mortar for tuck pointing work.
- F. Use pointing mortar for items specified.

3.3 PARGING

- A. Parge the masonry surfaces listed below with Type N mortar.
 1. Rough masonry opening of circular window and where shown on drawings in Dixie Building.
- B. Fill voids; parge as needed to provide smooth even surface to receive coating, sealant, and window construction specified elsewhere.

--- E N D ---

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies grout materials and mixes.

1.2 RELATED WORK:

- A. Testing Laboratory Services during Construction: Section 01 45 29.
- B. Grout used in Section:
1. Section 04 20 00, UNIT MASONRY.
 2. Section 04 05 16 - Masonry Grouting.
- C. Grout Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 TESTS PROVIDED BY CONTRACTOR

- A. Test grout and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing Prior to Construction:
1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 2. Grout:
 - a. Test for compressive strength; ASTM C1019.
 - b. Grout compressive strength of 2000 psi at 28 days.
 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Grout mixes. Include description of type and proportions of ingredients.
- C. Certificates:
 - 1. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Grout.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Coarse aggregate for grout.
 - g. Color admixture.
- D. Laboratory Test Reports:
 - 1. Grout, each type.
 - 2. Admixtures.
- E. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect from damage from handling, dirt, stain, water and wind.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - 1. C40-04 Organic Impurities in Fine Aggregates for Concrete
 - 2. C91-05 Masonry Cement
 - 3. C150-09 Portland Cement
 - 4. C207-08a Hydrated Lime for Masonry Purposes
 - 5. C404-07 Aggregate for Masonry Grout
 - 6. C476-09 Grout for Masonry

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- | | | |
|-----|----------|---|
| 7. | C595-09 | Blended Hydraulic Cement |
| 8. | C979-05 | Pigments for Integrally Colored Concrete |
| 9. | C1019-09 | Sampling and Testing Grout |
| 10. | D1751-04 | Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types) |

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT

- A. ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT

- A. ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT:

- A. ASTM C91. Type S.
B. Use white masonry cement whenever white mortar is specified.

2.5 PORTLAND CEMENT

- A. ASTM C150, Type I.
B. Use white Portland cement wherever white mortar is specified.

2.6 LIQUID ACRYLIC RESIN

- A. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.7 WATER

- A. Potable, free of substances that are detrimental to grout, masonry, and metal.

2.8 GROUT

- A. Conform to ASTM C476 except as specified.

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- B. Grout type proportioned by volume as follows:
1. Fine Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to 3 times sum of volumes of cement and lime used.
 2. Coarse Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to 3 times sum of volumes of cement and lime used.
 - d. Coarse aggregate: 1 to 2 times sum of volumes of cement and lime used.
 3. Sum of volumes of fine and coarse aggregates: Do not exceed 4 times sum of volumes of cement and lime used.

2.9 JOINT FILLER

- A. Provide 1/2 inch thick filler, full depth and conforming to ASTM D1751.

2.10 COLOR ADMIXTURE:

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Mix in a mechanically operated grout mixer.
1. Mix grout for at least five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

3.2 GROUT USE LOCATIONS

- A. Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 2 inches or less.
- B. Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 2 inches.

--- E N D ---

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Through-wall flashing.
 - a. All flashings shall have factory formed end dams.
2. Cavity wall insulation.
3. Accessories.
4. Maintain watertight integrity of ABW within the wall system.

1.2 RELATED WORK (Items not included in this Project Manual are available from the Construction Manager upon request)

- A. Cast-In-Place Concrete: Section 03 30 09.
- B. Mortar and grout for reinforced masonry: Section 04 05 13 and 04 05 16.
- C. Brick Masonry: Section 04 20 00 – Unit Masonry.
- D. Concrete Unit Masonry: Section 04 20 00 – Unit Masonry.
- E. Cast Stone: Section 04 72 00.
- F. Steel Lintels and Ledger Angles: Section 05 12 00.
- G. Cold-Formed Metal Framing: Section 05 40 00.
- H. Loose steel lintels: Section 05 50 00.
- I. Cementitious Sheathing: Section 06 16 13.
- J. Thermal insulation: Section 07 21 13.
- K. Air Weather Barrier (AWB): Section 07 27 30.
- L. Metal flashing and reglets: Section 07 60 00.
- M. Flashing associated with curtain wall construction:
 1. Internal flashings: 08 44 13.
 2. Below Copings: Section 07 60 00.
- N. Sealant at control joints: Section 07 92 00.
- O. Color and texture of masonry accessories: Section 09 06 00, SCHEDULE FOR FINISHES.
- P. Door Anchors: Section 08 11 13.

1.3 REFERENCES (latest edition unless otherwise noted)

A. American Concrete Institute (ACI):

318 Building Code Requirements for Structural Concrete.

530.1 See Sections 04 05 13 for masonry mortar and 04 05 16 for masonry grout.

B. American Society for Testing and Materials (ASTM):

C 578 Rigid, Cellular Polystyrene Thermal Insulation.

D 1056 Flexible Cellular Materials - Sponge or Expanded Rubber.

C. Brick Institute of America (BIA):

Technical Notes on Brick and Tile Construction.

D. National Concrete Masonry Association (NCMA):

TEK Bulletins.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Provide complete description for all accessories.

C. Shop Drawings: Show locations and placement of all accessories; indicate tolerance allowed and requirements for integration and connection with work specified elsewhere.

D. Samples: Submit for approval two samples of each type of accessory proposed for use; include manufacturer's printed data substantiating compliance with specifications. Include the following:

1. Flashing:

- a. Flashing Termination: Flashing with back dam and end dam and stainless steel drip edge.
- b. Interior corner conditions with back dam.
- c. Exterior corner conditions with back dam.

1.5 QUALITY ASSURANCE

A. Materials provided under this Section to conform to ACI 530.1

B. All masonry flashing assemblies shall be installed by masonry craft workers who have completed the International Masonry Institute, 800 IMI-0988 phone, upgrade training course for Masonry Flashing, or equal.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- 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. Provide products by Hohmann & Barnard, Heckman Building Products, or Dur-O-Wal. Specialty products as noted.

2.2 MATERIALS

- A. Zinc-Tin-Alloy-Coated Stainless Steel (TCS): Provide as specified in Section 07 60 00 – Flashing and Sheet Metal, minimum 0.012" thick.
- B. Membrane Flashing: As specified.

2.3 FLASHING

- A. Brake Metal: Zinc-Tin-Alloy-coated stainless steel, "TCS".
1. Shop fabricate in accordance with Section 07 60 00 - Flashing and Sheet Metal.
 2. Shop fabricate the following items; make watertight with soldered joints.
 - a. End Dams: Nominal 6-inch lengths.
 - b. Corners: Inside and outside; minimum 4-inch legs at shortest length.
 3. Drip Edge: 0.014" thick, Zinc-Tin-Alloy-coated stainless steel, nominal ½" formed drip with hemmed edge fabricated from 2" wide strip and adhered to membrane.
 - a. Zinc-Tin-Alloy-coated stainless steel: Provide as specified in Section 07 60 00 - Flashing and Sheet Metal.
- B. Polymer Membrane Flashing:
1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - 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) DuPont; Thru-Wall Flashing.
 - 2) Hohmann & Barnard, Inc.; Flex-Flash.
 - 3) Hyload, Inc.; Hyload Cloaked Flashing System.
 - 4) Mortar Net USA, Ltd.; Total Flash.
 - b. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch (1.0 mm) thick.
 - c. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch (0.64 mm) thick, with a 0.015-inch- (0.38-mm-) thick coating of adhesive.
 - d. Colors: As specified in Section 09 06 00, Schedule For Finishes.
 - e. Preformed Shapes ("Cloaks"): Manufactured three-dimensional flashing devices with watertight high frequency welded seams. Fabricate from standard polymer flashing membrane. Provide in standard and custom shapes as needed to negotiate changes in elevation or direction including, but not limited to corners, end dams, control joints, and obstructions.
 - 1) Edges of flashings concealed in masonry joints opposite drain side shall be turned up 3 inch or more to form dam.
 - f. Accessories:

-
- 1) Seaming Materials: Provide seaming materials, including mastics, adhesives, primers, and seam tapes, produced by flashing manufacturer for bonding flashing sheets to each other and to substrates.
 - a) Seaming material shall be chemically compatible with the other materials or substrates.
 - b) Provide materials in contact with visible silicone sealant joints shall that do not alter the color of the sealant. Asphaltic material in contact with visible sealants not permitted.
 - 2) Others: As required for a complete installation.
- C. Termination Bar: Nominal 1 inch high x 1/8 inch thick device; 8 foot lengths, or longer, with slotted attachment holes at not less than 8-inch centers.
1. Material: Type 304 stainless steel.
- D. Weep Ventilator: U.V. resistant polypropylene co-polymer device with screen designed to properly facilitate the passage of moisture from cavities and to prevent the entrance of insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint. Provide in custom or standard heights as needed so bottom of weeps set directly on flashing +0 or -1/16 inch.
1. Color: As selected by Architect from manufacture's full line of colors, and match color of mortar joints.

2.4 CAVITY WALL INSULATION

- A. Extruded Polystyrene: Rigid board, ASTM C 578, Type X, with compressive strength not less than 15 psi.
1. Profile of Edges Along Length of Board: Ship lap.
- B. Other Characteristics:
1. Conductivity (K) value not to exceed 0.21 per inch, aged.
 2. Water Absorption: Not to exceed 0.3%.
 3. Fire characteristics per ASTM E 84:
 - a. Flame spread: 75 maximum.
 - b. Smoke developed: 450 maximum.
- C. Size:
1. Thickness: 1-1/2 inch typical.
 2. Heights: 16 inches between ship lap joints.
- D. Sealant Tape for Cavity Wall Insulation: Butyl sealant tape.
1. Manufacturer: Manufactured by manufacturer of the rigid insulation or as recommended by the manufacturer of the rigid insulation.
 2. Properties:
 - a. Self-adhering tape: Butyl adhesive backed with a foil based composite facer or high-density poly- ethylene (HDPE) film facer; with paper release liner.
 - b. Self-sealing, self-healing, fully adhered flashing engineered for exceptional long term adhesion to extruded-polystyrene board insulation.
 - c. Width: 4 inches, minimum.
 - d. Thickness: 11 mils, minimum.
 - e. Water Vapor Transmission: Less than 1 perm, ASTM E96.
 - f. Application Temperature: 30 degrees Fahrenheit.
 - g. UV Resistance, days: 120.

3. Contractor's Option: Provide spray foam sealant manufactured by the rigid insulation manufacturer that has been designed to maintain the continuity of insulation at joints and penetrations.
- E. Adhesive: Urethane based adhesive recommended by rigid insulation manufacturer for adhering insulation to face of wall. Material shall be compatible with AWB and other substrates for insulation board.

2.5 ACCESSORIES

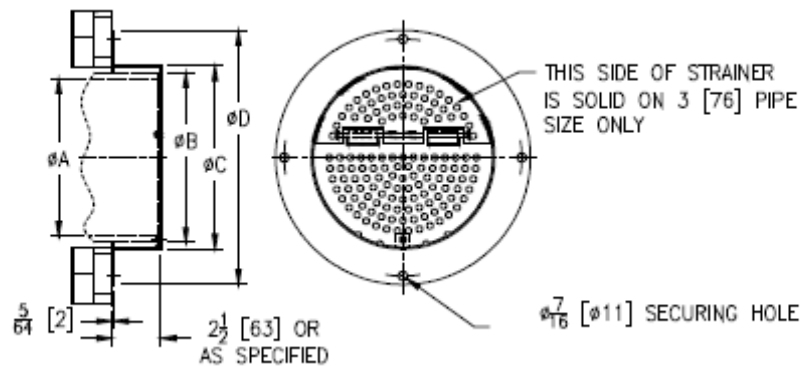
- A. Flashing Support: Rigid extruded polystyrene insulation with average compressive strength of 40 psi. Products by Dow, Amoco, or UC Industries.
- B. Weep Protection: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advanced Building Products Inc.; Mortar Break II.
 - b. Archovations, Inc.; CavClear Masonry Mat.
 - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - d. Mortar Net USA, Ltd.; Mortar Net.
 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips full depth of cavity and installed to full height of cavity.
 - d. Sheets not less than 0.40" thick by 20" high strip formed, by bending, into a U-shape and designed to expand against the three surfaces (rigid insulation, bottom of cavity, interior face of brick or cast stone) that form the "U-shape at the bottom of the cavity wall construction. Secure top edge against insulation with termination bar. Install and positioned at bottom of each masonry cavity.
- C. Compressible Filler: Premolded neoprene filler strips, ASTM D 1056, Type 2 (closed cell), Class A, Grade 1 with compressibility not less than 35 percent.
1. Thickness suitable for conditions.
 2. Width: Full width of masonry wythe less dimension required for sealant materials specified elsewhere.

D. Precast Concrete Lintels: Nominal 8 inches high x length as required; minimum 4 inches thick; minimum 4,000 psi concrete; reinforced with minimum 1 #4 bar top and bottom; conform to applicable portions of ACI 318. Provide 4 inches or more bearing at each end. Provide scoring to simulate adjacent masonry where lintels are exposed in completed work.

- E. Steel Lintels: Specified elsewhere.
- F. Reglets: Furnished under Division 7 for installation under Division 3.
- G. Downspout Cover:
1. Coordination:

SEE RFI 04293.1: IF PRECAST LINTELS ARE USED THEY MUST BE ENGINEERED.

- a. Provide factory cut round opening in exterior wall system for installation of piping by Division 22. Opening to approximately 1/2" larger than outside diameter of downspout cover inlet (Dimension "C" below).
 - b. Provide concealed blocking for support of scupper and securing supper fasteners through wall system to blocking. Pipe provided Division 22 shall be supported by Division 22.
 - c. The sealing of pipe to Air Weather Barrier and the scupper to the Composite Panels shall be provided under Section 07 27 30 - Air Weather Barrier (AWB).
2. Downspout Cover will be provided by Division 22. The information below regarding the downspout cover is for information only.
 3. Basis of Design: Model Number "Z199-DC" Downspout Cover.
 - a. Manufacturer: Zurn Plumbing Products.
 4. Exposed Material: Stainless steel.
 5. Fasteners: Stainless steel fastener with Robertson type head finish.
 6. Size: Match to pipe size provided by Division 22 for piping to the scupper.
 7. Appearance and Profile: As shown below.



PART 3 - EXECUTION

3.1 FLASHING OF MASONRY WORK

- A. Provide flashing by skilled mechanics in configurations shown and required, all as follows:
- B. Locations:
 1. Shelf and Relief Angles: Directly above steel support.
 2. At grade for all veneer.
 3. Other through wall flashing conditions where shown or required.
- C. Installation:
 1. As approved, in accordance with recommendations of BIA and NCMA.
 2. Divert water to exterior.
 3. Support flashing over cavity spans with one of the following methods and as approved by Architect:
 - a. Field cut rigid insulation properly supported, or:
 - b. Minimum 24 gage G 90 galvanized sheet; attached to wall and bearing minimum 2 inches on masonry.

4. Steel Substrate: Place tape or mastic adhesive on substrate as needed to maintain proper placement during subsequent work. Bring edge of flashing beyond face of masonry as specified under "Terminations" below.
5. Masonry Substrate: Place polymer flashing on thin bed of mortar and cover with membrane flashing as specified above for "Steel Substrate".
6. Extend flashings the full length of lintels and minimum of 4 inches into masonry each end.
7. Penetrations: Seal penetrations in flashing with mastic before covering with mortar.
8. Joints:
 - a. Install flashing in longest lengths and with fewest joints possible but not less than 10 feet between joints in polymer flashing.
 - b. Lap ends 4 inches minimum and seal as follows:
 - 1) Between flashing layers, install continuous strip of seam tape or other seaming material recommended by manufacturer. Place fully into corners to assure seal. Apply firm pressure by hand and steel roller to joint to assure bond; provide special attention to corners to assure watertight seal.
 - 2) Apply mastic to top exposed lap joint.
9. Continue flashing around corners, obstructions, and other gaps in shelf angles to prevent discontinuities.
10. Coordinate installation with AWB specified in Section 07 27 30 - Air Weather Barrier (AWB).

D. Terminations:

1. Bottom Edge: Set bend for metal drip edge (this is not the hemmed edge) flush with face of masonry. Flexible membrane shall be lapped over and adhered to stainless steel, and not be visible in finished work. Rake mortar joint below metal flashing/drip edge. Silicone sealant shall be installed in this raked mortar joint per Section 07 91 00 - Joint Sealants.
2. Top Edge Concealed Terminations: Terminate concealed ends of through-wall flashing 8 inches minimum above drainage plane as follows:
 - a. Masonry Back-up: Terminate 1 inch minimum into bed joint of back-up.
 - b. Stud Back-up: Seal to face of sheathing in continuous bed of flashing mastic or seam tape. Secure to wall with termination bar screwed to each stud. Where building paper (membrane dampproofing) is installed before flashing, trim paper horizontally 4 inches below termination point, raise paper edge to install termination, and replace raised paper to cover termination.
 - c. Concrete back-up: Terminate into reglet.
 - d. Structural Steel Back-up: Seal to face of steel in continuous bed of flashing mastic or seam tape. Secure to steel member with termination bar. Attach termination bar with self-drilling screws or other suitable methods approved by Architect. Cover screw heads and penetrations in termination bar with mastic.
3. Provide end dams for flashing terminations, minimum 3 inch high.

SEE RFI 4388:
CONFIRMED THAT
FLASHING IS TO
TERMINATE 1" INTO
CMU BED JOINT.

E. Movement Joints:

1. Control Joints: Provide custom preformed vee shape, minimum ½ inch high centered on joint and sealed to flashing on both sides. Building Expansion Joints: Terminate flashing with end dam on both sides of joint.
2. Building Expansion Joints: Terminate flashing with end dam on both sides of joint.

3.2 WEEPS

- A. Brick Veneer: Install weeps in head joints at 24 inches on center immediately above flashing.
1. Install vents in open head joint; rake bottom of joint clear of mortar to permit unobstructed flow of water from cavity.

- B. CMU: Install weeps in bed joints at 16-inch centers.
1. Locations:
 - a. Immediately above flashing.
 - b. On top of bond beams where masonry is continued above.
 2. Locate in non-reinforced cells. Do not place where weeps will be imbedded with grout.
 3. Use minimum specified lengths of rope; leave minimum 2 inch rope exposed. In cavity, place half of length directly on flashing; turn remaining half vertically and attach to substrate with tape at top. Cut exterior rope flush with masonry after mortar has fully hardened.
- C. Weep Protection: Above flashing course, install weep protection in accordance with manufacturer's recommendations.

3.3 CAVITY WALL INSULATION

- A. Install with tight joints in accordance with Section 04 20 00 – Unit Masonry.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of masonry unit walls.
- B. Section Includes:
1. Concrete masonry unit construction.
 - a. Standard and special units.
 2. Anchors, reinforcing and accessories where noted or where specified.
 3. Lightweight or normal weight masonry units may be provided unless noted otherwise. See Structural Drawings.
 4. Face brick.
 - a. Special shapes.
 5. Maintaining watertight integrity of AWB within the cavity wall system.
 6. Specialty metal subcontractor to install metal "Reveals".
 7. Masonry cleaning including existing brick and paint/graffiti removal at Dixie Building.
 8. Additional masonry work for interior portions of Dixie Building as needed due to demolition work.
- C. Work Specified Elsewhere, but Provided Under this Section:
1. Masonry Mortaring: Provide as specified in Section 04 05 13.
 2. Masonry Grouting: Provide as specified in Section 04 05 16.
 3. Masonry Accessories: Provide as specified in Section 04 05 23.
- D. Work Specified Elsewhere, but Installed Under this Section:
1. Metal "Reveals" supplied under Section 05 70 50, Architectural Metal Fabrications.
- E. Products Supplied But Not Installed Under This Section:
1. Dovetail anchor slots. Furnish to Section 03 30 09, Cast-In-Place Concrete.
- F. Alternate: See Section 01 23 00, Alternates for work affecting this Section.
- 1.2 RELATED WORK (Items not included in this Project Manual are available through Construction Manager upon request)
- A. Work of this Section affected by Alternates: Section 01 23 00, Alternates.
- B. Cast-In-Place Concrete: Section 03 30 09.
- C. Architectural Precast Concrete: Section 03 45 05.
- D. Mortars and grouts: Section 04 05 13.
- E. Masonry Accessories: Section 04 05 23.

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- F. Masonry Mortaring: Section 04 05 16, Masonry Grouting.
 - G. Structural details for CMU: Structural Drawings.
 - H. Self-drilling Metal structural Fasteners: Section 05 05 23 - Metal Fastening.
 - I. Steel lintels and shelf angles: Section 05 50 00, Metal Fabrications, and Structural drawings.
 - J. Cavity insulation: Section 04 05 23 - Masonry Accessories. .
 - K. Air Weather Barrier (AWB): Section 07 27 30.
 - L. Flexible Masonry Flashing: 04 05 23 - Masonry Accessories.
 - M. Metal Flashing: Section 07 60 00, Flashing and Sheet Metal.
 - N. Sealants and sealant installation: Section 07 92 00, Joint Sealants.
 - O. Color and texture of masonry units: Section 09 06 00, Schedule for Finishes.

1.3 DEFINITIONS

- A. CMU: Concrete Masonry Units.
- B. Very Low-Pressure Spray: Under 100 psi.
- C. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- D. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
- E. High-Pressure Spray: 800 to 2000 psi; 4 to 6 gpm.

1.4 DESIGN REQUIREMENTS

- A. Control Joints:
 - 1. Locations and spacing for units with proper storage practice are specified.
 - 2. Locations of control joints subject to Architect's approval. Architect reserves the right to modify locations of control joints for aesthetic considerations. Modifications to be issued prior to beginning of portions of work in which joints are required.

1.5 DESIGN REQUIREMENTS

- A. The Drawings show aesthetic design intent. Products provided must conform to design intent shown and performance levels specified. The drawings and specifications are complimentary regarding the aesthetic design intent.
- B. Design components provided by this Section to meet or exceed requirements of this Section, and applicable building Codes.
 - 1. Applicable Building Codes:
 - a. International Building Code (IBC), 2006 Edition
 - b. Life Safety Code 2006.

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- C. Water-Managed Assembly: The wall is a cavity wall construction with AWB over the back-up wall system behind the face brick. Design and provide membrane flashing to weep water on the back-up wall system to the exterior of the building; and counter flash to AWB in conformance with Section 07 27 30 to maintain a continuous water drainage path to the exterior of the building. Water-Managed Assembly shall not allow water to enter into the interior of the building or adjacent exterior wall systems. Provide membrane flashing as specified in Section 04 05 23.
- D. Provide end dams with all flashing.

1.6 PERFORMANCE REQUIREMENTS

- A. Erection: See Section 01 73 00 - Execution Requirements.
- B. Fire-Rated Construction: Provide masonry in thickness shown and of type required to furnish the required fire resistance based on equivalent thickness and aggregate type required by Code and in accordance with ASTM E 119. See SUBMITTALS.
- C. Cleaning at Dixie Building: Existing unit masonry shall not be damaged or marred in the process of cleaning. Open joints shall be temporarily caulked or otherwise protected to prevent water and cleaner intrusion into the interior of the structure from pressure spraying. Non-masonry materials and severely deteriorated unit masonry shall be protected by approved methods prior to initiation of cleaning operations. Unit masonry cleaning shall remove all organic and inorganic contaminants from the surface and pores of the substrate, returning the masonry to its natural color. Surfaces shall be evenly cleaned with no evidence of streaking or bleaching. The cleaning process shall not affect the density, porosity, or color of the unit masonry or mortar. Cleaned unit masonry shall have a neutral pH. Methods used for cleaning unit shall be the gentlest possible to achieve the desired results. Test patches shall be made to determine a satisfactory cleaning result. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall be performed in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to unit masonry. The cleaning materials, equipment, and methods shall not result in staining, erosion, marring, or other damage to the surfaces of the unit masonry or other building materials. Following an initial inspection and evaluation of the structure and surfaces, the structure shall be given a surface cleaning. The surface cleaning shall be completed prior to start of repair work, and sampling and testing of mortars. The cleaning shall provide for the complete cleaning of all exterior unit masonry surfaces of the structures, removing all traces of moss, dirt, and other contaminants. Following completion of the surface cleaning of the structure the unit masonry shall be dried prior to the start of any repair work.
- D. Paint/Graffiti Removal Cleaning at Dixie Building: Paint and other coatings shall be removed from masonry units and mortar joints prior to general cleaning. Unit masonry shall not be damaged or marred in the process of paint removal. Areas where paint is to be removed shall first be cleaned with water and detergent solution to remove surface dirt, rinsed, and allowed to dry. Chemical paint removers shall be applied in accordance with manufacturer's instructions. Surrounding painted surfaces to remain intact shall be protected from exposure to chemical paint removers to avoid damage. Paint removal shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Paint removal shall be performed in a manner which results in uniform surfaces; without streaking or damage to unit masonry. Grinding Discs as specified in RFI 06658 are acceptable to use in locations approved by the Resident Engineer and Architect.

1.7 SEQUENCING AND SCHEDULING OF EXISTING MASONRY

- A. Perform masonry restoration work in the following sequence:
 - 1. Remove plant growth.
 - 2. Remove paint.
 - 3. Clean masonry surfaces.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in mortar joints to comply with "Repointing Masonry" Article in Section 04 12 00 - MAINTENANCE OF UNIT MASONRY in WP-9A, and match mortar used in WP-9A for repoint masonry.

1.8 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Concrete masonry units, when exposed in finish work.
 - 2. Anchors, and ties, one each and joint reinforcing 48 inches long.
 - 3. Structural clay tile units.
 - 4. Glazed structural clay facing tile, clipped panels (triplicate) of four wall units with base units, showing color range, each color and texture.
- C. Shop Drawings:
 - 1. Special masonry shapes.
 - 2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
 - 3. Concrete masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
 - 4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work. Show elevations of reinforced walls.
- D. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of Contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Face brick.
 - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
 - 3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.
- E. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.

2. Shear keys.
3. Reinforcing bars.
4. Paint removal and cleaning materials.

F. Cleaning Program and Paint/Graffiti removal Program for the Dixie Building.

1.9 QUALITY ASSURANCE

A. ACI 530.1-05: Work to conform to referenced standard with the following exceptions:

1. Para. 1.6A, Testing Agency's Services and Duties: See Section 01 45 29 - Testing and Inspection Services.

B. Para. 1.6B, Inspection Agency's Services and Duties: See Section 01 45 29 - Testing and Inspection Services.

C. Brick Anchor Length: Verify anchor lengths suitable for actual conditions; anchors to engage masonry 2 inches, minimum, yet remain no closer than 5/8 inches from exposed face of wall.

D. Specialty Metal Subcontractor: Experienced and regularly engaged in installation of metal work of the type specified under Section 05 70 50, Architectural Metal Fabrications. Installed work to comply with requirements of Section 05 70 50. Specialty subcontractor may be installing tradesman of Section 05 70 50.

E. Sandblasting masonry is prohibited.

F. Use of high-pressure water blasting on masonry is prohibited.

G. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

H. Quality-Control Program for Dixie Building: 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 performance and preventing damage due to worker fatigue.

I. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for any phase of restoration 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 and worker's ability to use such materials and methods properly.

J. Paint and Graffiti Removal Program: Prepare a written paint and graffiti removal program that describes paint and graffiti removal process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.

K. Pre-installation Conference: Conduct conference at Project site:

1. Review methods and procedures related to work of Division 4, including but not limited to the following:

- a. Methods and sequence of installation, including construction scheduling.
- b. Quality control requirements.
- c. Evaluation of suitability of specified materials and sealants for anticipated weather conditions.
- d. Coordination with other trades.
- e. Field testing, inspecting and certifying procedures.

1.10 SAMPLE PANEL

- A. Before starting masonry, lay up a sample panel in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
 1. Use masonry units from random cubes of units delivered on site.
 2. Include reinforcing, ties, and anchors.
- B. Use sample panels approved by Resident Engineer for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

1.11 WARRANTY

- A. Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.12 APPLICABLE PUBLICATIONS (latest editions unless otherwise indicated)

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 1. A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 2. A951-06 Steel Wire for Masonry Joint Reinforcement.
 3. A615/A615M-09b Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 4. A675/A675M-03(2009) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
 5. C34-03 Structural Clay Load-Bearing Wall Tile
 6. C55-09 Concrete Building Brick
 7. C56-09 Structural Clay Non-Load-Bearing Tile
 8. C62-08 Building Brick (Solid Masonry Units Made From Clay or Shale)
 9. C67-09 Sampling and Testing Brick and Structural Clay Tile
 10. C90-09 Load-Bearing Concrete Masonry Units
 11. C476-09 Standard Specification for Grout for Masonry
 12. C612-09 Mineral Fiber Block and Board Thermal Insulation
 13. C744-08 Prefaced Concrete and Calcium Silicate Masonry Units.
 14. C1715 Standard Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage Systems
 15. D1056-07 Flexible Cellular Materials - Sponge or Expanded Rubber
 16. D2000-08 Rubber Products in Automotive Applications
 17. D2240-05 Rubber Property - Durometer Hardness

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- 18. D3574-08 Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
 - 19. E119 – 09C Fire Tests of Building Construction and Materials
 - 20. E1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
 - 21. F1667-05 Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
- 1. All Weather Masonry Construction Manual, 2000.
- D. American Welding Society (AWS):
- 1. D1.4-05 Structural Welding Code – Reinforcing Steel.
- E. Federal Specifications (FS):
- 1. FF-S-107C-00 Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction (BIA):
- 1. 11-1986 Guide Specifications for Brick Masonry, Part I
 - 2. 11A-1988 Guide Specifications for Brick Masonry, Part II
 - 3. 11B-1988 Guide Specifications for Brick Masonry, Part III Execution
 - 4. 11C-1998 Guide Specification for Brick Masonry Engineered Brick Masonry, Part IV
 - 5. 11D-1988 Guide Specifications for Brick Masonry Engineered Brick Masonry, Part IV continued
 - 6. Technical Notes on Brick and Tile Construction.
- G. Masonry Standards Joint Committee; Specification for Masonry Structures. (ACI 530.1-08/ASCE 6-08/TMS 608-08).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 167 or A 276; Type 304, typical unless otherwise noted. Mill finish.
- B. Zinc-Tin Alloy-Coated Stainless-Steel Sheet (TCS): As specified in Section 07 60 00 - Flashing and Sheet Metal. **RFI 06779: THE SAME MATERIAL WAS REQUIRED ON THE RESTORATION OF THE DIXIE BUILDING AND WAS PROCURED. CONSIDER USING THE SAME SUPPLIER.**
- C. Carbon Steel: ASTM A 606 for sheet and plate, ASTM A 82 for wire, ASTM A 615 for deformed bars.
- D. Hot-Dipped Galvanized Finish: Typical for all carbon steel devices except reinforcing bars and other devices specifically identified as "mill galvanized". Provide galvanized finish after fabrication.
 - 1. Two-Component Devices: ASTM A 153 for Class B-2 material.
 - 2. One Piece Devices: ASTM A 123.
- E. Self Drilling Screws: Provide as specified in Section 05 05 23 - Metal Fastening.

2.2 BRICK

A. Face Brick:

1. ASTM C216, Grade SW, Type FBS.
2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
3. Size:
 - a. Modular: 3-5/8" wide x 7-5/8" long x 2-1/4" high.

B. General: Provide factory fabricated shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
5. Offsets greater than 5/8 inches in single wythe veneer. Provide as follows at top and bottom of all offsets:
 - a. 100% solid units to assure cores not exposed to view nor collection points for water.
 - b. Special depth equal to sum of normal bed depth plus offset dimension. This will maintain depth of bond equal to non-offset brick.
 - c. Slope exposed portion of offset 1/8 inch or approximately 6 degrees from horizontal.
6. Others: As shown or required.

C. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.

2.3 CONCRETE MASONRY UNITS

A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.

1. Unit Weight: Normal weight.
2. Fire rated units for fire rated partitions.
3. Sizes: Modular.
4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
5. Use bullnose concrete masonry units at corners exposed in finished work with 1 inch minimum radius rounded vertical exterior corners (bullnose units).

RFI 06419: use
normal weight CMU
blocks

B. Concrete Brick: ASTM C55.

2.4 SHEAR KEYS

- A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
- B. Shear key dimensions: Approximately 2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange.

2.5 GROUT

- A. Grout: Provide in conformance with Section 04 05 16 - MASONRY GROUTING.

2.6 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, grade as shown.
- B. CMU Joint Reinforcement:
 - 1. Form from wire complying with ASTM A951.
 - 2. Galvanized after fabrication.
 - 3. Width of joint reinforcement 1.6 inches less than nominal width of masonry wall or partition.
 - 4. Cross wires welded to longitudinal wires.
 - 5. Joint reinforcement at least 10 feet in length.
 - 6. Joint reinforcement in rolls is not acceptable.
 - 7. Joint reinforcement that is crimped to form drip is not acceptable.
 - 8. Maximum spacing of cross wires 16 inch to longitudinal wires.
 - 9. Ladder Design:
 - a. Longitudinal wires deformed 0.148 inch diameter wire.
 - b. Cross wires 0.148 inch diameter.
 - 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 0.148 inch nominal diameter.
 - b. Longitudinal wires deformed.
- C. Cavity Wall Ties and Joint Reinforcement:
 - 1. Longitudinal wires 0.148 inch, two in each CMU wythe with ladder truss wires 0.148 inch welded to each longitudinal wire. Provide ladder design where CMU is vertically reinforced and grouted.
 - 2. Loops: 3/16 inch U-shaped wire with eyes to accept adjustable ties and welded to outer longitudinal wire.
 - 3. Ties: 3/16 inch wire, rectangular shaped pintles designed to project minimum 3 inches into brick wythe.
 - 4. Basis of Design: #270-ML by Hohmann & Barnard or equal.
- D. Stack Bond Veneer Joint Reinforcement: Galvanized after fabrication, ASTM A 951, one 0.148 inch diameter (9 gage) deformed wire. Provide in straight lengths not less than 10 feet.
- E. Dovetail Anchors:
 - 1. Triangular wire dovetail anchor 4 inch wide formed of 3/16 inch diameter steel wire with galvanized steel dovetail insert. Anchor length to extend at least 3 inches into masonry.

2. Form dovetail anchor slots from 0.0239 inch thick galvanized steel (with felt or fiber filler). See "Products Supplied But Not Installed Under This Section" under DESCRIPTION in Part 1 above.

F. Individual Ties: Form from 3/16 inch diameter galvanized steel rod.

1. Rectangular Ties: Form to a rectangular shape not less than 2 inches wide.
2. Z Ties: Form to a Z shape with legs not less than 2 inches wide.
3. Tie Length: Sufficient for ends of ties to extend within 1 inch of face of brick wall and engage CMU not less than 4 inches. Provide where there is not sufficient space for rectangular ties.
4. Ties that are crimped to form drip are not permitted.

G. Ridge Wall Anchors:

1. Form from galvanized steel not less than 1 inch wide by 3/16 inch thick by 24 inches long, plus 2 inch bends.
2. Other lengths as shown.

2.7 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

2.8 ACCESSORIES

A. Box Board:

1. Mineral Fiber Board: ASTM C612, Class 1.
2. 1 inch thickness.
3. Other spacing material having similar characteristics may be used subject to the Resident Engineer's approval.

B. Fasteners:

1. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.
 - a. Self-drilling Metal structural Fasteners: Comply with requirements Section 05 05 23 - Metal Fastening.

C. Grout Barriers:

1. Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

D. Sealant: Provide as specified in Section 07 92 00 - Joint Sealants.

2.9 PAINT AND GRAFFITI REMOVER FOR DIXIE BUILDING

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from stone masonry. Alkaline formula with organic solvents, removes multiple layers of paint and graffiti from masonry surfaces. Paint remover remains active for 24 hours.

Following paint removal, the masonry must be neutralized with product recommended by the manufacturer. Contains no methanol or methylene chloride, and can be rinsed with water.

1. Chemical paint removers shall be effective for removal of paint on limestone and mortar without altering, damaging, or discoloring the limestone and mortar surface.
2. Gel consistency to adhere to vertical surfaces.
3. Dwell Time: Remains Active and can be rinsed successfully with water after 24 hours or more.
4. Do not use on wood.
5. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. PROSOCO; Sure Klean Heavy-Duty Paint Stripper D.
 - b. ABR Products, Inc.; 800 Brush Grade.
 - c. Diedrich Technologies Inc.; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover.

2.10 MASONRY CLEANER FOR DIXIE BUILDING

A. Cleaners:

1. Detergent type cleaner selected for each type masonry used.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Protection:

1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.

B. Cold Weather Protection:

1. Masonry may be laid in freezing weather when methods of protection are utilized.
2. Comply with BIA "Hot and Cold Weather Masonry Construction", Technical Notes on Brick Construction.
3. Warm Weather Protection:
4. Comply with BIA "Hot and Cold Weather Masonry Construction", Technical Notes on Brick Construction.

3.2 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:

B. Maximum variation from plumb:

1. In 10 feet - 1/4 inch.
2. In 20 feet - 3/8 inch.

3. In 40 feet or more - 1/2 inch.

C. Maximum variation from level:

1. In any bay or up to 20 feet - 1/4 inch.
2. In 40 feet or more - 1/2 inch.

D. Maximum variation from linear building lines:

1. In any bay or up to 20 feet - 1/2 inch.
2. In 40 feet or more - 3/4 inch.

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 1/4 inch.
2. Plus 1/2 inch.

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 inch.
2. Plus 1/4 inch.

3.3 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.
3. Surfaces to be firm, dry, clean, and free of oily or waxy films or curing compounds.

B. Electrical, plumbing, and HVAC work in or behind masonry to be installed before proceeding with masonry work.

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

3.4 PREPARATION

A. Cold Weather/Hot Weather: Provide as required by ACI 530.1.

1. Protect grouted masonry for 48 hours unless Type III Portland cement is used in the grout.

B. Coordination:

1. Obtain exact sizes of openings for ducts, grilles, piping, and other work furnished by other trades and properly build around same.
2. Locate pipe and conduit in walls accurately and so as not to weaken strength of the masonry.

3.5 INSTALLATION GENERAL

- A. Installation Procedures and Sequence: See ERECTION in Section 01 73 00 - Execution Requirements.
- B. Workmanship and Methods for CMU: In accordance with applicable TEK Bulletins of NCMA and ACI 530.1 unless otherwise specified.
- C. Workmanship and Methods for Brick: Unless otherwise indicated, in accordance with applicable Technical Notes of BIA.
- D. Lay work to true lines, plumb and level, within allowable tolerances, unless otherwise indicated.
- E. Build in accessories specified elsewhere.
- F. Fill joints, except expansion joints, joints of open-end hollow masonry units, and space between masonry veneer and backing, unless grouting is required.
- G. Build in work furnished by other trades, as required, without weakening or defacing masonry.
 - 1. Machine cut masonry neatly for installation of outlet boxes and similar equipment.
- H. Lay brick units in full beds of mortar; fill all head joints. RFI 8670 for clarification of caulking requirements for Level 4 Vivariums
- I. Fill around sleeves for pipes and ducts passing through masonry walls solid with mortar.
- J. Keep finish work free from mortar smears or spatters as work progresses, and leave neat and clean.
- K. Anchor masonry as specified in Paragraph, ANCHORAGE.
- L. Joints: Make all joints of uniform thickness, approximately 3/8 inch. All vertical joints to be full by throwing excess mortar on end of brick and the brick shoved into place. Using proper tool, compress and tool joints to smooth concave shape.
 - 1. Joints at Vivarium: Use oversize tool to make a shallow concave shape as approved to reduce water-retaining surface.
 - 2. Control Joints: Rake out mortar and form continuous vertical joints in masonry construction to receive sealant at the locations listed below.
 - a. Abutments with other construction.
 - b. Straight runs spaced not over 20 feet apart.
 - c. At joints in masonry back-up.
 - d. As indicated on drawings.
- M. Offset Brick: See "Special Shapes" under MATERIALS in Part 2 above. Install special depth brick at all offsets exceeding 5/8 inch.
 - 1. Single Wythe Veneer Work:
 - a. Install at top and bottom of each offset.
 - b. Orient sloped top to drain.
 - c. At bottom of offset, orient sloped top to exterior.
 - d. At top of offset, orient sloped top to interior to drain into cavity.

N. Wall Openings:

1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. If items are not available when walls are built, prepare openings for subsequent installation.

O. Tooling Joints:

1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless indicated otherwise.
4. Tool Exposed interior joints in finish work concave unless indicated otherwise.

P. Partition Height:

1. Extend partitions to overhead construction, unless indicated otherwise.
2. Extend finish masonry partitions at least four inches above suspended ceiling and continue with concrete masonry units to overhead construction:

Q. Lintels:

1. Use steel lintels, for openings. Steel lintels shall comply with Structural General Notes. Steel that is susceptible to having condensation on the face of steel or not within a weather-tight conditioned space shall be hot dipped galvanized in compliance with Section 05 05 15 - Hot Dip Galvanizing; and hot dipped galvanized steel exposed to view shall also be painted in conformance with Section 05 05 15 - Hot Dip Galvanizing.
2. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
3. Length for minimum bearing of 7-1/2 inch at ends, unless indicated otherwise.

R. Wall, Furring, and Partition Units:

1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
 - a. See Section 01 23 00, Alternates, for work of Alternates affecting brick bond pattern.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Use no piece shorter than 4 inches long.
5. On interior partitions provide a 3/8 inch open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use not less than 4 inches nominal thick masonry for free standing furring unless shown otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

S. Use not less than 4 inches nominal thick masonry for fireproofing steel columns unless shown otherwise.

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- T. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- U. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- V. Structural Steel Encased in Masonry:
1. Where structural steel is encased in masonry and the voids between the steel and masonry are filled with mortar, provide a minimum 1 inch mortar free expansion space between the masonry and the steel by applying a box board material to the steel before the masonry is laid.
 2. Do not place spacing material where steel is bearing on masonry or masonry is bearing on steel.
- W. Chases:
1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
 2. Masonry 4 inch nominal thick may have electrical conduits 1 inch or less in diameter when covered with soaps, or other finishes.
 3. Fill recess chases after installation of conduit, with mortar and finish flush.
 4. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.
- X. Wetting and Wetting Test:
1. Test and wet brick in accordance with BIA 11B.
 2. Do not wet concrete masonry units before laying.
- Y. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- Z. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- AA. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.
- BB. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
1. 10 days for girders and beams.
 2. 7 days for slabs.
 3. 7 days for reinforced masonry soffits.

3.6 ANCHORAGE

- A. Veneer to Concrete Beams or Walls:
1. Install dovetail slots in concrete vertically at 16 inches on centers.

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2. Locate dovetail anchors at 16 inch maximum vertical intervals.
 3. Anchor new masonry facing to existing concrete with 3/16" diameter triangular wire wall ties spaced at 16 inch, maximum vertical intervals, and at 16 inches maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.
- B. Brick Facing to Backup and Cavity Wall Ties:
1. Use joint reinforcing with adjustable ties for new work. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.
 2. Stagger ties and joint reinforcing in alternate courses, and space at 16 inches maximum vertically, and 16 inches horizontally.
 3. At Openings:
 - a. Running Bond: Provide additional ties spaced not more than 3 feet apart vertically around perimeter of opening, and within 12 inches from edge of opening.
 - 1) See Section 01 23 00, Alternates, for work of Alternates affecting brick bond pattern.
 - b. Stack Bond: Provide at all openings that do not otherwise have a tie in the jamb brick. Space at 16-inch centers vertically.
 4. Anchor new masonry facing to existing masonry with adjustable veneer anchors spaced at 16 inch maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
- C. Anchorage of Abutting Masonry:
1. Anchor interior 4 inch thick masonry partitions to exterior masonry walls with wall ties. Space ties at 16 inch maximum vertical intervals. Extend ties 4 inches minimum into masonry.
 2. Anchor interior masonry bearing walls or interior masonry partitions over 4 inches thick to masonry walls with rigid wall anchors spaced at 16 inch maximum vertical intervals.
 3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 16 inch maximum vertical intervals. Secure anchors to existing wall with two 3/8 inch by 3 inch expansion bolts or two power-driven fasteners.
 4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 4 inches into joints of new masonry. Fastened to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 16 inch maximum vertical intervals.
- D. Masonry Furring:
1. Anchor masonry furring less than 4 inches nominal thick to masonry walls or to concrete with corrugated wall ties or dovetail anchors.
 2. Space not over 16 inches on centers in both directions.
- E. Anchorage to Steel Beams or Columns:
1. Use adjustable beam anchors on each flange.
 2. At columns weld the 1/4 inch steel rod to steel columns at 12 inch intervals, and place wire ties in masonry courses at 16 inches maximum vertically.

3.7 REINFORCEMENT

A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing to be used in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 16 inch maximum vertical intervals.
4. Additional joint reinforcement is required in mortar joints at both 8 inches and 16 inches above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
5. Horizontal joint reinforcement is required in every other course of stack bond CMU masonry.
6. Horizontal joint reinforcement is required in every 16 inches vertically of stack bond brick masonry.

B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
 - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#5 reinforcing steel unless shown otherwise. Do not cut reinforcement.
 - b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Stack Bond:
 - a. Locate additional joint reinforcement in vertical and horizontal joints as shown.
 - b. Anchor vertical reinforcement into the foundation or wall or bond beam below and hold in place.
 - c. Provide temporary bracing for walls over 8 ft. tall until permanent horizontal bracing is completed.
5. Grout openings:
 - a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
 - b. Locate 3 in. x 3 in. min. clean-out holes at location of vertical reinforcement.
 - c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

3.8 CMU CONTROL JOINTS

- A. General: Provide for exterior and interior masonry. Provide sash blocks with premolded shear key. Rake out mortar, if any, and form continuous vertical joints in masonry construction to receive sealant at the locations listed below. Verify locations with Architect.
- B. Provide CMU control (CJ) joints where shown on drawings.
- C. Locations: In accordance with NCMA-TEK Bulletins 10-1 and 10-2.

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1. Changes in wall height or thickness.
 2. Expansion joints in foundations, roof, and floors.
 3. Abutments with other construction.
 4. Within 1/2 normal design spacing or less of:
 - a. Corners. Provide on both legs of corners.
 - b. Intersecting bonded walls.
 5. Openings: Provide as follows:
 - a. Openings Less than 6 Feet Wide: May use reinforcement as specified elsewhere in lieu of control joint.
 - b. Opening 6 Feet Wide or More: Provide control joints on both sides of opening.
 - 1) Above Openings: Offset to ends of lintel.
 - 2) At Opening: Use vertical side of opening as part of joint.
 - 3) Below Openings (Above Floor): Align with side.
 6. As indicated on drawings except not less than specified.
- D. CMU, Straight Runs: Distance between joints shall not exceed the least of:
1. Length/ Height of wall ratio shall not exceed 1.5.
 2. 25 feet.
 3. As indicated on drawings.
- E. Keep joint free of mortar and other debris.
- F. Where joints occur in masonry walls.
1. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 2. Install filler, backer rod, and sealant on exposed faces.
- G. Use standard notched concrete masonry units (sash blocks) made in full and half- length units where shear keys are used to create a continuous vertical joint
- H. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- I. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- 3.9 BUILDING EXPANSION AND SEISMIC JOINTS
- A. Expansion Joint Covers: Specified elsewhere.
- B. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement
- C. Form expansion joints in brick as follows:
1. Build flanges of factory-fabricated, expansion-joint units into masonry.

3.10 ISOLATION SEAL

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

3.11 BRICKWORK

- A. Lay clay brick in accordance with BIA Technical Note 11 series.
- B. Laying:
 - 1. Lay brick as follows:
 - a. Base Bid: Running bond with masonry bonded corners.
 - b. Alternate: Stretcher stack bond with unbonded masonry corners.
 - 2. Maintain bond pattern throughout.
 - 3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
 - 4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
 - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
 - 6. Do not structurally bond multi wythe brick walls unless shown.
 - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
 - 8. Lay brick for sills with wash and drip.
 - 9. Build solid brickwork as required for anchorage of items.
 - 10. Extend brick a minimum of 2 brick courses above soffits.
- C. Joints:
 - 1. Exterior and interior joint widths: Lay for three equal joints in 8 inches vertically, unless shown otherwise.
 - 2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
 - 3. Brick expansion joints:
 - a. Expansion Joints: Rake out mortar and form continuous vertical joints in masonry construction to receive sealant at the locations listed below. Sealant and backer rod specified elsewhere.
 - 1) Abutments with other construction.
 - 2) Straight runs spaced not over 20 feet apart.
 - 3) At joints in masonry back-up.
 - 4) Within eight feet of exterior corner at one of the two walls forming the corner.
 - 5) Provide brick expansion (BEJ) joints where shown on drawings.
 - 6) Conform to Brick Industry Association Tech Note 18A.
- D. Weep Vents and Weep Protection: As specified in Section 04 05 23 - Masonry Accessories.
- E. Cavity Type Exterior Walls:

1. Keep air space clean of mortar accumulations and debris.
 - a. Clean cavity by use of hard rubber, wood or metal channel strips having soft material on sides contacting wythes.
 - b. Lift strips with wires before placing next courses of horizontal joint reinforcement, or individual ties, or adjustable cavity wall ties.
2. Lay the interior wythe of the masonry wall full height where waterproofing is required on cavity face. Coordinate to install waterproofing prior to laying outer wythe.
3. Insulated Cavity Type Exterior Walls: Provide insulation thickness as specified. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Install insulation over CMU and exterior within cavity. Install after AWB has been installed. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Bond rigid insulation to substrate with insulation adhesive, specified in Section 04 05 23, and following manufacturers recommendations. Press insulation firmly against substrate so air cavities are not formed. Where electrical outlets, ducts, pipes, vents or other utility items occur, place insulation on the dry side of the item away from excessive humidity. Butt joints in insulation tight and seal edge of joints with spray foam as insulation is installed or apply sealant tape over face of all joints in conformance with manufacturer's recommendations. Cavity Wall Insulation system materials are specified in Section 04 05 23. Seal all other penetrations in insulation to maintain continuity of insulation. Seal perimeter edges of insulation to substrate.

F. DAILY PROCEDURES

1. At end of each day's work:
 - a. Dry brush exposed masonry.
 - b. Remove mortar spots and droppings.
 - c. Turn back toe boards on scaffolding to reduce mortar splashes on masonry from rain.
2. When work is not in progress, keep tops of walls covered with nonstaining waterproof material; extend down not less than 24 inches on both sides of wall and secure in place. When work is resumed, clean top surface of loose mortar and other foreign matter.

G. CLEANING

1. Clean exposed brick work in accordance with recommendations of BIA Technical Notes 20 Revised or NCMA TEK Bulletin 8-2 as applicable, for non-acid cleaning or mild acid cleaning using "Bucket and Brush" method where "High Pressure Water Cleaning" is not effective or may be detrimental to Work. See "Sample Panel" under QUALITY ASSURANCE in Part 1 above.
2. Protect sash, louvers, and other corrodible parts. Acid cleaning is prohibited.

3.12 CONCRETE MASONRY UNITS

A. Kind and Users:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not use brick jambs in exposed finish work.
5. Use concrete building brick only as filler in backup material where not exposed.
6. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.

B. Laying:

1. Lay concrete masonry units with 3/8 inch joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout. RFI 06618: All voids with embedded connections are to be grouted regardless of load.
7. Provide a 3/8 inch open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 2 inches by 3 inches.
10. Do not wedge the masonry against the steel reinforcing. Minimum 1/2 inch clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.
22. Rake joints 1/4 to 3/8 inch deep for pointing with colored mortar when colored mortar is not full depth.

3.13 GROUTING

A. Preparation:

1. Clean grout space of mortar droppings before placing grout.

2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 30 feet. Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are in cells of units or between wythes as shown.

B. Placing:

1. Place grout by hand bucket, concrete hopper, or grout pump.
2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 1-1/2 inch below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 4 inches back of rake on low lift method.

C. Low Lift Method:

1. Construct masonry to a height of 5 ft maximum before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

D. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
2. Place grout in lifts not exceeding 1.5 m (5 ft).
3. Exception: Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft):
 - a. The masonry has cured for at least 4 hours.
 - b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
 - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

3.14 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.

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- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties as indicated.
 - D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Resident Engineer. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
 - E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
 - F. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations.
 - G. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations. Lap joint reinforcement not less than 6 inches at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
 - H. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
 - I. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.15 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8 inch joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
 - 1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
 - 2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
 - 3. Where horizontal reinforced beams (bond beams) are shown or indicated, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
- E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

F. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 4 inches in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 4 inch spaces or larger in both horizontal directions.
3. Grouting Technique: Use low-lift grouting techniques subject to requirements which follow.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 2 inches and clear area of 8 square inches in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.
3. Lay CMU to maximum pour height. Do not exceed 5 foot height, or if bond beam occurs below 5 foot height, stop pour 1-1/2 in below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one. Terminate grout pours 1-1/2 inches below top course of pour.
5. Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm² (10 square inches), respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.

10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Resident Engineer.
15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Mechanically consolidate each grout lift during pouring operation.
16. Place grout in lintels or beams over openings in one continuous pour.
17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.16 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 3/4 inch and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

C. Existing Masonry at Dixie Building:

1. Comply with recommendations of manufacturer of chemical cleaners for protecting building surfaces against damage from exposure to their product.
2. Remove paint/graffiti using precautions to safeguard adjacent and other materials. Test proposed cleaning method/material on small area. Obtain approval before proceeding with remaining areas.
3. Remove paint/graffiti on all exposed to view brick in completed work.
4. Clean all exposed to view brick in completed work.

3.17 WATER PENETRATION TESTING PROVIDED BY CONTRACTOR

- A. Seven days before plastering or painting, in the presence of Resident Engineer, test solid exterior masonry walls for water penetration.
- B. Direct water on masonry for a period of two hour at a time. Test in accordance with ASTM E1105, without air pressure difference. Using spray rack conforming to ASTM E1105.
- C. Test drainage of masonry wall in accordance with ASTM C1715.
- D. Should moisture appear on inside of walls tested; make additional tests at other areas as directed by Resident Engineer.
- E. Correct the areas showing moisture on inside of walls, and repeat test at repaired areas, to insure that moisture penetration has been stopped.
- F. Make water test at following locations:
 - 1. One test at each elevation.

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