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***SECTION 3***  
***SPECIFICATIONS***

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## SECTION 011100 - SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 LOCATION OF THE PROJECT

- A. The project is located on the northwest section of the Lakeland Community College Campus north of Clocktower Drive (the main entrance) and east of S.R. 306.

#### 1.2 PROJECT DESCRIPTION

- A. The project consists of the demolition of an existing parking lot, the construction of a new building, earthwork, installation of new asphalt and concrete pavement, utility connections, installation of a new turn lane, new site lighting and landscaping.
- B. The project is being bid in two contracts. Contract A – Site work and Contract B – Building. The bidder may bid either contract, both separate contracts, or the combined contract.
- C. Contract A – Site work shall include all improvements [demolition, clearing & grubbing, pavement removal, excavation, embankment, grading, utilities (incl. sanitary sewer Tap-in Fee to City of Willoughby), concrete and asphalt paving, site electrical, landscaping, irrigation, site amenities, etc.] to the site that fall outside of the building perimeter walk (north and south sides are the back of the curbs at the bus queue and shuttle loop and east and west sides are the edge of the perimeter walk as indicated on drawing Sheet No. 8 of 55) except for the communications and primary electrical feed. Items included in this contract inside the perimeter walk are embankment to 3" above proposed sub-grade elevations for the building pad and perimeter walk; sanitary sewer, storm sewer, and domestic waterlines to be installed within 5-foot of building foundation (capped and marked with wye poles); fire line and FDC line to be installed into Water Room to "first flange" and capped with plug; and site electrical and lighting conduit and wire shall be installed 1' above finished floor at panels in Gear Room. Site contractor to coordinate terminus points inside building with Contract B contractor.
- D. Contract B – Building work shall include all improvements (Transfer Center and canopy construction, perimeter walk, benches, trash receptacles, bike racks, etc.) to the site that fall inside of the outside edge of the building perimeter walk (north and south sides are the back of the curbs at the bus queue and shuttle loop and east and west sides are the edge of the perimeter walk as indicated on drawing Sheet No. 8 of 55) except for the following which shall be installed by the Site contractor: embankment to 3" above proposed sub-grade elevations for the building pad and perimeter walk; sanitary sewer, storm sewer, and domestic waterlines to be installed within 5-foot of building foundation (capped and marked with wye poles); fire line and FDC line to be installed into Water Room to "first flange" and capped with plug; and site electrical and lighting conduit and wire shall be installed 1' above finished floor at panels in Gear Room. Work included in this contract outside of the perimeter walk is the communications and primary electrical feed to and up the utility poles and canopy work which extends past the plan view footprint of Contract B

but is included in this work. Coordinate with electric vehicle charging vendor and their site installation subcontractor.

- E. The following fees have been paid by the Owner. All other applicable fees and permit fees shall be paid by the respective prime contractor.

State Building Permit – Building, Electrical, HVAC, Fire Suppression, and Fire Alarm (Note: The State Building Permit does not include Plumbing. The Building contractor shall apply for and pay all fees for the Plumbing permit from the Lake County Health District).

Waterline Fees to Aqua Ohio

Electrical Fees to First Energy

### 1.3 SPECIFICATIONS

- A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.
- B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.
- C. The "Construction and Material Specifications" of the State of Ohio Department of Transportation (ODOT), 2019 edition, current ODOT supplemental specifications, and current ODOT standard drawings shall govern work and materials which are not specified or modified herein or on the project Contract Drawings. All references to "the Department" shall be changed to "the Owner or his Representative." The project Contract Drawings and Specifications, in the event of a discrepancy, shall supersede the ODOT Specifications.
- D. The absence of an "As Per Plan" designation on some item descriptions in the proposal for which there are clear and controlling plan notes, specifications, or other requirements does not relieve the Contractor of the responsibility to read, bid and construct those particular items in accordance with the governing plan notes, specifications, or other requirements and the Contractor shall have no basis of claim based upon an "order of precedence".
- E. ODOT 104.02 D., 611.04, 611.12, and 611.13 shall not apply to this project.

### 1.4 DRAWING SCHEDULE

- A. The work to be done under this Contract is shown in the Construction Drawings Sheets 01-55.

1.5 MILESTONE DATES

Contract A – Building Pad and Fire & FDC Lines

November 19, 2019

Contract A & B - Concrete pavement and sidewalk in both contracts shall not be installed until after April 1, 2020.

END OF SECTION 011100

## SECTION 011419 – USE OF SITE

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

#### 1.2 USE OF STREETS

- A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any street and shall indemnify and save harmless the Owner from any expense whatsoever due to their operations over said streets
- B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.
- C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

#### 1.3 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

- A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

#### 1.4 SITE FACILITIES

- A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner. The contractors may not use any facilities within the existing buildings on site.

- B. The Contractor shall furnish and place dumpsters at locations convenient for use by the Contractor's personnel and Subcontractors and empty the dumpster(s) as often as needed to keep the site clean of debris and trash.

1.5 RESTORATION

- A. The contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

## SECTION 011423 - ADDITIONAL WORK, OVERTIME

### PART 1 - GENERAL

#### 1.1 NIGHT, SUNDAY AND HOLIDAY WORK

- A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

END OF SECTION 011423

## SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 MATERIALS AND EQUIPMENT

- A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.
- B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513



## SECTION 013119 - PROJECT MEETINGS

### PART 1 - GENERAL

#### 1.1 PRECONSTRUCTION MEETING

- A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.
- B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.
- C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.
- D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

#### 1.2 PROGRESS MEETINGS

- A. Monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.
- B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

## SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

### PART 1 - GENERAL

#### 1.1 PROGRESS SCHEDULE

- A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.
- B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

## SECTION 013223 – SURVEY AND LAYOUT DATA

### PART 1 - GENERAL

#### 1.1 STAKING

- A. The Contractor shall hire a surveyor licensed in the state the work is to be installed to provide all reference points not already established and staking. The Contractor shall protect and preserve the established staking and reference points as long as required for installation of the work and field verifications by any party. The Contractor's surveyor shall replace and accurately relocate all staking and reference points so lost, destroyed or moved.

#### 1.2 LAYOUT OF WORK

- A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall insure the new construction aligns with any existing work.

END OF SECTION 013223

## SECTION 013319 - FIELD TEST REPORTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes, but is not limited to, services performed by an independent testing laboratory. Laboratory services covered under this section are for testing materials used for field constructed elements of the work. Performance testing of manufactured items and shop fabricated materials shall be covered under their respective specification section.
- B. All testing performed under this item shall be for the protection and benefit of the Owner and shall not be construed by the Contractor as a comprehensive quality control program intended to protect the Contractor, his subcontractors, or his suppliers. The testing frequency and types of testing shall be at the discretion of the Owner.
- C. Inspections, tests, and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures and testing, which facilitate overall compliance with requirements of the contract documents. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities, or other authorized entities are not limited by the provisions of this Section.
- D. The Contractor is required to cooperate with the independent testing laboratories performing required inspections, test, and similar services and the Engineer or his representative.
- E. Materials and installed work may require testing or retesting at any time during progress of work. Retesting of rejected materials or installed work shall be done at Contractor's expense.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. The Contract Documents may include testing requirements furnished under other Sections. Work elements which may include other testing requirements are:
  - 1. Water distribution systems.
  - 2. Storm sewer systems.
  - 3. Sanitary sewer systems.

### 1.3 SELECTION AND PAYMENT

- A. The Owner will employ and pay for services of (an independent) (a) testing laboratory to perform specified testing separate and apart from this contract. Payment for the samples or materials submitted shall be considered incidental to the related work bid item.
- B. The testing laboratory and their personnel shall be under the direction of the Engineer's on-site representative, regardless of who employs their services.

### 1.4 REFERENCES

- A. AASHTO T-19, Standard Method of Test for Unit Weight and Voids in Aggregate.
- B. AASHTO T-37, Standard Method of Test for Sieve Analysis of mineral Filler for Road and Paving Materials.
- C. AASHTO T-230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
- D. ASTM C-29, Standard Method of Test for Unit Weight and Voids in Aggregate.
- E. ASTM C-31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- F. ASTM C-33, Standard Specification for Concrete Aggregates.
- G. ASTM C-39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C-40, Test Method for Organic Impurities in Fine Aggregates for Concrete.
- I. ASTM C-88, Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.
- J. ASTM C-94, Standard Specification for Ready-Mixed Concrete.
- K. ASTM C-117, Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
- L. ASTM C-136, Standard Method for Sieve Analysis of Fine and Course Aggregate.
- M. ASTM C-142, Test Method for Clay Lumps and Friable Particles in Aggregate.
- N. ASTM C-143, Standard Test Method for Slump of Hydraulic Cement Concrete.
- O. ASTM C-172, Standard Practice for Sampling Freshly Mixed Concrete.

- P. ASTM C-173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- Q. ASTM C-231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- R. ASTM C-535, Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- S. ASTM C-1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- T. ASTM D-698, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-kg) Rammer and 12-inc. (305-mm) Drop.
- U. ASTM D-2487, Standard Test Method for Classification of Soils for engineer purposes.
- V. ASTM D-2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
- W. ASTM D-4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- X. ASTM D-4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- Y. ODOT Supplement 1021, Method of Test for Determination of the Percent of Fractured Pieces in Gravel.
- Z. ODOT Supplement 1029, Method of Test for Determining the Percentage of Deleterious Materials in Course Aggregate.
- AA. ODOT Supplement 1036, Method of Test for Determination of Percent Air Voids in Compacted Dense Bituminous Paving Mixtures.
- AB. ODOT Supplement 1044, Mix Design Method for Bituminous Aggregate Base.
- AD. Uni-Bell PVC Pipe Association UNI-B-6-98 for Low Pressure Air Testing of Installed Sewer Pipe.
- AD. ASTM – C969 – Standard practice for infiltration and exfiltration acceptance of installed concrete sewer pipe.

## 1.5 RESPONSIBILITIES

- A. Notify the Engineer 24 hours prior to expected time for operations requiring testing services for scheduling purposes. Materials will not be permitted to be placed without the proper testing being performed in conformance with this Section.

## 1.6 LIMITS OF LABORATORY AUTHORITY

- A. The laboratory may not release, revoke, alter, or enlarge the requirements of the contract documents.
- B. The laboratory may not approve or accept any portion of the work.
- C. The laboratory may not assume any duties of the Contractor.
- D. The laboratory has no authority to stop the work.

## 1.7 SCHEDULE OF TESTS

Testing anticipated on this project shall include, but is not limited to:

- A. Earthwork
  - 1. Special backfill material sieve analysis per ASTM C-136, one test per source.
  - 2. On-site trench backfill analysis per ASTM D-2487, as directed by Engineer.
  - 3. Pipe bedding and cover sieve analysis per ASTM C-136, one test per source.
  - 4. Drainage fill sieve analysis per ASTM C-136, one test per source.
  - 5. Soil compaction per ASTM D-698.
    - a. Embankment testing shall be at least one (1) test/5,000 S.F. of each lift;
    - b. Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
    - c. Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or 5,000 S.F. of slabs subject to greater frequency due to soil conditions or Engineer's direction.
  - 6. Backfill compaction per ASTM D-4253 and D-4254, one test per 50 L.F. of each lift.
  - 7. Low Strength Mortar testing per ASTM D-4832.
- B. Concrete
  - 1. Concrete aggregate deleterious substances per ASTM C-40, ASTM C-117, and ASTM C-142, one test per source.
  - 2. Concrete aggregate abrasion per ASTM C-535, one test per source.
  - 3. Sodium sulfate soundness of coarse aggregate per ASTM C-88, one test per source.
  - 4. Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C 94.

- a. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
  - b. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
  - c. Air Content: ASTM C-173, volumetric method of lightweight concrete; ASTM C-231 pressure method for normal weight concrete; at least one for each pour of each type of air-entrained concrete, and each time a set of compression test specimens is made.
  - d. Concrete Temperature: ASTM C-1064, test hourly when air temperature is 40° F. (4° C.) and below, and when 80° F. (27° C.) and above; and each time a set of compression test specimens is made.
  - e. Compression Test Specimen: ASTM C-31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
  - f. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
    - i. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    - ii. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
  - g. Two (2) tests beams shall be made for each 250 square yards of concrete pavement and/or slabs on grade placed.
    - i. For traffic to be allowed on pavement or slab, the modulus of rupture shall be a minimum of 600 psi for Class C concrete or 400 psi for ODOT Class MS or FS.
  - h. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
5. Nondestructive Testing: Penetration resistance, sonoscope, or other nondestructive devices may be permitted but shall not be used as the sole basis for acceptance or rejection.



6. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
  - a. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
- C. Pavement
  1. Aggregate base sieve analysis per ASTM D-2940, one test per source.
  2. Sodium sulfate soundness of aggregate base per ASTM C-88, one test per source.
  3. Percent of fractured pieces for aggregate base per ODOT Supplement 1021, one test per source.
- D. Asphalt
  1. Provide testing for mixture acceptance in accordance with Ohio Department of Transportation Procedures. The person performing the testing must have a current Level 1 Bituminous Concrete approval from ODOT.
- E. Sewers
  1. Deflection Testing
    - a. All thermoplastic gravity sanitary sewer pipe shall be tested for allowable deflection.
    - b. Deflection tests shall be performed before final acceptance and no sooner than thirty (30) days after installation of final backfill
    - c. Maximum allowable pipe deflection shall be five (5) percent of the average inside diameter for the size and class of pipe specified.
    - d. Acceptance testing shall be performed with a non-adjustable "go, no-go" mandrel with a minimum of eight (8) contact points. Adjustable mandrels for acceptance testing shall be used only with permission of the Engineer.
    - e. The mandrel size shall be ninety-five (95) percent of the average inside diameter for the size and class of pipe specified.
    - f. If the "go, no-go" mandrel will not pass through a section of pipe a deflectometer or adjustable mandrel may be used to determine the extent and/or severity of the non-acceptable area. A "go, no-go" mandrel shall be re-run through the pipe section for final acceptance testing at no additional cost to the Owner.
    - g. The Contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.
    - h. All sewer runs shall be cleaned prior to testing.

- i. The acceptance test shall be performed without mechanical pulling devices.
  - j. All pipe failing the deflection test shall be exposed, repaired or replaced and retested at no additional cost to the Owner.
- 2. Leakage Testing
  - a. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
  - b. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.
  - c. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.
  - d. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.
  - e. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.
  - f. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- 3. Infiltration and Exfiltration Testing
  - a. All sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.
  - b. All sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.
  - c. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.
  - d. Each manhole run shall be tested separately.
- 4. Exfiltration Testing
  - a. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.
  - b. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.
  - c. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.

- d. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to seventy-two (72) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.
- e. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

Water Level Change in Test Manhole		Volume of Leakage	
		4 Ft. Dia. MH	5 Ft. Dia. MH
(Inches)	(Feet)	(Gals.)	(Gals.)
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.90
2	0.17	15.67	24.48

5. Infiltration Testing

- a. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
- b. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.
- c. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
- d. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

6. Allowable Leakage
  - a. The maximum allowable leakage for either infiltration or exfiltration shall be 50 gallons per inch of internal pipe diameter per mile per day.
  - b. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.
  - c. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.
7. Low Pressure Air Testing
  - a. PVC sanitary sewers 54-inch diameter and less may be air tested as specified. If the groundwater level is two (2) feet or more above the top of the pipe at the upstream end or if the air pressure required for the test is greater than 5 psig, the air test method should not be used for RCP sanitary sewers.
  - b. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses. Backfill shall be brought to final grade before testing. Testing shall be done prior to surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
  - c. Test equipment consists of valves and pressure gages to control airflow and to monitor pressure within the test section.
  - d. The sewer shall be flushed and cleaned prior to testing to clean out any debris. The pipe surface should be wet for more consistent results.
  - e. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged and securely braced to prevent air leakage, and possible blowouts.
  - f. Equipment used shall meet the following minimum requirements and be approved by the Engineer:
    - i. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
    - ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
    - iii. All air used shall pass through a single control panel.
    - iv. Three (3) individual hoses shall be used for the following connections:
      - a). From control panel to pneumatic plugs for inflation.
      - b). From control panel to sealed line for introducing the low pressure air.
      - c). From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

- g. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 9 psig. The plugs must hold against this pressure without having to be braced. No persons shall be allowed in the alignment of the pipe during plug testing.
- h. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches approximately 4 psig greater than the average groundwater back pressure, but not greater than 9 psig for PVC pipe or 5 psig for RCP.
- i. In areas where groundwater is known to exist, the Contractor must determine the average groundwater back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole. See Figure No. 1. This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.
- j. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in Reference Table 1.
- k. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.
- l. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.

- m. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.
  - n. The Contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.
  - o. Pressurizing equipment shall include a regulator or relief valve set at no higher than 9 psig for PVC pipe or 5 psig for RCP pipe to avoid over-pressurizing and damaging an otherwise acceptable line.
  - p. No one shall be allowed in the trench or manholes during testing.
  - q. Plugs shall not be removed until all pressure has been released.
  - r. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.
  - s. The air test data sheet marked Exhibit "A" at the end of this section shall be filled out for each section of piping tested in this manner.
  - t. Testing concrete pipe sewer lines by the low pressure air test method will be per ASTM C924-02 and C1103.
8. Hydrostatic Testing – Pressure Pipe, For Water Main and Force Main
- a. The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.
  - b. Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. A cure time of seven (7) days is recommended when Type I Portland Cement is used; three (3) days is recommended when Type III high-early Portland Cement is used.
  - c. Test ends should be restrained to withstand the appreciable thrusts that are developed under test pressure.
  - d. Air pressure testing of installed pressure pipe is expressly prohibited.
  - e. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
  - f. The hydrostatic testing sheet marked "Exhibit D" following this section shall be filled out for each section of piping tested in this manner.
  - g. After the pipe has been installed and partially backfilled (if applicable) subject all newly installed pipe, or any valved sections of it in such lengths of the force main as determined by the responsible agency, unless otherwise specified, to a hydrostatic pressure test equal to 1-1/2 times the line working pressure (50% over the working pressure) but not less than 1.25 times the working pressure at the highest point along the test section; but, in no case, shall such force mains be tested at

less than 150 pounds per square inch.. The duration of each test shall be at least 2 hours.

- h. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a booster pump connected to the pipe in a manner satisfactory to the Engineer. The duration of the test shall be for a minimum of sixty (60) minutes.
- i. No pipe installation will be accepted unless the leakage rate for the section of pipe being tested does not exceed a rate as shown on hydrostatic test chart, during a 24-hour test duration.
- j. The Contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

9. Manhole Vacuum Testing

- a. Temporarily plug all pipe entering the manhole. Each plug must be installed at a location beyond the manhole/pipe gasket (i.e. outside the manhole wall), and shall be braced to prevent the plug or pipe from being drawn into the Manhole.
- b. The test head shall be placed inside the rim of the cast iron frame at the top of the manhole and inflated, in accordance with the manufacturer's recommendations.
- c. A vacuum of at least 10 inches of mercury (10" Hg) shall be drawn on the manhole. Shut the line on the vacuum line to the manhole and shut off the pump or disconnect the vacuum line from the pump.
- d. The pressure gauge shall be liquid filled, having a 3.5" diameter face with a reading from zero to thirty inches of mercury.
- e. The manhole shall be considered to pass the vacuum test if the vacuum reading does not drop more than 1" Hg (i.e from 10" to 9" Hg) during the Table 1 minimum test time.
- f. If a manhole fails the vacuum test, the manhole shall be repaired with non-shrinkable grout or other material or method approved by the engineer. The manhole surfaces shall be properly prepared prior to any repairs. Once the repair material has cured according to the manufacturer's recommendations, the vacuum test shall be repeated. This process shall continue until a satisfactory test is obtained.
- g. All temporary plugs and braces shall be removed after each test.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 SEQUENCING AND SCHEDULING

- A. The Contractor shall coordinate the sequence of work activities so as to accommodate required testing and shall allow sufficient time for testing of materials by the laboratory so as to cause no delay in the work or the work of any other Contractor. In addition, the Contractor shall coordinate his work so as to

avoid the necessity of removing and replacing work to accommodate inspections and tests.

### 3.2 LABORATORY TEST RESULTS

- A. The testing laboratory shall submit a certified written report of each inspection, test, or similar service concurrently to the Owner, Engineer, and Contractor.
- B. Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
  - 1. Name of testing laboratory.
  - 2. Project name and construction contract reference number.
  - 3. Dates and locations of samples and tests or inspections.
  - 4. Date of report.
  - 5. Names of individuals making the inspection or test.
  - 6. Designation of the work and test method.
  - 7. Test results.
  - 8. Notation of significant ambient conditions at the time of sample taking and testing.

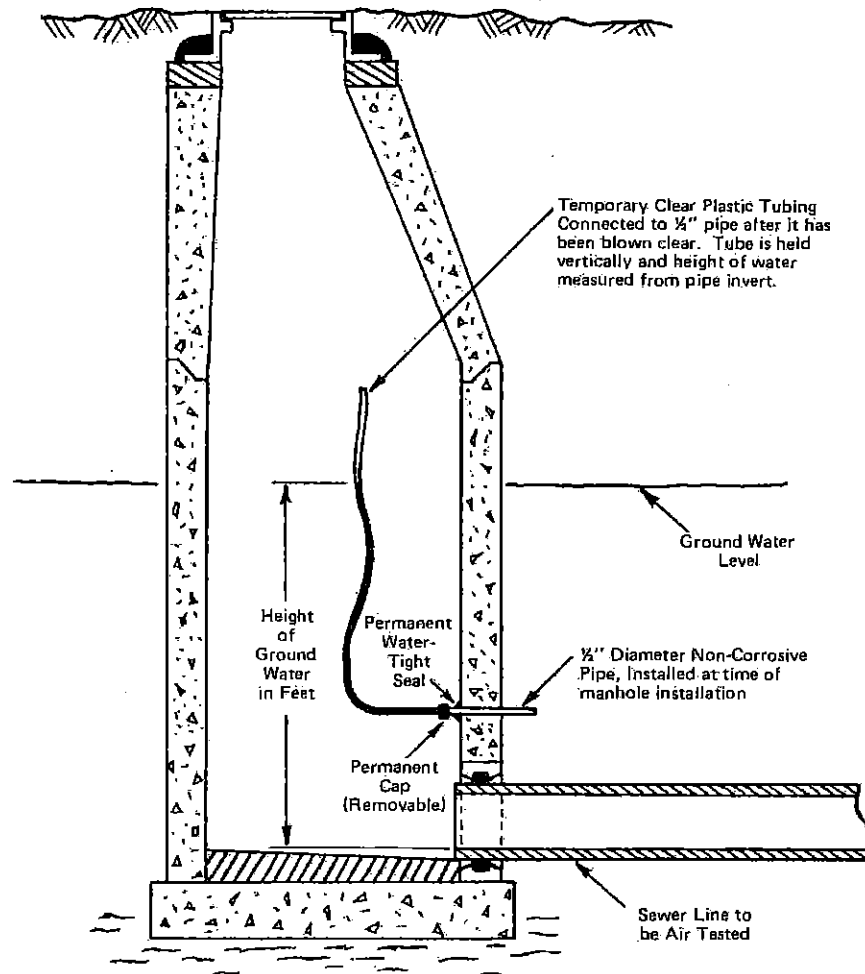
END OF SECTION 013319



UNI-B-6-98

FIGURE NO. 1

**MANHOLE CROSS-SECTIONAL VIEW  
OF THE PROPER METHOD FOR  
DETERMINING GROUND WATER HEIGHT**



AIR TEST DATA SHEET  
PIPE TESTING FORM

NOTE: Pressurize pipe to 4.5 P.S.I.F. and let stabilize for 5 minutes. Pressure should then be backed off to 4.0 P.S.I.G. and test time started.

JOB NAME:  
JOB LOCATION:  
JOB NO.

SANITARY ☐ STORM ☐

DATE:  
TEST COMPANY:  
PROJECT REP:

SPECIFIED PRESSURE DROP (     ) P.S.I.G.

BASE PRESSURE: 4.0 P.S.I.G.

PIPE

MATERIAL:  
(See Table 1 or Table II for Reference)

(Note: No test shall exceed 9.0 P.S.I.G.)

PIPE SECTION UNDER TEST					GROUND WATER DEPTH	BASE P.S.I.G. PLUS GROUND WATER ADJ. (÷ 2.31=P.S.I.G.)	TEST TIME DURATION	TEST START TIME	TEST STOP TIME	TEST TIME ELAPSED	PASS FAIL P or F
UPSTREAM MH/STATION	DN-STREAM MH/STATION	PIPE DIAMETER	PIPE LENGTH								

\*Identify any section(s) that failed:

\*Leak (was) (was not) located. Method used:

REMARKS:

**TABLE I**

Minimum specified time required for a 1.0 P.S.I.G. Pressure Drop

1 Pipe Diameter (Inches)	2 Minimum Time (Min:Sec)	3 Length for Minimum Time (Ft.)	4 Time for Longer Length (Sec)	Specification Time for Length (L) Shown (Min:Sec)							
				100 Ft.	150 Ft.	200 Ft.	250 Ft.	300 Ft.	350 Ft.	400 Ft.	450 Ft.
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	28.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

for size and length of pipe indicated for Q = 0.0015

**NOTE: If there has been no leakage, (zero P.S.I.G. drop), after one hour of testing, the test shall be accepted and the test complete. (See Section 7.5)**

**TABLE II**

Minimum specified time required for a 0.5 P.S.I.G. Pressure Drop  
for size and length of pipe indicated for Q = 0.0015

1 Pipe Diameter (Inches)	2 Minimum Time (Min:Sec)	3 Length for Minimum Time (Ft.)	4 Time for Longer Length (Sec)	Specification Time for Length (L) Shown (Min:Sec)							
				100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.	100 Ft.
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618 L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

**NOTE:** If there has been no leakage, (zero P.S.I.G. drop), after one hour of testing, the test shall be accepted and the test complete. (See Section 7.5)

**CT CONSULTANTS, INC.**  
**HYDROSTATIC LEAKAGE TEST**

JOB. NO. \_\_\_\_\_ PROJECT: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_ CLIENT: \_\_\_\_\_

WATERLINE TESTED AT: \_\_\_\_\_  
of Gauge) (Street Name) (Station

FROM STATION \_\_\_\_\_ TO STATION \_\_\_\_\_ ON \_\_\_\_\_

WATERLINE SIZE \_\_\_\_\_ TYPE \_\_\_\_\_

TESTED \_\_\_\_\_, \_\_\_\_\_ AT \_\_\_\_\_ FOR \_\_\_\_\_  
TOTAL L.F. PIPE SIZE PSI DURATION

ALLOWABLE LEAKAGE \_\_\_\_\_ PER 1,000 L.F. OR \_\_\_\_\_  
L.F. GALS./HR. TOTAL GALS. TOTAL

1<sup>ST</sup> TEST \_\_\_\_\_, \_\_\_\_\_ AND \_\_\_\_\_  
PASS / FAIL PRESSURE LOST GALLONS LOST

2<sup>ND</sup> TEST \_\_\_\_\_, \_\_\_\_\_ AND \_\_\_\_\_  
PASS / FAIL PRESSURE LOST GALLONS LOST

APPROVED BY \_\_\_\_\_  
(INSPECTOR)

COMMENTS: \_\_\_\_\_  
\_\_\_\_\_

---

---

**ALLOWABLE LEAKAGE PER 1,000 FEET OF WATERMAIN:**

<u>PIPE SIZE</u> <u>INCH DIAMETER</u>	<u>ALLOWABLE LEAKAGE</u> <u>GALS. / 1,000 FEET</u>
6	1
8	1.3
10	1.6
12	1.9
16	2.5
20	3.2
24	3.8
30	4.8
36	5.7

**NOTE: IN NO CASE SHALL THE TESTED SECTION EXCEED 2,000 FEET IN LENGTH.**



**CT Consultants**  
*engineers | architects | planners*

PROJECT: \_\_\_\_\_

SHEET NO. 1 OF \_\_\_\_\_

JOB NO. \_\_\_\_\_

STREET: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

PROJECT REP: \_\_\_\_\_

**MANHOLE VACUUM TEST**

M.H. NO.	M.H. Diameter (in.)	M.H. Depth (ft.) (btm. m.h. cover to shelf)	Vacuum Required (in Hg)	Vacuum Attained (in Hg)	Vacuum Drop (in Hg)	Holding Time Required (sec.)	Pass/Fail	Date Tested	Contractor Attest	Engineer Attest	Remarks

**TABLE 1 – Minimum Test Times for Various Manhole Diameter**

Depth (ft)	Diameter, in.									
	30	33	36	42	48	54	60	66	72	
Time(s)										
8	11	12	14	17	20	23	26	29	33	
10	14	15	18	21	25	29	33	36	41	
12	17	18	21	25	30	35	39	43	49	
14	20	21	25	30	35	41	46	51	57	
16	22	24	29	34	40	46	52	58	67	
18	25	27	32	38	45	52	59	65	73	
20	28	30	35	42	50	53	65	72	81	
22	31	33	39	46	55	64	72	79	89	
24	33	36	42	51	59	64	78	87	97	
26	36	39	46	55	64	75	85	94	105	
	39	42	49	59	69	81	91	101	113	
	42	45	53	63	74	87	98	108	121	

Note: Allowable drop equals 1 in. Hg for time shown

PROJECT REP: \_\_\_\_\_

DATE: \_\_\_\_\_

## SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.
- B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

- C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.
- D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.
- E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.
- F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

- G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.
- H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.
- I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 2.8 times direct labor cost plus expenses.

## 1.2 SUBMITTAL PROCEDURE

- A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.
- B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:
  - 1. Location
  - 2. Project Name
  - 3. Contract
  - 4. Name and Address of Engineer/Architect
  - 5. Name and Address of Contractor
  - 6. Name and Address of Subcontractor
  - 7. Name and Address of Supplier
  - 8. Name of Manufacturer
  - 9. Number and Title of appropriate Specification Section
  - 10. Drawing Number and Detail References, as appropriate.
  - 11. Submittal Sequence or Log Reference Number.
    - a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".
- D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:



Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

- E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.
- F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.
- G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.
- H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

### 1.3 REVIEW PROCEDURE

- A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
- B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.
- C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

- D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
  2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
  3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
  4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.
- E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

## APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SPECIFIED ITEM:

Page	Paragraph	Description
A.		The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.
B.		Change in Contract Price (indicate + or -) \$ _____
C.		Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.
D.		Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

\_\_\_\_\_ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_

Date: \_\_\_\_\_

Attachments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

For use by ENGINEER:

\_\_\_\_\_ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

\_\_\_\_\_ Accepted as evidenced by included CHANGE ORDER.

\_\_\_\_\_ Not accepted as submitted. See Remarks.

\_\_\_\_\_ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

\_\_\_\_\_ Not accepted. Do not resubmit.

By: \_\_\_\_\_

Date: \_\_\_\_\_

Remarks: \_\_\_\_\_  
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## APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SPECIFIED ITEM:

Page	Paragraph	Description
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A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

B. Change in Contract Price (indicate + or -) \$ \_\_\_\_\_

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 013323.

D. Signature:

Firm: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_ Date: \_\_\_\_\_

Attachments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

For use by ENGINEER:

\_\_\_\_\_ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

\_\_\_\_\_ Accepted as evidenced by included CHANGE ORDER.

\_\_\_\_\_ Not accepted as submitted. See Remarks.

\_\_\_\_\_ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

\_\_\_\_\_ Not accepted. Do not resubmit.

By: \_\_\_\_\_ Date: \_\_\_\_\_

Remarks: \_\_\_\_\_  
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END OF SECTION 013323

## SECTION 013543 - ENVIRONMENTAL PROTECTION

### PART 1 - GENERAL

#### 1.1 UNNECESSARY NOISE, DUST AND ODORS

- A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

#### 1.2 SURFACE AND FLOOD FLOWS

- A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

#### 1.3 WORK IN FREEZING WEATHER

- A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

#### 1.4 POLLUTION CONTROL

- A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to the SWPPP and all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NPDES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor's schedule, sequence of work, means and methods.
- C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.

- D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543



## SECTION 014126 - GENERAL REGULATIONS AND PERMITS

### PART 1 - GENERAL

#### 1.1 PERMITS

The respective contractor shall apply for all permits and pay for all fees and permit fees from authorities having jurisdiction except for the following which have been applied for and paid by the Owner:

State Building Permit – Building, Electrical, HVAC, Fire Suppression, and Fire Alarm (Note: The State Building Permit does not include Plumbing. The Building contractor shall apply for and pay all fees for the Plumbing permit from the Lake County Health District).

Waterline Fees to Aqua Ohio

Electrical Fees to First Energy

The Site contractor is responsible for payment of the tap-in fee to the City of Willoughby for the sanitary sewer.

#### 1.2 ARCHAEOLOGICAL DISCOVERIES

Contractors and subcontractors are required under O.R.C. Section 149.53, to notify the Ohio Historical Society and the Ohio Historic Site Preservation Board of Archaeological Discoveries located in the project area, and to cooperate with those entities in archaeological and historic surveys and salvage efforts if such discoveries are uncovered within the project area.

Contact: Department Head  
Resource Protection and Review  
Ohio Historic Preservation Office  
800 E. 17th Avenue  
Columbus, Ohio 43211-2497  
614-298-2000

Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

## SECTION 014223 - INDUSTRY STANDARDS

### PART 1 - GENERAL

#### 1.1 ABBREVIATIONS

- A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

#### 1.2 REFERENCE TO OTHER SPECIFICATIONS

- A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

#### 1.3 CODES AND STANDARDS

- A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

## SECTION 014323 – QUALIFICATIONS OF TRADESMEN

### PART 1 - GENERAL

#### 1.1 CHARACTER OF WORKMEN AND EQUIPMENT

- A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.
- B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

## SECTION 015100 - TEMPORARY POWER SERVICE

### PART 1 - GENERAL

#### 1.1 ELECTRICAL POWER

- A. The Contractor shall furnish at his own expense all electrical power which may be required for the project. All temporary lines shall be furnished and installed by the Contractor at his own expense in a manner which meets the approval of the Engineer, and shall be removed by the Contractor at the completion of the construction.

END OF SECTION 015100

## SECTION 015136 - TEMPORARY WATER AND DISTRIBUTION

### PART 1 - GENERAL

#### 1.1 WATER

- A. The Contractor shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At his own expense, he shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Engineer.

END OF SECTION 015136

## SECTION 015526 - TEMPORARY TRAFFIC CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 BARRICADES, SIGNS AND LIGHTS

- A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.
- B. No manhole, trench, excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.
- C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

#### 1.2 MAINTENANCE OF TRAFFIC

- A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation.
- B. The Contractor is also responsible for maintaining access at all times to the police station and loading dock adjacent to the police station.

END OF SECTION 015526

## SECTION 016600 - PRODUCT HANDLING AND PROTECTION

### PART 1 - GENERAL

#### 1.1 DELIVERY AND STORAGE OF MATERIALS

- A. The Contractor shall be responsible for delivery and storage of all materials.
- B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.
- C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer.
- D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.
- E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.
- F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.
- G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

## SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

### PART 1 - GENERAL

- 1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.
- A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).
  - B. Contractor's Certification of Completion.
  - C. Contractor's Affidavit of Prevailing Wage.
  - D. Consent of Surety Company for Final Payment.
  - E. Affidavit of Final Acceptance Date and Correction Period.
  - F. Before the OWNER will approve and accept the work and release the retainer, the CONTRACTOR will furnish the OWNER a written report indicating the resolution of any and all property damage claims filed with the CONTRACTOR by any party during the construction period. The information to be supplied shall include, but not be limited to, name of claimant, date filed with CONTRATOR, name of insurance company and/or adjuster handling claim, how claim was resolved and if claim was not resolved for the full amount, a statement indicating the reason for such action.

END OF SECTION 017800



## SECTION 017821 - CLEANING AND PROTECTION

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.
- B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.
- C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.
- D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.
- E. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

## SECTION 017839 - PROJECT RECORDS, DRAWINGS

### PART 1 - GENERAL

#### 1.1 RECORD DRAWINGS

- A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.
- B. The Contractor shall furnish dimensioned drawings indicating locations of all underground electrical facilities.

END OF SECTION 017839

## SECTION 024119 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. This section includes removal of pavement, curbs, sidewalk, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

#### 1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. State and local code requirements shall control the disposal of debris resulting from the removal operation.

#### 1.4 PROTECTION

- A. Structures shall be removed in such a manner as not to damage portions of the existing structure which are to remain in place.

### PART 2 - PRODUCTS (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 PAVEMENTS, SIDEWALKS, CURBING, SIMILAR STRUCTURES

- A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat and free from chipped or damaged edges.
- B. For removal of reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

### 3.2 EXCAVATION OF RIGID PAVEMENT

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

### 3.3 CATCH BASINS, INLETS AND SIMILAR STRUCTURES

- A. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
- B. Abandoned sewers shall be sealed and made watertight with approved masonry bulkheads.

### 3.4 EQUIPMENT REMOVAL

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.

### 3.5 DISPOSAL OF DEBRIS

- A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be disposed of offsite.
- B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

### 3.6 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 312323.14.

END OF SECTION 024119

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site. Do not add water to concrete during delivery, at Project site, or during placement unless approved in writing by Engineer.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Engineer.
- E. Dowel Layout: Indicate proposed dowels for CMU required to construct the structure.
  - 1. Location of dowels for reinforcing CMU cores shall be dimensioned on the shop drawings.
- F. Samples for Initial Selection: Color pigments for integrally colored concrete.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Fiber reinforcement.
  - 5. Curing compounds.
  - 6. Floor and slab treatments.
  - 7. Bonding agents.
  - 8. Adhesives.
  - 9. Vapor retarders.
  - 10. Semirigid joint filler.
  - 11. Joint-filler strips.
  - 12. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Mockups: For integrally colored, polished concrete slabs to demonstrate surface finish, texture, tolerances, floor treatments, and standard of workmanship.
  1. Build panel approximately 50 sq. ft. (4.5 sq. m) in the location directed by Architect.

#### 1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

#### 1.4 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301.
  2. ACI 117.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed, with each piece bearing legible inspection trademark.
  2. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns and Supports: Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water resistant adhesive with wax impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Use Finish-Free cylindrical forms by Sonotube, or equal, for above-grade concrete.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.



- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
  - 4. All form ties shall have a factor of safety of two (2) to determine the recommended safe working load.

## 2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.4 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, gray; Type I, Type I/II, or Type II with heat of hydration limitations, as indicated in concrete mixture requirements in this Section.
  - 2. Fly Ash: ASTM C 618, Class F or C.
  - 3. Slag Cement (Ground Granulated Blast Furnace Slag): ASTM C 989/C 989M, Grade 100 or 120.
  - 4. Silica Fume: ASTM C 1240, amorphous silica.

- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4M coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal, for slabs and walls at least 12 inches thick.
  - 2. Maximum Coarse-Aggregate Size: 1 inch nominal, for columns, beams and piers, and for slabs and walls up to 12 inches thick.
  - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Do not use accelerating admixtures.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.
- A. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ChemMasters, Inc.
    - b. Davis Colors.
    - c. Dayton Superior.
    - d. Hoover Color Corporation.
    - e. Lambert Corporation.
    - f. QC Construction Products.
    - g. Rockwood Pigments NA, Inc.
    - h. Scofield, L. M. Company.
    - i. Solomon Colors, Inc.
  - 2. Color: As selected by Architect from manufacturer's full range.

## 2.5 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Euclid Chemical Company (The); an RPM company.
    - b. Nycon, Inc.
    - c. Propex Operating Company, LLC.
    - d. Sika Corporation.

## 2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

## 2.7 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. BASF Corp. - Construction Chemicals.
    - b. ChemMasters, Inc.
    - c. Dayton Superior.
    - d. Euclid Chemical Company (The); an RPM company.
    - e. Kaufman Products, Inc.
    - f. L&M Construction Chemicals, Inc.
    - g. SpecChem, LLC.
    - h. W.R. Meadows, Inc.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. BASF Corp. - Construction Chemicals.
    - b. ChemMasters, Inc.
    - c. Dayton Superior.

- d. Euclid Chemical Company (The); an RPM company.
- e. Kaufman Products, Inc.
- f. L&M Construction Chemicals, Inc.
- g. SpecChem, LLC.
- h. W.R. Meadows, Inc.

## 2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent maximum.
  - 2. Combined Fly Ash and Pozzolan: 25 percent maximum.
  - 3. Slag Cement: 50 percent maximum.
  - 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  - 5. Silica Fume: 10 percent maximum.
  - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent maximum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent maximum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
  - D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
  - E. Admixtures: Use admixtures according to manufacturer's written instructions.
    1. Use water-reducing or high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
    2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
    3. Use water-reducing or high-range water-reducing or plasticizing admixture, as required, in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

## 2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Interior Foundation Walls: Normal-weight concrete.
  1. Minimum Compressive Strength: 4000 psi at 28 days.
  2. Maximum W/C Ratio: 0.50 unless noted otherwise. 0.45 for mat slabs and pit walls.
  3. Portland Cement: Type I or II.
  4. Slump Limit: 4 inches, plus or minus 1 inch, if no high-range water-reducing admixture or plasticizing admixture is used. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
  5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- B. Perimeter and Exterior Foundation Walls and Piers: Normal-weight concrete.
  1. Minimum Compressive Strength: 4000 psi at 28 days.
  2. Maximum W/C Ratio: 0.50.
  3. Portland Cement: Type I or II.
  4. Slump Limit: 5 inches, plus or minus 1 inch, if no high-range water-reducing admixture or plasticizing admixture is used. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
  5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
  6. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Interior Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.48.
3. Portland Cement: Type I/II.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.
7. Integral Color Pigment: As recommended by manufacturer to achieve color consistent with approved mockup.

D. Pipe Encasement, Concrete Fill, Pipe Bedding, and Sloping Bottoms of Tanks/Manholes Where Indicated: Normal-weight concrete. Use only where indicated. Do not use for any structural or reinforced concrete.

1. Minimum Compressive Strength: 2000 psi at 28 days.
2. Maximum W/C Ratio: 0.74.
3. Portland Cement: Type I.
4. Minimum Cementitious Materials Content: 423 lb/cu. yd.
5. Slump Limit: 4 inches, plus or minus 2 inches.
6. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

E. Concrete Pavement, Curbing, Driveways and Sidewalks, Unless Noted Otherwise on the Drawings: Normal-weight concrete. Do not use for any structural concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Portland Cement: Type I.
4. Slump Limit: 2-1/2 inches, plus or minus 1-1/2 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class D, 1 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete, except under masonry bearing.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 72 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### 3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with the manufacturer's recommended tape.



### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs on grade.
  - 2. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 4. Space vertical joints in walls as indicated and in accordance with approved construction joint submittals. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces, unless noted otherwise.
  - 6. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces, only in elevated interior slabs and other interior concrete which will not be in contact with ground or water.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  - 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### 3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.

- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
  - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Do not spray or sprinkle water on slabs.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces indicated or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish and measure surface, so gap at any point between concrete surface and an unveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

### 3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 4000 psi at 28 days.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 12-inch centers around the full perimeter of concrete base.
  - 5. For supported equipment, install hot-dip galvanized anchor bolts that extend through concrete base and anchor into structural concrete substrate. Use post-installed hot-dip galvanized anchors with chemical adhesive where indicated.
  - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist

cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Removal: After curing period has elapsed, for areas to receive floor coverings or penetrating liquid floor treatment, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
  - 3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period. Apply to exterior structural slabs, unless otherwise indicated, storage rooms, data/telecomm rooms, electrical rooms, and janitor closets, and other locations indicated.

### 3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least two months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - 5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as

- original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
  - F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### 3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports. Contractor shall coordinate dates and times of required tests and inspections with the testing agency.
- B. Inspections:
  1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change. Perform an additional test to verify slump before adding high-range water-reducing admixture or plasticizing admixture, for each slump test required after adding high-range water-reducing admixture or plasticizing admixture.

3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and field cure at least three sets of two standard cylinder specimens for each composite sample. Additional standard cylinders may be cast and cured, at the Contractor's option.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two field-cured specimens at 3 days, one set of two specimens at 7 days, and one set of two specimens at 28 days. Additional compressive-strength tests may be added, at the Contractor's option.
  - a. Test one set of two field-cured specimens at 3 days, one set of two specimens at 7 days, and one set of two specimens at 28 days. Additional specimens may be tested when the Contractor chooses.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for all 3-, 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.



- D. Measure floor and slab flatness and levelness according to the straightedge method within 48 hours of finishing.

END OF SECTION 033000

## SECTION 042000 - UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Masonry-cell insulation.

- B. Related Sections:

1. Section 055000 "Metal Fabrications" for furnishing steel lintels for brick masonry.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
  3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Samples for Initial Selection:

1. Face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and vents.
5. Accessories embedded in masonry.

## 1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.
  - a. Include data on material properties.
  - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
  - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS, GENERAL

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

### 2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  2. Provide bullnose units for outside corners exposed to view unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Density Classification: Normal weight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.4 BRICK

- A. General: Provide 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.

- B. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Grade: SW.
2. Type: FBX.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Size (Actual Dimensions): Utility 3-5/8 inches wide by 3-5/8 inches high by 11-5/8 inches long.
6. Application: Use where brick is exposed unless otherwise indicated.
7. Color and Texture: As selected by Architect from manufacturer's full range of products. Colors intended to match Architect's sample

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Cement: ASTM C 1329.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Davis Colors; True Tone Mortar Colors.
    - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
    - c. Solomon Colors, Inc.; SGS Mortar Colors.
- E. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  - 2. Pigments shall not exceed 10 percent of portland cement by weight.
  - 3. Pigments shall not exceed 5 percent of mortar cement by weight.
- F. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Euclid Chemical Company (The); Accelguard 80.
    - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
    - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- I. Water: Potable.

## 2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
  - 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
  - 5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
  - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
  - 7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

## 2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
  - 2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
  - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.
  - 2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
  - 3. Wire: Fabricate from 3/16-inch-(4.76-mm-) diameter, hot-dip galvanized steel wire.
- D. Partition Top anchors: 0.105-inch-(2.66-mm-) thick metal plate with 3/8-inch-(9.5-mm) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.



- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- F. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
    - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
  2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-(1.90-mm-) thick steel sheet, galvanized after fabrication.
  3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch-(4.76-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
  4. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
  5. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    - a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (76 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
  6. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Hohmann & Barnard, Inc.; DW-10.
    - b. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 9 inches (229 mm) long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 5-1/2 inches (140 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie.
  7. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
  - 2) Heckmann Building Products Inc.; 315-D with 316.
  - 3) Hohmann & Barnard, Inc.; DW-10HS.
  - 4) Wire-Bond; 1004, Type III.
- b. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (152 mm) long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie.
8. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
- a. Products: Subject to compliance with requirements, provide one of the following:
- 1) Hohmann & Barnard, Inc.; DW-10-X.
- b. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (152 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (152 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

## 2.8 MISCELLANEOUS ANCHORS

### A. Postinstalled Anchors: Chemical anchors.

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group (1) A1 stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

## 2.9 EMBEDDED FLASHING MATERIALS

### A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" " and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.

2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Advanced Building Products Inc.; Peel-N-Seal.
    - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
    - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
    - 4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
    - 5) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
    - 6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
    - 7) Hohmann & Barnard, Inc.; Textroflash.
    - 8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
    - 9) Polyguard Products, Inc.; Polyguard 400.
    - 10) Sandell Manufacturing Co., Inc.; Sando-Seal.
    - 11) Williams Products, Inc.; Everlastic MF-40.
  - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.

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. Mortar Net USA, Ltd.; BlockFlash

- E. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
  2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Advanced Building Products Inc.; Mortar Maze weep vent.
      - 2) Blok-Lok Limited; Cell-Vent.
      - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      - 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
      - 5) Hohmann & Barnard, Inc.; Quadro-Vent.
      - 6) Wire-Bond; Cell Vent.

- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:
    - a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
    - b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

## 2.11 MASONRY-CELL INSULATION

- A. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Concrete Block Insulating Systems; Korfil.
    - b. Shelter Enterprises Inc.; Omni Core.
- B. Foam-in-Place Insulation: Two component system consisting of amino-plast resin and a catalyst foaming agent surfactant.
1. Basis of Design product:
    - a. Tailored Chemical Products, Inc.; Core-Fill 500.

## 2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Diedrich Technologies, Inc.
  - b. EaCo Chem, Inc.
  - c. ProSoCo, Inc.

## 2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  1. Do not use calcium chloride in mortar or grout.
  2. Use mortar cement mortar unless otherwise indicated.
  3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  1. For masonry below grade or in contact with earth, use Type S.
  2. For reinforced masonry, use Type S.
  3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  1. Pigments shall not exceed 5 percent of mortar cement by weight.
  2. Mix to match Architect's sample.
  3. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
  1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
  1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.3 TOLERANCES

#### A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

#### B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

#### C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.



### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  2. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

### 3.6 MASONRY-CELL INSULATION

- A. Install molded-polystyrene insulation units into masonry unit cells before laying units.
- B. Install foam-in-place insulation into cavities to fill void spaces per manufacturer's written instructions. Maintain inspection ports to show presence of insulation at extremities of each area. Close the ports after filling has been confirmed.

### 3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
  2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### 3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

### 3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
  2. Install preformed control-joint gaskets designed to fit standard sash block.
  3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
  4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
  1. Build flanges of factory-fabricated, expansion-joint units into masonry.
  2. Build in compressible joint fillers where indicated.
  3. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

### 3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

### 3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
  3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
  4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
  2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

### 3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

### 3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
7. Clean stone trim to comply with stone supplier's written instructions.

### 3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

## SECTION 042113 - BRICK MASONRY UNITS

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Brick masonry units.
- B. Related Sections:
  - 1. Section 07190 - Water Repellents.
  - 2. Section 07900 - Joint Sealers.

#### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. C 33 - Specification for Concrete Aggregates.
  - 2. C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
  - 3. C 126 - Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
  - 4. C 216 - Specification for Facing Brick.
  - 5. C 270 - Specification for Mortar for Unit Masonry.
  - 6. C 652 - Specification for Hollow Brick.
  - 7. C 1019 - Method of Sampling and Testing Grout.

#### 1.03 SUBMITTALS

- A. Product Data, and Evaluation Reports as required for installation.
- B. Samples: Include samples of stretcher units in sufficient quantity to illustrate color range.
- C. Test Reports from an independent testing laboratory showing compliance with applicable specifications.

#### 1.04 QUALITY ASSURANCE

- A. Masonry Prism Testing: Perform masonry prism testing in accordance with ASTM C1314 Standard Test Method for Compressive Strength of Masonry Prisms.
- B. Certification: Furnish manufacturer's certification that clay brick units provided meet or exceed the requirements of this specification.
- C. Qualifications: Furnish installer's qualifications and experience with reinforced clay brick masonry construction. Installer shall have experience of at least 5 projects with reinforced clay brick masonry.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
- B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.
- C. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.
- D. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
- E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

#### 1.06 PROJECT CONDITIONS

- A. Cold Weather Requirements:
  - 1. In accordance ACI 530.1 1.8.c
  - 2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.
- B. Hot Weather Requirements:
  - 1. In accordance with ACI 530.1 1.8.d
  - 2. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
  - 3. Wet mortar board before loading and cover mortar to retard drying when not being used.
  - 4. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
  - 5. Place masonry units within one minute of spreading mortar.
- C. Wetting of Brick: shall be required at the time of laying if the unit's initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/645mm<sup>2</sup>.

#### 1.07 SEQUENCING AND SCHEDULING

- A. Because structural brick fall in the critical path of construction, the General Contractor should contact the supplier for availability and scheduling prior to selecting a mason contractor to assure adequate time for manufacturing.



## PART 2 PRODUCTS

### 2.01 HOLLOW LOAD BEARING BRICK MASONRY UNITS

- A. Manufacturers: One of the following or equal:
  - 1. Interstate Brick Co.
  - 2. H. C. Muddox Co.
- B. Type: ASTM C 652, Grade SW, Type HBS or HBX with minimum compressive strength of 8000 psi.
- C. Surface Texture: Matte unless otherwise noted on drawings: (To be selected by Architect/Engineer from manufacturer's full range of available textures.)
- D. Colors:
  - 1. Color as selected by Architect/Engineer from standard colors.
- E. Size: 8 inches wide by 4 inches high by 16 inches long, unless otherwise indicated on the Drawings.
- F. Special Sizes and Shapes: As required for window and door soldier coursing and custom sills where indicated, corners, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of brick masonry units.
- B. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

### 3.02 BRICK MASONRY UNITS

- A. Provide Custom Level of Quality in accordance with ASTM C652 and C216.
- B. Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units.
- C. Lay units to preserve unobstructed vertical continuity of cells to be filled with grout or insulation.
- D. Protect cells intended to remain free of grout using grout stops, mortar dams, or by other means.

- E. Align vertical cells to be filled with grout to maintain clear, unobstructed continuous vertical cell measuring not less than 2 by 3 inches.
- F. Butter vertical head joints for thickness equal to face shell thickness of units, and shove joints tightly together so that mortar bonds to both masonry units.
- G. Solidly fill joints from face of units to inside face of cells.
- H. Lay units to desired height with joints of uniform thickness.
- I. Bond shall be plumb throughout.
- J. Lay units to avoid formation of cracks when units are placed. Keep cells of units as free of mortar as possible as masonry wall height increases.
- K. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the tolerances of ACI 530.1 Section 3.3 F.
- L. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
- M. Remove mortar, mortar droppings, debris, and other obstructions and materials from inside of cell walls.
- N. Seal cleanouts after inspection and before grouting or placing insulation.

### 3.03 INJECTED INSULATION

- A. Lay brick masonry units protecting cells to receive grout from filling into those not intended to be grouted.
- B. Pour insulation into cells not intended to be grouted.
- C. Ensure that no insulation gets into cells which are to be filled with grout.

### 3.04 MORTAR JOINTS

- A. Make joints straight, clean, smooth, and uniform in thickness.
- B. Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush. Point factory cut grooves or as indicated on the elevation drawings.
- C. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in ACI 530.1 Section 3.3 F.

- D. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

### 3.05 BOND PATTERN

- A. Lay brick masonry units in running bond pattern, unless otherwise indicated on the Drawings.

### 3.06 GROUTING AND REINFORCEMENT

- A. Provide splices in vertical and horizontal reinforcing as outlined in ACI 530 Section 1.14, 1.15, 1.16 and Section 2.3 and 3.3. Hold vertical reinforcing bars in position at top and bottom and at intervals not exceeding 200 bar diameters. Use steel wire bar positioners to position bars and tie reinforcing bars to dowels with wire ties.
- B. Obtain acceptance of reinforcement placement before grouting.
- C. Fill all spaces and cells containing reinforcing or intended to be grouted solidly with grout.
- D. Low-lift Grouting:
  - 1. Hollow unit masonry to be grouted by the low lift method shall be constructed and grouted in lifts not exceeding 4 feet. Double wythe masonry which will be grouted by the low-lift method shall be constructed and grouted in lifts not exceeding 8 inches. Slushing with mortar will not be permitted.
- E. High-lift Grouting:
  - 1. If grouting is accomplished by the high-lift method, double wythe masonry shall be allowed to cure at least 72 hours and hollow unit masonry shall be allowed to cure at least 24 hours before grouting.
  - 2. In double wythe construction, vertical grout barriers shall be built across the grout space to the height of the grout lift.
  - 3. Grout barriers shall not be spaced more than 30 feet apart. Grout shall be placed in lifts not to exceed 6 feet in depth.
  - 4. Each lift shall be allowed to set for 10 minutes after initial consolidation of grout before successive lift is placed.
  - 5. The full height of each section of wall shall be grouted in one day.
- F. Grout in cells shall have full contact with surface of concrete footings.
- G. When grouting stops for one hour or longer, form horizontal construction joints by stopping grout placement 1-1/2 inches below top of uppermost unit containing grout.
- H. After placement, consolidate grout using mechanical immersion vibrators designed for consolidating grout.

- I. Placement:
  - 1. Use a hand bucket, concrete hopper, or grout pump.
  - 2. Place grout in final position within 1-1/2 hours after mixing.
  - 3. Place grout so as to completely fill the grout spaces without segregation of the aggregates.
  - 4. Do not insert vibrators into lower grout placements that are in a semi-solidified state.

### 3.07 BOND BEAMS

- A. Place horizontal reinforcement and solidly grout bond beam units in place.
- B. Provide wire mesh at openings in bottom of bond beams to support grout where walls are not grouted solid.

### 3.08 CUTTING BRICK MASONRY UNITS

- A. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.
- B. Cut and fit units with power-driven carborundum or diamond disc blade saw.

### 3.09 CONTROL JOINTS / EXPANSION JOINTS

- A. Provide in masonry walls where indicated on the Drawings.
- B. Make full height and continuous in appearance.
- C. Run bond beams and bond beam reinforcing bars continuously through control joints. Stop horizontal reinforcing at expansion joints
- D. Insert control joint filler in joints as wall is constructed.
- E. Insert 50% compressible neoprene expansion joint material in expansion joints.
- F. Apply sealant as specified in Division 07 section for sealants.

### 3.10 OPENINGS AND LINTELS

- A. Place horizontal reinforcement in fully grouted bond beam units.
- B. Use lintel units where underside of lintel will be exposed.
- C. Provide minimum of 8 inch bearing at each end of lintel.
- D. Embed reinforcing bars minimum 24 inches or 40 bar diameters, whichever is longer, into wall past edges of openings or as indicated on the Drawings.

1. At corners, provide 90-degree bend with equivalent total embedment.

### 3.11 STEEL DOOR FRAMES

- A. Anchor and fully grout jambs and head of steel door frames connected to brick unit masonry.
- B. Fill frames with grout as each 2 feet of brick unit masonry is laid.

### 3.12 BEARING PLATES

- A. Provide minimum of 12 inches of grouted brick unit masonry below steel bearing plates and beams bearing on masonry walls.

### 3.13 ANCHOR BOLTS

- A. Hold anchor bolts in place with template during grouting to assure precise alignment.
- B. Do not cut or ream members being anchored or use other means to accommodate misaligned anchor bolts in roof deck support angles.
- C. Provide minimum 6-inch wide grouted brick unit masonry entirely around anchor bolts and other attachment devices.

### 3.14 ENCLOSURES

- A. Where brick masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
- B. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
- C. Do not cover enclosures until inspected and when appropriate, tested.

### 3.15 OTHER EMBEDDED ITEMS

- A. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

### 3.16 PATCHING

- A. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

### 3.17 MISCELLANEOUS

- A. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

### 3.18 WATER REPELLENT

- A. Apply water repellent as specified in Division 07 section for sealants.

### 3.19 CLEANING

- A. Exercise extreme care to prevent mortar splotches.
- B. Do not attach construction supports to masonry walls.
- C. Wash off brick scum and grout spills before scum and grout set.
- D. Remove grout stains from walls.
- E. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
- F. Correct efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer.
  - 1. Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
  - 2. Do not use muriatic acid as cleaning solution.
  - 3. Do not use sandblast cleaning equipment.

### 3.20 FORMS AND SHORES

- A. Where required, construct forms to the shapes indicated on the Drawings.
  - 1. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
  - 2. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
    - a. Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
    - b. Wait at least 64 hours before applying concentrated loads.

### 3.21 PROTECTION

- A. Provide temporary protection for exposed masonry corners subject to damage.

B. Bracing:

1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
2. Keep bracing in place until permanent supporting elements of structure are in place.

C. Limited Access Zone:

1. Establish limited access zone prior to start of masonry wall construction.
2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.
3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

### 3.22 GROUTING EQUIPMENT

A. Grout Pumps:

1. Do not pump grout through aluminum tubes.
2. Operate pumps to produce a continuous stream of grout without air pockets.
3. Upon completion of each days pumping, eject grout from pipeline without contamination or segregation of the grout.
  - a. Remove waste materials and debris from the equipment.
  - b. Dispose of waste materials, debris, and all flushing water outside the masonry.

B. Vibrators:

1. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout.
2. Maintain at least one spare vibrator, at the site at all times.
3. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine.
4. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

END OF SECTION 042113

## SECTION 042200 - CONCRETE UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Miscellaneous masonry accessories.
6. Masonry-cell fill.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete".
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

#### 1.3 DEFINITIONS

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

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls. Shop drawings without elevations of the reinforced walls will be rejected.
  3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.



- C. Samples for Verification: For each type and color of the following:
  - 1. Exposed CMUs.
  - 2. Mortar. Make Samples using same sand and mortar ingredients to be used on Project.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include data on material properties.
    - b. For masonry units, include data and calculations establishing average net-area compressive strength of units.
  - 2. Integral water repellant used in CMUs.
  - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 4. Mortar admixtures.
  - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 6. Grout mixes. Include description of type and proportions of ingredients.
  - 7. Reinforcing bars.
  - 8. Joint reinforcement.
  - 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
  - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

### 2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

### 2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide bullnose-edged units for exposed outside corners unless otherwise indicated.
- B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Lightweight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

## 2.5 MASONRY LINTELS

- A. Built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

## 2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Cement: ASTM C1329/C1329M.
  1. Manufacturers:
    - a. Cemex S.A.B. de C.V.
    - b. Essroc.
    - c. Holcim (US) Inc.
    - d. Lafarge North America Inc.
    - e. Lehigh Hanson; Heidelberg Cement Group.
- D. Aggregate for Mortar: ASTM C144.
  1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  1. Manufacturers:
    - a. BASF Corp. - Construction Chemicals.
    - b. Euclid Chemical Company (The); an RPM company.

- c. GCP Applied Technologies Inc.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
  - 1. Manufacturers:
    - a. ACM Chemistries.
    - b. BASF Corp. - Construction Chemicals.
    - c. Euclid Chemical Company (The); an RPM company.
    - d. GCP Applied Technologies Inc.
- H. Water: Potable.

## 2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
  - 1. Manufacturers:
    - a. Dur-O-Wal; a Hohmann & Barnard company.
    - b. Heckmann Building Products, Inc.
    - c. Hohmann & Barnard, Inc.
    - d. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
  - 1. Interior Walls: Mill- galvanized carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon steel.
  - 3. Wire Size for Side Rods: 0.148-inch diameter.
  - 4. Wire Size for Cross Rods: 0.148-inch diameter.
  - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
  - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

## 2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating, for all walls.
  2. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G90 zinc coating.
  3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
  4. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
  2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized steel wire.
- D. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

## 2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

## 2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  1. Do not use calcium chloride in mortar or grout.
  2. Use mortar cement mortar unless otherwise indicated.
  3. For exterior masonry, use mortar cement mortar.
  4. For reinforced masonry, use mortar cement mortar.

5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  1. For masonry below grade or in contact with earth, use Type S.
  2. For reinforced masonry, use Type S.
  3. For mortar parge coats, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C476.
  1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  2. Proportion grout in accordance with ASTM C476, Table 1 and/or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
  4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

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

### 3.3 TOLERANCES

#### A. Dimensions and Locations of Elements:

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

#### B. Lines and Levels:

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

#### C. Joints:

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



### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Fasten partition top anchors to structure above and build into top of partition.
  - 2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

### 3.6 MASONRY-JOINT REINFORCEMENT

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

### 3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

### 3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

### 3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 16 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

### 3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.
- I. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

### 3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

### 3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste Recycling: Return broken CMUs to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
  - 2. Field-installed shear connectors.

- B. Related Requirements:

- 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
  - 2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.

#### 1.3 DEFINITIONS

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

#### 1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 ACTION SUBMITTALS

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  2. Direct-tension indicators.
  3. Tension-control, high-strength, bolt-nut-washer assemblies.
  4. Shear stud connectors.
  5. Shop primers.
- F. Source quality-control reports.
- G. Field quality-control reports.

## 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.
  2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Moment Connections: Type FR, fully restrained.
- B. Construction: Combined system of moment frame and shear walls.

### 2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M, except ASTM A 572/A 572M, Grade 50 for shapes indicated as steel with  $F_y = 50$  ksi. .
- C. Plate and Bar: ASTM A 36/A 36M, except ASTM A 572/A 572M, Grade 50 for shapes indicated as steel with  $F_y = 50$  ksi. .
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
  1. Weight Class: Standard, Extra strong, or Double-extra strong, as indicated.
  2. Finish: Black except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS requirements.



## 2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls and exterior locations.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls and exterior locations.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 4. Finish: Plain, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls and exterior locations.
- D. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 4. Finish: Plain, except Hot-dip zinc coating, ASTM A 153/A 153M, Class C in perimeter walls and exterior locations.
- E. Loose Bearing and Leveling Plates.
  - 1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
  - 2. Galvanize plates.

## 2.4 PRIMER

- A. Primer: SSPC-Paint 15 Steel Joist Shop Primer/Metal Building Primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 or ASTM A 780/A 780M.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
  2. Fabricate beams with rolling camber up.
  3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Baseplate Holes: Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.

3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  4. Galvanized surfaces.
  5. Surfaces enclosed in interior construction. An unscrupulous subcontractor tried to interpret this item to mean every single structural steel member inside the building, which is completely wrong. Don't be that guy. Nobody likes that guy. This item pertains only to small individual surfaces of a structural steel member that are totally enclosed or wrapped by interior construction materials, similar to the items above for concrete-encased steel or surfaces to receive sprayed fireproofing.
- B. Surface Preparation: Clean surfaces of structural steel. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

## 2.9 SOURCE QUALITY CONTROL

- A. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.
- B. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.

### 3.5 INSTALLING LEVELING AND BEARING PLATES

- A. Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

## SECTION 053100 - STEEL DECKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.
  - 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
  - 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
  - 4. Division 09 sections on painting and coatings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.

- D. Evaluation Reports: For steel deck, from ICC-ES.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

### 2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ASC Profiles, Inc.
  - 2. Canam Steel Corporation; Canam Group, Inc.
  - 3. Cordeck.
  - 4. DACS, Inc.
  - 5. Epic Metals Corporation.
  - 6. Marlyn Steel Decks, Inc.
  - 7. New Millennium Building Systems, LLC.
  - 8. Nucor Corp.
  - 9. Roof Deck, Inc.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 for Type "B" or "WR" wide rib deck, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.



- a. Color: Manufacturer's standard.
- 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 for Type "B" or "WR" wide rib deck, G60 zinc coating unless noted otherwise.
- 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 for Type "B" or "WR" wide rib deck, G60 zinc coating unless noted otherwise, G90 zinc coating in the exterior canopy areas; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.

- 4. Deck Profile: As indicated. Type "B" or "WR" wide rib.
- 5. Profile Depth: As indicated.
- 6. Design Uncoated-Steel Thickness: As indicated, but minimum 0.0295 inch.
- 7. Span Condition: As indicated, but triple span or more where possible.
- 8. Side Laps: Overlapped or interlocking seam at Contractor's option.

## 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- J. Galvanizing Repair Paint: ASTM A 780/A 780M or SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal, for Type "B" or "WR" wide rib deck.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of four welds per deck unit at each support (36/4 pattern) for 36"-wide Type "B" or "WR" deck panels, unless noted otherwise. At exterior face deck edge support angles, weld edge and ribs of deck units with a minimum of seven welds per deck unit at each support (36/7 pattern) for 36"-wide Type "B" or "WR" deck panels.
  - 3. Weld Washers: Install weld washers at each weld location.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 24 inches for side-laps, at intervals not exceeding the lesser of one-third of the span or 12 inches for perimeter edges, and as follows, unless noted otherwise:
  - 1. Mechanically fasten side-laps with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. Fasten perimeter edges with welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and or mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

### 3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
  2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 sections on painting and coatings.
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09 sections on painting and coatings.

END OF SECTION 053100

## SECTION 054000 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Canopy framing.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
  - 1. Steel sheet.
  - 2. Expansion anchors.
  - 3. Power-actuated anchors.

4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 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. ClarkDietrich Building systems.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
  1. Design Loads: As indicated on Drawings.
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
    - b. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.

- c. Roof Rafter Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
  - d. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.
- 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
  - 1. Floor and Roof Systems: AISI S210.

## 2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G60 (Z180).

## 2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.
  - 7. Gusset plates.
  - 8. Stud kickers and knee braces.
  - 9. Joist hangers and end closures.
  - 10. Hole-reinforcing plates.
  - 11. Backer plates.

## 2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
  - 1. Uses: Securing cold-formed steel framing to structure.
  - 2. Type: Adhesive anchor.
  - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.



- E. Welding Electrodes: Comply with AWS standards.

## 2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M.
- B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

## 2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
  - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
  2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

### 3.4 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
  2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
1. Joist Spacing: 16 inches (406 mm).
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
  - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
  - 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
  - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.5 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for overhead doors.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Metal ladders.
6. Metal bollards.
7. Metal downspout boots.
8. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels for brick.
2. Shelf angles.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

- C. Related Requirements:

1. Section 051200 "Structural Steel Framing."

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for overhead doors.
  - 2. Steel tube reinforcement for low partitions.
  - 3. Steel framing and supports for mechanical and electrical equipment.
  - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 5. Metal ladders.
  - 6. Metal bollards.
  - 7. Metal downspout boots.
  - 8. Loose steel lintels.
- C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

#### 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

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

### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.079-inch nominal thickness.
- I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- J. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- K. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- L. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- M. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- N. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.



- O. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with topcoats specified in Interior and Exterior Painting Sections.

- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports where indicated.

## 2.7 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
  - 1. Space siderails 18 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
  - 3. Rungs: 3/4-inch- diameter steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
  - 6. Galvanize exterior ladders, including brackets.

## 2.8 METAL BOLLARDS

- A. Fabricate metal bollards from galvanized Schedule 40 steel pipe.

## 2.9 METAL DOWNSPOUT BOOTS

- 1. Provide downspout boots made from cast iron or aluminum in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
  - a. Vertical, to discharge into pipe.
  - b. Prime paint cast-iron downspout boots.

## 2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

## 2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.

## 2.12 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.14 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  1. Cast Aluminum: Heavy coat of bituminous paint.
  2. Extruded Aluminum: Two coats of clear lacquer.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

### 3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
  - 1. Fill bollards solidly with concrete, mounding top surface to shed water.

### 3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

## SECTION 055813AIA - COLUMN COVERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes snap-together metal column covers.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for column covers.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-(150-mm-) square Samples of metal of same thickness and material indicated for the Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For column cover finish to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing column covers similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

- C. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver column covers wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

## PART 2 - PRODUCTS

### 2.1 SNAP-TOGETHER COLUMN COVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ATAS International, Inc
  - 2. Ceilings Plus.
  - 3. Construction Services, Inc.
  - 4. Firestone Metal Products, LLC; Una-Clad.
  - 5. Frey Reglet Corporation.
  - 6. Hi-Tech Metals, Inc.
  - 7. Industrial Louvers, Inc.
  - 8. Kanalco Ltd.
  - 9. Leed Himmel Industries, Inc.
  - 10. Metal Sales & Service, Inc.; Metalwerks Division.
  - 11. MM Systems Corporation.
  - 12. Pittcon Industries.
  - 13. Protean Construction Products, Inc.
  - 14. Southwest Metalsmiths.
- B. Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that engages continuous mounting clips.
  - 1. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304 0.050 inch (1.27 mm) thick.
    - a. Finish: No. 2B.
  - 2. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide flat surfaces where indicated.
  - 3. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.



4. Form returns at vertical joints to provide 1/2-inch- (12-mm-) wide reveal at joints. Provide snap-in metal filler strips at reveals that leave reveals 1/2 inch (12 mm) deep.
5. Fabricate column covers with 1/2-inch- (12-mm-) wide reveals at horizontal joints produced by forming returns on mating ends of column cover sections. Provide snap-in metal filler strips at reveals matching reveals at vertical joints. Locate horizontal joints as indicated.
6. Fabricate base ceiling ring to match column covers.

## 2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
  1. Provide concealed fasteners for interconnecting column covers and for attaching them to other work unless otherwise indicated.
- B. Backing Materials: Provided or recommended by column cover manufacturer.

## 2.3 FABRICATION, GENERAL

- A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of column covers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Locate and place column covers plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install column covers.
  - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

### 3.3 ADJUSTING AND CLEANING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

### 3.4 PROTECTION

- A. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 055813AIA

## SECTION 072726AIA - FLUID-APPLIED MEMBRANE AIR BARRIERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Vapor-retarding, fluid-applied air barriers.
  - 2. Vapor-permeable, fluid-applied air barriers.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
  - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 3. Include details of interfaces with other materials that form part of air barrier.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
  - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

## 1.7 DELIVERY, STORAGE, AND HANDLING

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

## 1.8 FIELD CONDITIONS

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

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. Products: Subject to compliance with requirements, provide one of the following manufacturers:
  - 1. W.R. Meadows, Inc.
  - 2. Tremco, Inc.
  - 3. Carlisle Coatings & Waterproofing, Inc.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

## 2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.
  - 1. Modified Bituminous Type:
    - a. One-component, polymer-modified, cold-applied liquid air/vapor barrier membrane.
  - 2. Physical and Performance Properties:
    - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
    - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method.
    - c. Ultimate Elongation: Minimum 1500 percent; ASTM D 412, Die C.
    - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
    - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

## 2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

- B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.
- C. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  - 3. Verify that substrates are visibly dry and free of moisture.
  - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

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

- H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.
  - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
  - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness [as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.
- C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
  - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
  - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.



- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726AIA

## SECTION 074213.23AIA - METAL COMPOSITE MATERIAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes metal composite material wall panels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

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

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retail protective covering on metal composite material panels during installation.

## 1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturer's written instructions and warranty requirements.

## 1.9 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two (2)-years from date of Substantial Completion.

Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20-years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:  
Wind Loads: As indicated on Drawings.
  1. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
  1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
  1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Alcoa Architectural Products (USA) Reynobond (PE).
  - b. ALUCOBOND; 3A Composites USA, Inc.: Alucobond.
  - c. Firestone Metal Products, LLC; UNA-FAB (Series 1000).
- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, anodized aluminum sheet facings.
  1. Panel Thickness: 0.157 inch (4 mm) As indicated on Drawings.
  2. Core: Standard.
  3. Exterior Finish: Clear anodized.
- C. Attachment Assembly Components: Formed from material compatible with panel facing.

## 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

## 2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
  - 1. Exposed Anodized Finish:

- a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
  - a. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
  - b. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
  - c. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

### 3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
  - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-

resistive barriers and flashings that will be concealed by metal composite material panels are installed.

3. Install screw fasteners in predrilled holes.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Install flashing and trim as metal composite material panel work proceeds.
  6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weather-tight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
  2. Copper Panels: Use copper, stainless-steel or hardware-bronze fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
  2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.



- G. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  2. Do not apply sealants to joints unless otherwise indicated.

- H. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
1. Attach routed-and-turned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
  2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
  3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  4. Do not apply sealants to joints unless otherwise indicated.

Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- J. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof,

form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

#### 3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

#### 3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer.
- B. Maintain in a clean condition during construction.
- C. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- D. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23