

April 01, 2022

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## **PROJECT MANUAL**

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# **Mountain Home Aquatic Center**

980 McKenna Dr  
Mountain Home, Idaho 83647

### **City of Mountain Home**

P.O. Box 10  
160 South 3<sup>rd</sup> East  
Mountain Home, Idaho 83647

### **Cole Architects, PLLC**

1008 W Main Street  
Boise, Idaho 83702  
208.345.1800  
Project Number: 20-031

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

- SECTION 001116 - INVITATION TO BID
- SECTION 001153 - REQUEST FOR QUALIFICATIONS
- SECTION 002113 - INSTRUCTIONS TO BIDDERS
- SECTION 002213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS
- SECTION 002513 - PREBID MEETINGS
- SECTION 002600 - PROCUREMENT SUBSTITUTION PROCEDURES
- SECTION 003113 - PRELIMINARY SCHEDULE
- SECTION 003119 - EXISTING CONDITION INFORMATION
- SECTION 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION
- SECTION 003132 - GEOTECHNICAL DATA
- SECTION 003143 - PERMIT APPLICATION
- SECTION 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)
- SECTION 004313 - BID SECURITY FORMS
- SECTION 004323 - ALTERNATES FORM
- SECTION 004373 - PROPOSED SCHEDULE OF VALUES FORM
- SECTION 004393 - BID SUBMITTAL CHECKLIST
- SECTION 005100 - NOTICE OF AWARD
- SECTION 006000 - PROJECT FORMS

DIVISION 01 - GENERAL REQUIREMENTS

- SECTION 011000 - SUMMARY
- SECTION 012100 - ALLOWANCES
- SECTION 012300 - ALTERNATES
- SECTION 012500 - SUBSTITUTION PROCEDURES
- SECTION 012600 - CONTRACT MODIFICATION PROCEDURES
- SECTION 012900 - PAYMENT PROCEDURES
- SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION
- SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION
- SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION
- SECTION 013300 - SUBMITTAL PROCEDURES
- SECTION 014000 - QUALITY REQUIREMENTS
- SECTION 014200 - REFERENCES
- SECTION 016000 - PRODUCT REQUIREMENTS
- SECTION 017300 - EXECUTION
- SECTION 017700 - CLOSEOUT PROCEDURES
- SECTION 017823 - OPERATION AND MAINTENANCE DATA
- SECTION 017839 - PROJECT RECORD DOCUMENTS
- SECTION 017900 - DEMONSTRATION AND TRAINING

DIVISION 04 - MASONRY

Preliminary  
03/28/2023 6:52:23 PM

**Preliminary**  
03/28/2023 6:52:23 PM

SECTION 040110 - MASONRY CLEANING  
SECTION 040120.63 - BRICK MASONRY REPAIR  
SECTION 040120.64 - BRICK MASONRY REPOINTING  
SECTION 042000 - UNIT MASONRY

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

SECTION 061000 - ROUGH CARPENTRY  
SECTION 062023 - INTERIOR FINISH CARPENTRY

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 070150.19 - PREPARATION FOR REROOFING  
SECTION 071113 - BITUMINOUS DAMPPROOFING  
SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING  
SECTION 071900 - WATER REPELLENTS  
SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS  
SECTION 073113 - ASPHALT SHINGLES  
SECTION 076100 - SHEET METAL ROOFING  
SECTION 076200 - SHEET METAL FLASHING AND TRIM  
SECTION 077100 - ROOF SPECIALTIES  
SECTION 077253 - SNOW GUARDS  
SECTION 079200 - JOINT SEALANTS

DIVISION 08 - OPENINGS

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES  
SECTION 083113 - ACCESS DOORS AND FRAMES  
SECTION 088300 - MIRRORS  
SECTION 089516 - WALL VENTS

DIVISION 09 - FINISHES

SECTION 096723 - RESINOUS FLOORING  
SECTION 099113 - EXTERIOR PAINTING  
SECTION 099123 - INTERIOR PAINTING  
SECTION 099600 - HIGH-PERFORMANCE COATINGS

DIVISION 10 - SPECIALTIES

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE  
SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE  
SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS  
SECTION 102116.17 - PHENOLIC-CORE SHOWER AND DRESSING COMPARTMENTS  
SECTION 102800 - TOILET BATH AND LAUNDRY ACCESSORIES

- SECTION 104413 - FIRE PROTECTION CABINETS
- SECTION 104416 - FIRE EXTINGUISHERS
- SECTION 105113 - METAL LOCKERS

DIVISION 12 - FURNISHINGS

- SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

DIVISION 13 - SPECIAL CONSTRUCTION

Preliminary

03/28/2023 6:52:23 PM

2

- ~~SECTION 131100 - SWIMMING POOL CONTRACTOR GENERAL REQUIREMENTS~~
- ~~SECTION 131105 - SWIMMING POOL REQUIRED TESTING AND INSPECTIONS~~
- ~~SECTION 131109 - SWIMMING POOL START UP~~
- ~~SECTION 131111 - SWIMMING POOL PIPING SYSTEMS~~
- ~~SECTION 131120 - SWIMMING POOL CAST-IN-PLACE POOL CONCRETE~~
- ~~SECTION 131121 - SWIMMING POOL CAST-IN-PLACE DECK CONCRETE~~
- SECTION 131122 - SWIMMING POOL SHOTCRETE
- ~~SECTION 131125 - SWIMMING POOL CEMENTITIOUS WATERPROOFING~~
- ~~SECTION 131130 - SWIMMING POOL SEALANTS AND CAULKING~~
- SECTION 131140 - SWIMMING POOL PLASTER

DIVISION 22 - PLUMBING

- SECTION 220000 - PLUMBING GENERAL REQUIREMENTS
- SECTION 220100 - PLUMBING

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- SECTION 230000 - HVAC GENERAL REQUIREMENTS
- SECTION 230100 - HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 26 - ELECTRICAL

- SECTION 260500 - ELECTRICAL GENERAL PROVISIONS
- SECTION 260501 - FIELD TEST AND OPERATIONAL CHECK
- SECTION 260519 - CONDUCTORS AND CABLES
- SECTION 260526 - GROUNDING
- SECTION 260529 - SUPPORTING DEVICES
- SECTION 260533 - RACEWAYS AND BOXES
- SECTION 260543 - UNDER SLAB AND UNDERGROUND ELECTRICAL WORK
- SECTION 260800 - LIGHTING SYSTEMS COMMISSIONING
- SECTION 260923 - LIGHTING CONTROL DEVICES
- SECTION 262416 - PANELBOARDS
- SECTION 262726 - WIRING DEVICES
- SECTION 262813 - FUSES
- SECTION 262815 - DISCONNECT SWITCHES

SECTION 265100 - INTERIOR LIGHTING

SECTION 265600 - EXTERIOR LIGHTING

SECTION 266000 - ELECTRICAL DEMOLITION AND REPAIR

DIVISION 27 - COMMUNICATIONS

SECTION 271101 - TELECOM RACEWAY SYSTEMS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 323113 - CHAIN LINK FENCES AND GATES

**Preliminary**  
03/28/2023 6:52:23 PM

DOCUMENT 001116 - INVITATION TO BID

1.1 BID SUBMITTAL AND OPENING

- A. Bids will be thereafter [privately opened] [opened in the presence of the bidders and read aloud] [publicly opened and read aloud].

DOCUMENT 002513 - PREBID MEETINGS

END OF DOCUMENT 002513

1.2 BID SECURITY

- A. Bid security shall be submitted with each bid in the amount of [5] <Insert number> percent of the bid amount. No bids may be withdrawn for a period of [60] <Insert number> days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.3 PREBID CONFERENCE

- A. A prebid conference for all bidders will be held at <Insert location> on <Insert date> at [10:00 a.m.] <Insert time>, local time. Prospective bidders are [requested] [required] to attend.

1.4 TIME OF COMPLETION[ AND LIQUIDATED DAMAGES]

- A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.[ Work is subject to liquidated damages.]

1.5 BIDDER'S QUALIFICATIONS

- A. Bidders must be prequalified by Owner.
- B. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work.[ A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.]

END OF DOCUMENT 001116

## DOCUMENT 001153 - REQUEST FOR QUALIFICATIONS

## 1.1 PURPOSE, LAWS, AND REGULATIONS

- A. The purpose of the Prequalification Procedure described in this Document is to provide Owner with a mechanism to evaluate and determine whether Prospective Bidders are qualified to participate in the construction of Project. Evaluation will be limited to that office of the Prospective Bidder that is proposed to perform the Work.
- B. Applicable provisions of <Insert titles of laws and regulations> shall be observed in the soliciting, receiving, and evaluating of Prospective Bidders' qualifications.
- C. Applicable provisions of <Insert titles of laws and regulations> shall be observed in bidding, letting, and execution of the Work.
- D. Prospective Bidders are required to comply with these Requirements for Prequalification. Only those Prospective Bidders who have complied with the Requirements for Prequalification and have been determined to be qualified will be eligible to submit construction bids on Project.

## 1.2 PREQUALIFICATION DOCUMENTS

- A. Prequalification Documents: Consist of the Advertisement for Prequalification of Bidders; this Request for Qualifications document; AIA Document A305, "Contractor's Qualification Statement"; and additional documents issued by Owner.
- B. Obtaining Prequalification Documents: Prospective Bidders may obtain complete sets of the Prequalification Documents from the issuing office designated in the Advertisement for Prequalification of Bidders. Prospective Bidders shall use complete sets of Prequalification Documents in preparing their submittal. Owner assumes no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Prequalification Documents.
- C. Interpretation or Correction of Prequalification Documents: If the Prospective Bidder is in doubt as to the interpretation of any part of the Prequalification Documents, or finds discrepancies in or omissions from any part of the Prequalification Documents, it must submit a written Request for Interpretation thereof no later than [seven] <Insert number> days prior to acceptance of Submittals of Qualifications. Address all communications to Owner.

## 1.3 WITHDRAWAL

- A. A Qualification Statement may be withdrawn on personal request received from the Prospective Bidder.

## 1.4 PREQUALIFICATION CRITERIA

- A. Prospective Bidders must demonstrate the following to the satisfaction of Owner:
  - 1. Proper license under the laws and regulations governing their respective trade(s).
    - a. <Insert additional licensure requirements>.

2. Capacity to provide Performance Bond, Labor and Material Payment Bond, and Insurance in a form acceptable to Owner in amounts adequate to bond the Work based on the scope indicated in the Advertisement for Prequalifications.
3. Applicable experience of firm as described in the Contractor's Qualification Statement, including the following:
  - a. For purposes of this submittal, reference to "key individuals" as described in the Contractor's Qualification Statement shall be understood to mean the principal in charge, the project manager(s), and the project field superintendent(s) committed by the Prospective Bidder to carry out the Work of this Project. Prospective Bidder by submitting qualifications of key individuals agrees that Owner reserves the right to approve or reject subsequent reassignment of key individuals.
  - b. For purposes of this submittal, "successful completion" shall be understood to mean completion of project within project schedule and budget. Provide additional information indicating reasons why any referenced project did not meet project schedule or project budget.
  - c. For purposes of this Qualification, "similar project" shall be understood to include the following project elements:
    - 1) Reinforced masonry load-bearing construction.
    - 2) Long-span, steel-framed roof structure.
    - 3) Automated building systems (controls, fire detection and alarm, technology wiring infrastructure, intercommunications).
    - 4) Renovation/addition work on occupied sites.
4. Adequate financial resources, including ability to secure materials and labor necessary for completion of the Work and other work in hand, within the anticipated contract times, and reflecting the anticipated retainage from progress payments.
5. Work-in-hand capacity, such that the Prospective Bidder demonstrates adequate work under contract to continue its business operations at least at their current level, at the same time indicating the capability to carry out Owner's proposed work.
6. Adequate organization to complete work of the scope anticipated, including firm management, project management, field superintendence, and field engineering and quality control.
7. Acceptable past performance as indicated by firm's references, including ability to meet contract time and to monitor, manage, and communicate interim scheduling requirements, to carry out required quality-control activities, to properly prepare interim and final payment requests, and to successfully complete project closeout requirements.
8. Acceptable documentation of firm's ability to comply with Owner's Minority-owned business enterprise/woman-owned business enterprise (MBE/WBE) requirements. Prospective Bidders shall contact Owner to obtain copies of requirements.



9. Acceptable documentation of firm's employee screening practices as indicating by affidavit describing background check procedures for firm's employees and requirements for same incorporated in firm's subcontracts.
10. <Insert additional qualifications>.
- B. Consideration of qualifications may be withheld if the Qualification Statement shows any unexplained erasures, omissions, alterations of form, additions not called for, added restrictions or qualifying conditions, or other irregularities of any kind.
- C. Owner may make such investigations as it deems necessary to determine the ability of the Prospective Bidder to perform the Work, and the Prospective Bidder shall furnish to Owner all such information for this purpose as Owner may request. Owner reserves the right to withhold qualification if the evidence submitted by or investigation of such Prospective Bidder fails to satisfy Owner that such Prospective Bidder is properly qualified to carry out the obligations of the proposed Project. The determination of which bidders are prequalified is not protestable, except as allowed by law.
- D. Prequalification Submittal and data contained therein is considered privileged and confidential and will not be disclosed to any outside party except as required by law.

#### 1.5 ACCEPTANCE OF QUALIFICATIONS

- A. Prospective bidders will be notified of Owner's determination, within [14] <Insert number> days from the date of submission.
- B. Evaluations will be confidential. Notifications will be publicly available information.
- C. Owner may deny prequalification if it finds one or more of the following:
1. The Prospective Bidder does not have sufficient financial capacity to perform the Work.
  2. The Prospective Bidder does not have the appropriate experience to perform the Work, including, but not limited to, having met the experience criteria set forth herein.
  3. The Prospective Bidder or any officer, director, or owner thereof has had judgments entered against him within the past five years for the breach of contracts for governmental or nongovernmental construction work including, but not limited to, design-build or construction management contracts.
  4. The Prospective Bidder has been in substantial noncompliance with the terms and conditions of prior construction with Owner, or in documented substantial noncompliance with the terms and conditions of prior construction with another public body without good cause.
  5. The Prospective Bidder or any officer, director, owner, or chief financial official thereof has been convicted within the past 10 years of a crime related to governmental or nongovernmental construction or contracting.

6. The Prospective Bidder or any officer, director, or owner thereof is currently debarred pursuant to an established debarment procedure from bidding or contracting by any public body, agency of another state, or agency of the Federal Government.
  7. The Prospective Bidder failed to provide to the public body in a timely manner any information required by the public body relevant to the six preceding subparagraphs.
  8. The Prospective Bidder provides false, nonresponsive, misleading, or incomplete information for items required herein.
- D. The acceptance of a Prospective Bidder's qualifications will be a Notice of Prequalification, signed by a duly authorized representative of Owner; no other act by Owner or its agents shall constitute the acceptance of qualifications. The acceptance of a Prospective Bidder's qualifications by Owner does not constitute a contract or promise to award a contract to the Prospective Bidder.

#### 1.6 PROSPECTIVE BIDDER'S CHECKLIST

- A. In an effort to assist the Prospective Bidder in properly completing all documentation required, the following checklist is provided for the Prospective Bidder's convenience. The Prospective Bidder is solely responsible for verifying compliance with prequalification requirements.
- B. Attach this completed checklist to the outside of the Submittal envelope.
  1. Reviewed the Prequalification Documents, including the Advertisement for Prequalification and Requirements for Prequalification, prior to preparing this submittal.
  2. Prepared AIA Document A305, "Contractor's Qualification Statement," as required by the document instructions and by the Requirements for Prequalification, including all attachments and data required as part of the Qualification Statement, properly notarized.
  3. Attached: Copy of applicable Contractor's license(s).
  4. Attached: Affidavit of Employee Screening.
  5. Attached: Resumes of key individuals.
  6. Attached: Other attachments as necessary to provide information required.
  7. Envelope shows name and address of the Prospective Bidder.
  8. Envelope shows the Prospective Bidder's Contractor's License No.
  9. By submitting notarized statement, the Prospective Bidder certifies that the Bidder can provide executed Performance Bond and Labor and Material Bond meeting requirements given in the Requirements for Prequalification.
  10. By submitting notarized statement, the Prospective Bidder certifies that the Bidder can provide Certificates of Insurance in the amounts indicated in the Requirements for Prequalification.

END OF DOCUMENT 001153

DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113

## DOCUMENT 002213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

## 1.1 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

1. AIA Document A701, "Instructions to Bidders[.]"[," a copy of which is bound in this Project Manual.]
2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

## 1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

## 1.3 ARTICLE 1 - DEFINITIONS

A. <Insert definitions>.

## 1.4 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Add Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Add Section 2.1.5:

1. 2.1.5 - The Bidder is a properly licensed Contractor according to the laws and regulations of <Insert name of jurisdiction> and meets qualifications indicated in the Procurement and Contracting Documents.

C. Add Section 2.1.6:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

## 1.5 ARTICLE 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. <Insert supplementary text>.

## 1.6 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within [10] <Insert number> days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through [Architect] [Construction Manager], in such number of counterparts as Owner may require.

2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement [or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to Owner].
4. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF DOCUMENT 002213

## DOCUMENT 002513 - PREBID MEETINGS

## 1.1 PREBID MEETING

A. Owner will conduct a Prebid meeting as indicated below:

1. Meeting Date: April 1, 2022.
2. Meeting Time: 2:00 p.m., local time.
3. Location: The City of Mountain Home City Hall 160 S. 3rd E. Mountain Home, Idaho 83647

B. Attendance:

1. Prime Bidders: Attendance at Prebid meeting is recommended.

C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two business days prior to meeting.

D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:

1. Procurement and Contracting Requirements:

- a. Advertisement for Bids.
- b. Instructions to Bidders.
- c. Bidder Qualifications.
- d. Bonding.
- e. Insurance.
- f. Bid Security.
- g. Bid Form and Attachments.
- h. Bid Submittal Requirements.
- i. Bid Submittal Checklist.
- j. Notice of Award.

2. Communication during Bidding Period:

- a. Obtaining documents.
- b. Access to Project Web site.
- c. Bidder's Requests for Information.
- d. Bidder's Substitution Request/Prior Approval Request.
- e. Addenda.

3. Contracting Requirements:

- a. Agreement.
- b. The General Conditions.
- c. The Supplementary Conditions.
- d. Other Owner requirements.

4. Construction Documents:

- a. Scopes of Work.
- b. Temporary Facilities.
- c. Use of Site.
- d. Work Restrictions.
- e. Alternates, Allowances, and Unit Prices.
- f. Substitutions following award.

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03/28/2023 6:52:24 PM

5. Separate Contracts:
    - a. Work by Owner.
    - b. Work of Other Contracts.
  6. Schedule:
    - a. Project Schedule.
    - b. Contract Time.
    - c. Liquidated Damages.
    - d. Other Bidder Questions.
  7. Site/facility visit or walkthrough.
  8. Post-Meeting Addendum.
- E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees[ and others known by the issuing office to have received a complete set of Procurement and Contracting Documents]. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
1. Sign-in Sheet: Minutes will include list of meeting attendees.
  2. List of Planholders: Minutes will include list of planholders.

END OF DOCUMENT 002513

## DOCUMENT 002600 - PROCUREMENT SUBSTITUTION PROCEDURES

## 1.1 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.2 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
1. Extensive revisions to the Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
  3. The request is fully documented and properly submitted.

## 1.3 SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing[ by prime contract Bidder only] in compliance with the following requirements:
1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
  2. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.
    - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
    - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
      - 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
      - 2) Copies of current, independent third-party test data of salient product or system characteristics.
      - 3) Samples where applicable or when requested by Architect.



- 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from [ICC-ES] <Insert applicable code organization>.
  - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
- c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
  - d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.
- B. Architect's Action:
1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.
- C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 002600

DOCUMENT 003113 - PRELIMINARY SCHEDULES

1.1 PROJECT SCHEDULE

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but do not affect Contract Time requirements. This Document and its attachments are not part of the Contract Documents.
- B. Project schedule including design and construction milestones and Owner's occupancy requirements is available for viewing on Project Web site.
- C. Related Requirements:
  - 1. Document 004113 "Bid Form - Stipulated Sum (Single-Prime Contract)" for Contract Time.

END OF DOCUMENT 003113

DOCUMENT 003119 - EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

END OF DOCUMENT 003119

DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

END OF DOCUMENT 003126

## DOCUMENT 003132 - GEOTECHNICAL DATA

## 1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

END OF DOCUMENT 003132

DOCUMENT 003143 - PERMIT APPLICATION

1.1 PERMIT APPLICATION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.
- B. Permit Application: Complete building permit application and file with authorities having jurisdiction within five days of the Notice of Award.
- C. Permit Application: The building permit for Project has been applied for by Architect. A copy of the Permit Application is available for viewing on Project Web site.

END OF DOCUMENT 003143

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SECTION 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_
- B. Project Name: .
- C. Project Location: .
- D. Owner: .
- E. Owner Project Number: .
- F. Architect: .
- G. Architect Project Number: .

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by <Insert Architect's firm name> and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

- 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).
- 2. The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within [10] <Insert number> days after a written Notice of Award, if offered within [60] <Insert number> days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

- 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

- 1. Concrete Work: \_\_\_\_\_
- 2. Masonry Work: \_\_\_\_\_

- 3. Roofing Work: \_\_\_\_\_
- 4. Plumbing Work: \_\_\_\_\_
- 5. HVAC Work: \_\_\_\_\_
- 6. Electrical Work: \_\_\_\_\_

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

- 1. Addendum No. 1, dated \_\_\_\_\_.
- 2. Addendum No. 2, dated \_\_\_\_\_.
- 3. Addendum No. 3, dated \_\_\_\_\_.
- 4. Addendum No. 4, dated \_\_\_\_\_.

1.6 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

- 1. Bid Form Supplement - Alternates.
- 2. Bid Form Supplement - Unit Prices.
- 3. Bid Form Supplement - Allowances.
- 4. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.7 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in <Insert Project jurisdiction>, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.8 SUBMISSION OF BID

- A. Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, <Insert year>.
- B. Submitted By: \_\_\_\_\_ (Name of bidding firm or corporation).
- C. Authorized Signature: \_\_\_\_\_ (Handwritten signature).
- D. Signed By: \_\_\_\_\_ (Type or print name).
- E. Title: \_\_\_\_\_ (Owner/Partner/President/Vice President).
- F. Witnessed By: \_\_\_\_\_ (Handwritten signature).
- G. Attest: \_\_\_\_\_ (Handwritten signature).
- H. By: \_\_\_\_\_ (Type or print name).
- I. Title: \_\_\_\_\_ (Corporate Secretary or Assistant Secretary).
- J. Street Address: \_\_\_\_\_.
- K. City, State, Zip: \_\_\_\_\_.
- L. Phone: \_\_\_\_\_.

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M. License No.: \_\_\_\_\_  
N. Federal ID No.: \_\_\_\_\_ (Affix Corporate Seal Here).

END OF DOCUMENT 004113

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SECTION 004313 - BID SECURITY FORMS

1.1 BID FORM SUPPLEMENT

A. A completed bid bond form is required to be attached to the Bid Form.

1.2 BID BOND FORM

A. AIA Document A310-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

B. Copies of AIA standard forms may be obtained from The American Institute of Architects; <https://www.aiacontracts.org/>; email: [docspurchases@aia.org](mailto:docspurchases@aia.org); (800) 942-7732.

END OF DOCUMENT 004313

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SECTION 004323 - ALTERNATES FORM

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_
- B. Prime Contract: \_\_\_\_\_
- C. Project Name: .
- D. Project Location: .
- E. Owner: .
- F. Owner Project Number: .
- G. Architect: .
- H. Architect Project Number: .
- I. Construction Manager: .

1.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.

1.3 DESCRIPTION

- A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.
  - 1. Cost-Plus-Fee Contract: Alternate price given below includes adjustment to Contractor's Fee.
- B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."
- C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."
- D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.
- E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within [60] days of the Notice of Award unless otherwise indicated in the Contract Documents.
- F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

- A. Alternate No. : :
  - 1. ADD\_\_\_ DEDUCT\_\_\_ NO CHANGE\_\_\_ NOT APPLICABLE\_\_\_.
  - 2. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).
  - 3. ADD\_\_\_ DEDUCT\_\_\_ calendar days to adjust the Contract Time for this alternate.

1.5 SUBMISSION OF BID SUPPLEMENT

- A. Respectfully submitted this \_\_\_ day of \_\_\_\_\_, <Insert year>.
- B. Submitted By: \_\_\_\_\_(Insert name of bidding firm or corporation).

C. Authorized Signature: \_\_\_\_\_ (Handwritten signature).  
D. Signed By: \_\_\_\_\_ (Type or print name).  
E. Title: \_\_\_\_\_ (Owner/Partner/President/Vice President).

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END OF DOCUMENT 004323

## SECTION 004373 - PROPOSED SCHEDULE OF VALUES FORM

This form is used to provide a detailed cost breakdown of the bid or proposal and indicate the Bidder's proposed basis for applications for payment. It is required to be attached to the Bid Form.

## 1.1 BID FORM SUPPLEMENT

- A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

## 1.2 PROPOSED SCHEDULE OF VALUES FORM

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of [five] <Insert number> percent of the Contract Sum.
- B. Arrange schedule of values using AIA Document G703-1992.
  1. Copies of AIA standard forms may be obtained from the American Institute of Architects; [https://www.aiacontracts.org/ library](https://www.aiacontracts.org/library); (800) 942-7732.

END OF DOCUMENT 004373

## DOCUMENT 004393 - BID SUBMITTAL CHECKLIST

This Document uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Much of this Document consists of Project-specific data. Examples given in the model document text illustrate possible document content. Use the model text to develop text for specific Project requirements.

## 1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Prime Contract: \_\_\_\_\_.
- C. Project Name: .
- D. Project Location: .
- E. Owner: .
- F. Owner Project Number: .
- G. Architect: .
- H. Architect Project Number: .
- I. Construction Manager: .

## 1.2 BIDDER'S CHECKLIST

- A. In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.
- B. Attach this completed checklist to the outside of the Submittal envelope.
  - 1. Used the Bid Form provided in the Project Manual.
  - 2. Prepared the Bid Form as required by the Instructions to Bidders.
  - 3. Indicated on the Bid Form the Addenda received.
  - 4. Attached to the Bid Form: Bid Supplement Form - Allowances.
  - 5. Attached to the Bid Form: Bid Supplement Form - Unit Prices.
  - 6. Attached to the Bid Form: Bid Supplement Form - Alternates.
  - 7. Attached to the Bid Form: Proposed Schedule of Values Form.
  - 8. Attached to the Bid Form: <Insert name of Bid Form supplement>.
  - 9. Attached to the Bid Form: Bid Bond OR a certified check for the amount required.
  - 10. Bid envelope shows name and address of the Bidder.
  - 11. Bid envelope shows the Bidder's Contractor's License Number.
  - 12. Bid envelope shows name of Project being bid.
  - 13. Bid envelope shows name of Prime Contract being bid, if applicable.
  - 14. Bid envelope shows time and day of Bid Opening.
  - 15. Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
  - 16. Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

Mountain Home Aquatic

Issue for Bid

April 01, 2022

END OF DOCUMENT 004393

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## DOCUMENT 005100 - NOTICE OF AWARD

This Document uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Much of this Document consists of Project-specific data. Examples given in the model document text illustrate possible document content. Use the model text to develop text for specific Project requirements.

## 1.1 BID INFORMATION

- A. Bidder: .
- B. Bidder's Address: .
- C. Prime Contract: .
- D. Project Name: .
- E. Project Location: .
- F. Owner: .
- G. Owner Project Number: .
- H. Architect: .
- I. Architect Project Number: .

## 1.2 NOTICE OF INTENT TO AWARD CONTRACT

- A. Notice: The above Bidder is hereby notified that their bid, dated <Insert date>, for the above Contract has been considered and the Bidder is hereby awarded a contract for <Insert brief description of Work or sections of Work awarded>.
- B. Alternates Accepted: The following alternates have been accepted by Owner and have been incorporated in the Contract Sum:
  - 1. Alternate No. 1: <Insert alternate title>.
  - 2. Alternate No. 2: <Insert alternate title>.
- C. Contract Sum: The Contract Sum is <Insert written amount> dollars (\$<Insert numeric amount>).

## 1.3 EXECUTION OF CONTRACT

- A. Contract Documents: Copies of the Contract Documents will be made available to the Bidder immediately. The Bidder must comply with the following conditions precedent within [10] <Insert number> days of the above date of issuance of the Notice:
  - 1. Deliver to Owner [three] <Insert number> sets of fully executed copies of the Contract Documents.
  - 2. Deliver with the executed Contract Documents Bonds and Certificates of Insurance required by the Contract Documents.
  - 3. <Insert conditions precedent>.
- B. Compliance: Failure to comply with conditions of this Notice within the time specified will entitle Owner to consider the Bidder in default, annul this Notice, and declare the Bidder's Bid security forfeited.



1. Within 10 days after the Bidder complies with the conditions of this Notice, Owner will return to the Bidder one fully executed copy of the Contract Documents.

1.4 NOTIFICATION

A. This Notice is issued by:

1. Owner: \_\_\_\_\_.
2. Authorized Signature: \_\_\_\_\_ (Handwritten signature).
3. Signed By: \_\_\_\_\_ (Type or print name).
4. Title: \_\_\_\_\_ (Owner/Partner/President/Vice President).

END OF DOCUMENT 005100

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## SECTION 006000 - PROJECT FORMS

Revise this Document to identify Contract forms to be used for Project. Review list of standard forms for applicability to Project. Some Owner contracts stipulate Owner's own administrative forms; coordinate provisions of Division 01 General Requirements if Owner forms are used in lieu of AIA standard forms.

## 1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

1. AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."
  - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
2. AIA Document A102-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price."
  - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
3. AIA Document A103-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is the Cost of the Work Plus a Fee without a Guaranteed Maximum Price."
  - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
4. AIA Document A105-2017 "Standard Short Form of Agreement between Owner and Contractor."
5. AIA Document A132-2009 "Standard Form of Agreement between Owner and Contractor, Construction Manager as Adviser Edition."
  - a. The General Conditions for Project are AIA Document A232-2009 "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition."
6. AIA Document A133-2009 "Standard Form of Agreement between Owner and Construction Manager as Constructor Where the Basis of Payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price."
  - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
7. AIA Document A195-2008 "Standard Form of Agreement between Owner and Contractor for Integrated Project Delivery."
  - a. The General Conditions for Project are AIA Document A295-2008 "General Conditions of the Contract for Integrated Project Delivery."
8. The General Conditions are [included in the Project Manual] [incorporated by reference].

9. The Supplementary Conditions for Project [are incorporated into a modified copy of the General Conditions included in the Project Manual] [are separately prepared and included in the Project Manual].
10. Owner's document(s) bound following this Document.

## 1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; [www.aiacontractdocsaicontracts.org](http://www.aiacontractdocsaicontracts.org); (800) 942-7732.
- C. Preconstruction Forms:
  1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."
  2. Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."
- D. Information and Modification Forms:
  1. Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
  2. Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."
  3. Change Order Form: AIA Document G701-2017 "Change Order."
  4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."
  5. Form of Change Directive: AIA Document G714-2017 "Construction Change Directive."
- E. Payment Forms:
  1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."
  2. Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."
  3. Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."
  4. Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."
  5. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF SECTION

## SECTION 011000 - SUMMARY

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Owner-furnished / Contractor-installed (OFICI) products.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

## B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

## 1.2 PROJECT INFORMATION

A. Project Identification: Mountain Home Aquatic Facility.

B. Project Location: 980 McKenna Dr, Mountain Home, ID 83647

C. Owner: City of Mountain Home

1. Owner's Representative: Tiffany Belt <tbelt@mountain-home.us>.

D. Architect: Cole Architects, PLLC.

1. Architect's Representative: Ian B Hoffman <ian@colearchitects.com>.

E. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Structural Engineer: McClendon Engineering

- a. Structural Representative: Sarah McClendon <Sarah@McClendonEngineering.com>.

2. Mechanical and Electrical Engineers: Musgrove Engineering, PA.

a. Mechanical Representative:

- 1) Bill Carter <billc@musgrovepa.com>

b. Electrical Representative:

- 1) Kurt Lechtenberg <kurtl@musgrovepa.com>

## 1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. the project consists of renovating and an addition to an existing outdoor public pool facility. This will include the addition of a mechanical room and storage room to the existing building, ADA upgrades for existing restrooms, a new outdoor swimming pool, and landscaping. Type of Contract:
2. Project will be constructed under a single prime contract.

#### 1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 OWNER-FURNISHED/ CONTRACTOR-INSTALLED (OFICI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
  - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

- B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

- C. Owner-Furnished / Contractor-Installed (OFICI) Products:

1. As indicated on drawings.

#### 1.6 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Existing Building: Contractor shall have full use of the existing building for construction operations during construction period except where noted otherwise on the drawings. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

- B. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations and must coordinate their work with the sitework being performed under a separate contract.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

#### 1.7 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

#### 1.8 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than two days in advance of proposed utility interruptions.
  2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances within the existing building, is not permitted.

#### 1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
  3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
  4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

3.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
  - 1. Contingency allowances.

3.2 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 4 - PRODUCTS (Not Used)

PART 5 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of \$75,000.00 for use according to Owner's written instructions.

END OF SECTION 012100

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## SECTION 012300 - ALTERNATES

## PART 1 - GENERAL

## 5.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

## 5.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

## 5.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

## PART 6 - PRODUCTS (Not Used) PART 3 - EXECUTION

## 6.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Light Wells

1. Base Bid: No Work done.
2. Alternate: Provide three (3) solatube light wells to each changing rooms.

a. Basis of Design:

- 1) Solatube SolaMaster with Polycarbonate Dome

B. Alternate No. 2: Resinous Flooring

1. Base Bid: Provide resinous flooring at changing room and restrooms only.
2. Alternate: Provide resinous flooring at all locations excluding mechanical and storage room additions

a. Basis of Design:

- 1) Dur-a-Flex
- 2) Dur-a-Chip
- 3) Color to be selected by Architect from Manufacturer's full range

C. Alternate No. 3: Interior Painting

1. Base Bid: Paint changing rooms and restrooms
2. Alternate: Paint all interior rooms excluding mechanical and storage room additions.

D. Alternate No. 4: Exterior Lighting

1. Base Bid : Provide exterior lighting as noted on drawings
2. Alternate: Replace all existing building mounted exterior lights to match new lighting.

E. Alternate No. 5: Interior Lighting

1. Base Bid: Provide interior lighting as noted on drawings
2. Alternate: Replace all existing interior lights to match new lighting.

F. Alternate No. 6: Metal Roofing

1. Base Bid: Provide asphalt shingle roofing as noted on the drawings
2. Alternate: Provide standing seam metal roofing in lieu of asphalt shingles as noted on the drawings

G. Alternate No. 7: Exterior Painting

1. Base Bid: Repaint the existing and new exterior of the building to match existing color and design.
2. Alternate: Paint the existing and new exterior of the building with a new mural to match artists rendering. Artists rendering to be determined. Contractor to provide an allowance.

END OF SECTION

## SECTION 012500 - SUBSTITUTION PROCEDURES

## PART 1 - GENERAL

## 6.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
  2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

## 6.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

## 6.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use form acceptable to Architect.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicated deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.

- f. Certificates and qualification data , where applicable or requested .
  - g. Cost information, including a proposal of change, if any, in the Contract Sum.
  - h. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - i. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated .

#### 6.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

#### 6.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

#### 6.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submissions.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted .
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.

- e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at the discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Substitution request is fully documented and properly submitted.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.
  - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 7 - PRODUCTS (Not Used)

PART 8 - EXECUTION (Not Used)

END OF SECTION

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES PART 1 - GENERAL

## 8.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

## 8.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

## 8.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
  - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - c. Include costs of labor and supervision directly attributable to the change.
  - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

#### 8.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Contractor will prepare a Change Order for signatures of Owner, Architect, and Contractor.

#### 8.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 9 - PRODUCTS (Not Used) PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 012900 - PAYMENT PROCEDURES

## PART 1 - GENERAL

## 9.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

## 9.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Arrange schedule of values consistent with format of AIA Document G703.
  2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site.
  4. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
  5. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
  6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

## 9.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.



- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or similar forms for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Electronically submit signed and notarized Application for Payment to Architect by a method ensuring receipt. Include waivers of lien and similar attachments if required.
1. Upon approval, Architect will transmit the Application to the Owner for review and Payment. Allow 30 days for processing by the Owner.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.

2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Submittal schedule (preliminary if not final).
  6. Copies of building permits.
  7. Initial progress report.
  8. Report of preconstruction conference.
  9. Certificates of insurance and insurance policies.
  10. Data needed to acquire Owner's insurance.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificate of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706.
  5. AIA Document G706A.
  6. Final liquidated damages settlement statement.

PART 10 - PRODUCTS (Not Used)

PART 11 - PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION PART 1 - GENERAL

## 11.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

## 11.2 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Preinstallation conferences.
6. Project closeout activities.

## 11.3 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and electronically submit an RFI.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Date.
  2. RFI number, numbered sequentially.
  3. RFI subject.
  4. Specification Section number and title and related paragraphs, as appropriate.
  5. Drawing number and detail references, as appropriate.
  6. Field dimensions and conditions, as appropriate.
  7. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  8. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow four business days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of substitutions.
      - a. Requests for approval of substitutions.
      - b. Requests for approval of Contractor's means and methods.
      - c. Requests for coordination information already indicated in the Contract Documents.
      - d. Requests for adjustments in the Contract Time or the Contract Sum.
      - e. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.
- E. RFI Log: If requested by Architect, prepare, and submit a tabular log of RFIs organized by the RFI number. Include the following:
1. Project name.
  2. Name of Contractor.

3. RFI number including RFIs that were returned without a citation or withdrawn.
  4. RFI description.
  5. Date the RFI was submitted.
  6. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

#### 11.4 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
  2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  3. Digital Drawing Software Program: Contract Drawings are available in Revit 2021 or exported DWG format.
  4. Contractor shall execute a data licensing agreement in the form of Agreement acceptable to the Architect.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.

#### 11.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.

- b. Critical work sequencing and long lead items.
- c. Lines of communications.
- d. Use of web-based Project software.
- e. Procedures for processing field decisions and Change Orders.
- f. Procedures for RFIs.
- g. Procedures for testing and inspecting.
- h. Procedures for processing Applications for Payment.
- i. Distribution of the Contract Documents.
- j. Submittal procedures.
- k. Use of the premises and existing building.
- l. Work restrictions.
- m. Working hours.
- n. Owner's occupancy requirements.
- o. Responsibility for temporary facilities and controls.
- p. Procedures for moisture and mold control.
- q. Procedures for disruptions and shutdowns.
- r. Construction waste management and recycling.
- s. Parking availability.
- t. Office, work, and storage areas.
- u. Equipment deliveries and priorities.
- v. First aid.
- w. Security.
- x. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

PART 12 - PRODUCTS (Not Used) PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Construction schedule updating reports.
3. Construction reports.

## 1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

## 1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Photos: Submit at weekly intervals.

E. Site Condition Reports: Submit at time of discovery of differing conditions.

## 1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## 1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  1. When revisions are made, distribute updated schedules to the same parties. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

#### 1.6 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 15 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Periodic construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

2. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.2 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

B. Periodic Construction Photographs: Take photographs daily. Select vantage points to show status of construction and progress since last photographs were taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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## SECTION 013300 - SUBMITTAL PROCEDURES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

## 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

## 1.3 SUBMITTAL FORMATS

## A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of firm or entity that prepared submittal.
5. Names of subcontractor, manufacturer, and supplier.
6. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals. For example, the first submittal created for 087100 - DOOR HARDWARE should receive a submittal number of 087100-1.0. The next revision of that submittal should receive a submittal number of 087100-1.1. The second submittal created for 087100 - DOOR HARDWARE should receive a submittal number of 087100-2.0 and so on.
7. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
8. Drawing number and detail references, as appropriate.
9. Indication of full or partial submittal.
10. Location(s) where product is to be installed, as appropriate.
11. Other necessary identification.
12. Remarks.

## B. Options: Identify options requiring selection by Architect.

## C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into a single PDF file. Name PDF file with submittal number and title.

#### 1.4 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include project information in email subject line.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Resubmittal Review: Allow 10 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's submittal stamp.

#### 1.5 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

- a. Manufacturer's catalog cuts.  
b. Manufacturer's product specifications.  
c. Standard color charts.  
d. Statement of compliance with specified referenced standards.  
e. Testing by recognized testing agency.  
f. Application of testing agency labels and seals.  
g. Notation of coordination requirements.  
h. Availability and delivery time information.
4. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
- a. Identification of products.  
b. Schedules.  
c. Compliance with specified standards.  
d. Notation of coordination requirements.  
e. Notation of dimensions established by field measurement.  
f. Relationship and attachment to adjoining construction clearly indicated.  
g. Seal and signature of professional engineer if specified.
- C. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- E. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- F. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.

2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
  5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
  6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- G. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
  2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
  3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
  4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
  5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
  6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
    - a. Name of evaluation organization.

- b. Date of evaluation.
- c. Time period when report is in effect.
- d. Product and manufacturers' names.
- e. Description of product.
- f. Test procedures and results.
- g. Limitations of use.

#### 1.6 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit PDF file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

#### 1.7 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.8 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
  - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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## SECTION 014000 - QUALITY REQUIREMENTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services may be required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

## 1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
  - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.



- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

### 1.3 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.4 ACTION SUBMITTALS

#### A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

#### 1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, telephone number, and email address of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Statement on condition of substrates and their acceptability for installation of product.
  2. Statement that products at Project site comply with requirements.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.

2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Other required items indicated in individual Specification Sections.

#### 1.7 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- F. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

#### 1.8 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
  1. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  2. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

3. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  6. Security and protection for samples and for testing and inspection equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

## SECTION 014200 - REFERENCES

## PART 1 - GENERAL

## 1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

## 1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
  - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

### 1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut fur Normung e.V.; [www.din.de](http://www.din.de).
  2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
  2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
  3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
  4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
  6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
  7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
  8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
  11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
  12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
  13. SD - Department of State; [www.state.gov](http://www.state.gov).
  14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
  15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
  16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
  17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
  18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
  19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.govinfo.gov](http://www.govinfo.gov).
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
  - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org](http://www.wbdg.org).
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



## SECTION 016000 - PRODUCT REQUIREMENTS

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

## 1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.

3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

### 1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

### 1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
  - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
2. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
3. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

- a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
- a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
- b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- ## 2.2 COMPARABLE PRODUCTS
- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
  2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

### PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 017300 - EXECUTION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
1. Installation of the Work.
  2. Cutting and patching.
  3. Progress cleaning.
  4. Protection of installed construction.
- B. Related Requirements:
1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  2. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

## 1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

## 1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Examine walls and roofs for suitable conditions where products and systems are to be installed.
  2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

### 3.3 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. 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.
- F. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- G. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.4 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.



- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.5 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

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## SECTION 017700 - CLOSEOUT PROCEDURES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
  2. Final completion procedures.
  3. Warranties.
  4. Final cleaning.
- B. Related Requirements:
1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

## 1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

## 1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to Owner. Label with manufacturer's name and model number.
  5. Submit testing, adjusting, and balancing records.
  6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Complete final cleaning requirements.
  2. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

#### 1.5 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
  2. List of Incomplete Items: Submit copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

### 1.6 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

### 1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format unless otherwise required by Owner. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit by email to Owner and Architect.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Product maintenance manuals.

## 1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by email to Architect. Enable reviewer comments on draft submittals.

C. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

## 1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Avoid scanned documents to the greatest extent possible. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

## 1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### 1.5 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.



3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 017839 - PROJECT RECORD DOCUMENTS

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

## 1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

## 1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
- b. Accurately record information in an acceptable drawing technique.
- c. Record data as soon as possible after obtaining it.
- d. Record and check the markup before enclosing concealed installations.
- e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking may include, but are not limited to, the following:

- a. Dimensional changes to Drawings.
- b. Revisions to details shown on Drawings.
- c. Depths of foundations.
- d. Locations and depths of underground utilities.
- e. Revisions to routing of piping and conduits.

- f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made by Change Order or Construction Change Directive.
  - k. Changes made following Architect's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record prints with red-colored annotations. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Architect for resolution.

#### 1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

#### 1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

#### 1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, legible condition. Provide access to Project Record Documents for Architect's reference.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 017900 - DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

## 1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

## 1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

## 1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

## 1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

## 1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Systems and equipment operation manuals.
    - c. Systems and equipment maintenance manuals.
    - d. Product maintenance manuals.
    - e. Project Record Documents.
    - f. Identification systems.
    - g. Warranties and bonds.
    - h. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.

- h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

#### 1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

#### 1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### 1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. Digital Video Recordings: Provide high-resolution, digital video..
1. Submit video recordings on thumb drive or by uploading to web-based Project software site.
- B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
- C. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION



SECTION 040110 - MASONRY CLEANING

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## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes cleaning the following:

1. Unit masonry surfaces.

## 1.2 DEFINITIONS

A. Low-Pressure Spray.

## 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

## 1.5 QUALITY ASSURANCE

A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.
  - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
  - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

## PART 2 - PRODUCTS

## 2.1 PAINT REMOVERS

- A. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming, alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
- B. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation, for removing paint from masonry.
- C. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.

## 2.2 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

- C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.
- D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
- G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
- H. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
- I. One-Part Limestone Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.

### 2.3 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
- B. Acidic Cleaner Solution for Nonglazed Masonry: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.
1. Stones: Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.
- C. Acidic Cleaner for Glazed Masonry: Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch or otherwise damage glazed or polished surface, but not greater than that recommended in writing by chemical-cleaner manufacturer.
1. Stones: Use only on polished granite and polished dolomite marble.

## PART 3 - EXECUTION

## 3.1 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

## 3.2 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.
- B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
  2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
    - a. Equip units with pressure gages.
    - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    - d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

- E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

### 3.3 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.
1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
  2. Remove paint and calking with alkaline paint remover.
    - a. Comply with requirements in "Paint Removal" Article.
    - b. Repeat application up to two times if needed.
  3. Remove asphalt and tar with solvent-type paste paint remover.
    - a. Comply with requirements in "Paint Removal" Article.
    - b. Apply paint remover only to asphalt and tar by brush without prewetting.
    - c. Allow paint remover to remain on surface for 10 to 30 minutes.
    - d. Repeat application if needed.

### 3.4 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Remove loose and peeling paint using low -pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
3. Apply cover according to manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with cold water applied by low -pressure spray to remove chemicals and paint residue.
7. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
8. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
9. Retreat spots of remaining paint.

C. Paint Removal with Solvent-Type Paste Paint Remover:

1. Remove loose and peeling paint using low -pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with cold water applied by low -pressure spray to remove chemicals and paint residue.

### 3.5 CLEANING MASONRY

A. Detergent Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold water applied by low -pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.

3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
  4. Rinse with cold water applied by low -pressure spray to remove mold, mildew, and algae remover and soil.
  5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- C. Nonacidic Gel Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
  2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
  3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
  4. Remove bulk of gel cleaner.
  5. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
  6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- D. Nonacidic Liquid Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
  2. Apply cleaner to surface in two applications by brush or low-pressure spray.
  3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
  4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
  5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- E. Mild-Acid Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
  2. Apply cleaner to surface in two applications by brush or low-pressure spray.
  3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
  4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
  5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- F. Acidic Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.

2. Apply cleaner to surface in two applications by brush or low-pressure spray.
  3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
  4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
  5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- G. One-Part Limestone Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
  2. Apply cleaner to surface by brush or low-pressure spray.
  3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
  4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
  5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.

END OF SECTION

SECTION 040120.63 - BRICK MASONRY REPAIR

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## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes repairing brick masonry.

## 1.2 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

## 1.3 DEFINITIONS

- A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and locations of replacement bricks on the structure.
  - 2. Show provisions for expansion joints or other sealant joints.
- C. Samples: For each exposed product and for each color and texture specified.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Quality-control program.

## 1.6 QUALITY ASSURANCE

- A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.
- B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.
- C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
  - 1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work.



## PART 2 - PRODUCTS

## 2.1 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.

1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.

a. Physical Properties: According to ASTM C67 and as follows:

- 1) Compressive Strength: .
- 2) 24-Hour Cold-Water Submersion Absorption: .
- 3) Five-Hour Boil Absorption: .
- 4) Saturation Coefficient: .
- 5) Initial Rate of Absorption: .

b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

2. Special Shapes:

a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.

b. Provide specially ground units, shaped to match patterns, for arches and where indicated.

c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.

B. Building Brick: ASTM C62, Grade SW where in contact with earth or Grade SW, MW, or NW for concealed backup; and of same vertical dimension as face brick, for masonry work concealed from view.

## 2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91/C91M.

D. Mortar Cement: ASTM C1329/C1329M.

E. Mortar Sand: ASTM C144.

1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.

2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- F. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
- G. Water: Potable.

### 2.3 MANUFACTURED REPAIR MATERIALS

- A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
  1. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than bricks being repaired, and develops high bond strength to all types of masonry.
  2. Formulate patching compound in colors and textures to match each brick being patched.

### 2.4 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.
- B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
  1. Previous effectiveness in performing the work involved.
  2. Minimal possibility of damaging exposed surfaces.
  3. Consistency of each application.
  4. Uniformity of the resulting overall appearance.
  5. Do not use products or tools that could leave residue on surfaces.

### 2.5 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
  1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
  1. Rebuilding (Setting) Mortar by Volume: ASTM C270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand.
  2. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.
  3. Rebuilding (Setting) Mortar by Property: ASTM C270, Property Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.

4. Pigmented, Colored Mortar: Add mortar pigments to produce exposed setting (rebuilding) mortar of colors required.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Remove gutters and downspouts adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
  1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
  1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
  2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
  1. Maintain joint width for replacement units to match existing joints.
  2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
  1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.

2. Rake out mortar used for laying brick before mortar sets according to Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
  3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

### 3.3 BRICK MASONRY PATCHING

#### A. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

### 3.4 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
1. Do not use metal scrapers or brushes.
  2. Do not use acidic or alkaline cleaners.

END OF SECTION

SECTION 040120.64 - BRICK MASONRY REPOINTING

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## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes repointing joints with mortar.

## 1.2 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Quality-control program.

## 1.5 QUALITY ASSURANCE

- A. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.
- B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.
- C. Mockups: Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide, unless otherwise indicated, for each type of repointing required, and repoint one of the areas.

## PART 2 - PRODUCTS

## 2.1 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.
  - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Masonry Cement: ASTM C91/C91M.
- D. Mortar Cement: ASTM C1329/C1329M.
- E. Mortar Sand: ASTM C144.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
  2. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- F. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
- G. Water: Potable.

## 2.2 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
1. Pointing Mortar by Volume: ASTM C270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand. Add mortar pigments to produce mortar colors required.
  2. Pointing Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.
  3. Pointing Mortar by Property: ASTM C270, Property Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repointing. Reinstall when repointing is complete.
1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 REPOINTING

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints indicated as sealant-filled joints. Seal joints according to Section 079200 "Joint Sealants."
3. Joints at locations of the following defects:
  - a. Holes and missing mortar.
  - b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
  - c. Cracks Insert dimension or more in width and of any depth.
  - d. Hollow-sounding joints when tapped by metal object.
  - e. Eroded surfaces 1/4 inch or more deep.
  - f. Deterioration to point that mortar can be easily removed by hand, without tools.
  - g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of joint width plus 1/8 inch. Do not remove unsound mortar more than deep; consult Architect for direction.
2. Remove mortar from brick and other masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of brick or other masonry units or widen joints. Replace or patch damaged brick or other masonry units as directed by Architect.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.

3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than . Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to feather edge the mortar.
  4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
  5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
  6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
- F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

### 3.3 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION



SECTION 042000 - UNIT MASONRY

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Brick.
4. Structural clay facing tile.
5. Mortar and grout materials.
6. Reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Accessories.
10. Mortar and grout mixes.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.
- C. Samples: For each type and color of exposed masonry unit.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product and for masonry units, include data on material properties.
- 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 in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

## 1.4 QUALITY ASSURANCE

- A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
  1. Build sample panels for each type of exposed unit masonry construction in sizes approximately long by high by full thickness.

## 1.5 FIELD CONDITIONS

- A. 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.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

## PART 2 - PRODUCTS

### 2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, 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 and will be within 20 ft. vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

### 2.2 CONCRETE MASONRY UNITS

- A. <Double click to insert sustainable design text for regional materials.>
- B. 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.
- C. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
- D. CMUs: ASTM C90, [normal weight] [medium weight] [lightweight] [unless otherwise indicated].
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [2150 psi] [2800 psi] [3050 psi] <Insert value>.
- E. Concrete Building Brick: ASTM C55, [normal weight] [medium weight] [lightweight] [unless otherwise indicated].
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [2800 psi] [3050 psi] [3750 psi] [4050 psi] <Insert value>.
  - 2. Size (Actual Dimensions): 3-5/8 inches wide by [2-1/4 inches] [2-3/4 inches] [3-5/8 inches] high by 7-5/8 inches long.
- F. Decorative CMUs: ASTM C90, [normal weight] [medium weight] [lightweight].
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [2150 psi] [2800 psi] [3050 psi] <Insert value>.

2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
  3. Pattern and Texture: [Standard pattern, ground-face finish] [Standard pattern, split-face finish] [Standard pattern, split-ribbed finish] [Scored vertically to appear square in stacked bond, standard finish] <Insert pattern>.[ Match Architect's samples.]
- G. Pre-faced CMUs: ASTM C90, lightweight [hollow] [solid] units, with manufacturer's standard smooth resinous facing complying with ASTM C744.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [2150 psi] [2800 psi] [3050 psi] <Insert value>.
  2. Size: Manufactured to dimensions specified in "CMUs" Paragraph above but with pre-faced surfaces having 1/16-inch- wide returns of facing to create 1/4-inch- wide mortar joints with modular coursing.
  3. Colors and Patterns: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
- H. Concrete Face Brick: ASTM C1634, [normal weight] [medium weight] [lightweight].
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
  2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [3750 psi] [4050 psi] <Insert value>.
  3. Size (Actual Dimensions): 3-5/8 inches wide by [2-1/4 inches] [2-3/4 inches] [3-5/8 inches] high by [7-5/8 inches] [11-5/8 inches] [15-5/8 inches] long.
  4. Texture: [Split-face] [Ground-face] finish <Insert description>.[ Match Architect's samples].

### 2.3 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.[ Provide lintels with net-area compressive strength of not less than that of CMUs.]
- B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 032000 "Concrete Reinforcing," and with reinforcing bars indicated.
- C. Masonry Lintels: Prefabricated or 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. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.
  1. Stainless Steel: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316].
  2. Carbon Steel[, Galvanized after Fabrication]: ASTM A1008/A1008M[, with ASTM A153/A153M, Class B coating].

## 2.4 BRICK

- A. <Double click to insert sustainable design text for brick.>
- B. 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 shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Clay Face Brick: Facing brick complying with ASTM C216, [Grade SW] [Grade MW or Grade SW], [Type FBX] [Type FBS] [Type FBA] [or] [Type HBX] [Type HBS] [Type HBA].
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [3350 psi] [4150 psi] [4950 psi] [6200 psi] [6600 psi] [8250 psi] <Insert value>.
  2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
  3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
  4. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft.[ or have a history of successful use in Project's area].
  5. Size (Actual Dimensions): [2-3/4 inches] [3 inches] [3-1/2 inches] [3-5/8 inches] <Insert dimension> wide by [2-1/4 inches] [2-3/4 inches] [2-5/8 inches] [2-13/16 inches] [3-1/2 inches] [3-5/8 inches] [7-1/2 inches] [7-5/8 inches] <Insert dimension> high by [7-1/2 inches] [7-5/8 inches] [8 inches] [9-5/8 inches] [11-1/2 inches] [11-5/8 inches] <Insert dimension> long.
- D. Building (Common) Brick: ASTM C62, [Grade SW] [Grade MW or Grade SW] [Grade NW, Grade MW, or Grade SW].
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of .
  2. Size (Actual Dimensions): [3-1/2 inches wide by 2-1/4 inches high by 7-1/2 inches long] [or] [3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long] <Insert dimensions>.
- E. Hollow Brick: ASTM C652, Grade SW, [Class H40V (void areas between 25 and 40 percent of gross cross-sectional area)] [Class H60V (void areas between 40 and 60 percent of gross cross-sectional area)], [Type HBX] [Type HBS] [Type HBA] [Type HBB].
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
  2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [3350 psi] [4150 psi] [4950 psi] [6200 psi] [6600 psi] [8250 psi] <Insert value>.

3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft.[ or have a history of successful use in Project's area].
5. Size (Actual Dimensions): [5-1/2 inches] [5-5/8 inches] [7-1/2 inches] [7-5/8 inches] <Insert dimension> wide by [3-1/2 inches] [3-5/8 inches] <Insert dimension> high by [11-1/2 inches] [11-5/8 inches] [15-1/2 inches] [15-5/8 inches] <Insert dimension> long.

## 2.5 STRUCTURAL CLAY FACING TILE

### A. General:

1. Where reinforced masonry is indicated, provide multicored units designed for use in reinforced, grouted masonry, either with vertical cores and with webs notched to receive horizontal reinforcement, or with horizontal cores and with holes in bed shells for placement of grout and to receive vertical reinforcement.
2. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated, including applications that cannot be produced by sawing standard units.

### B. Glazed Structural Clay Facing Tile: ASTM C126, Grade S (Select).

1. Basis-of-Design Product: .
2. Sizes: 6P Series with actual face dimensions of 3-5/8 inches high by 11-5/8 inches long by widths indicated.
3. Width: Manufactured to dimensions [5/16 inch] [3/8 inch] less than nominal dimensions.
4. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
5. Provide special units glazed on ends and tops, as well as faces for corners, jambs, sills, pilasters, columns, and other applications indicated, where glazed units are exposed on other surfaces and faces.
6. Colors and Patterns: As indicated by manufacturer's designations.
7. Where shown to "match existing," provide glazed structural clay tile matching color range, texture, and size of existing adjacent glazed structural clay tile.

### C. Unglazed Structural Clay Facing Tile: ASTM C212, [Type FTX] [Type FTS], [Standard Class] [Special-Duty Class].

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Number of Faces: Single faced[, where only one finished face is exposed when units are installed; double faced, where both finished faces are exposed when units are installed].
3. Size: [As indicated] [Match existing] <Insert size>.

## 2.6 MORTAR AND GROUT MATERIALS

- A. <Double click to insert sustainable design text for mortar and grout.>
- B. 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 will not be more than 0.1 percent when tested in accordance with ASTM C114.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Masonry Cement: ASTM C91/C91M.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- G. Colored Cement Products: Packaged blend made from [portland cement and hydrated lime] [or] [masonry cement] and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Colored Masonry Cement:
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- H. Preblended Dry Mortar Mix: Packaged blend made from [portland cement and hydrated lime] [masonry cement], sand, [mortar pigments,] [water repellents,] and admixtures and complying with ASTM C1714/C1714M.
1. Preblended Dry Portland Cement Mortar Mix:
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Preblended Dry Masonry Cement Mortar Mix
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- I. 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.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- J. Aggregate for Grout: ASTM C404.
- K. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- L. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with [ASTM C494/C494M, Type C] [ASTM C1384], and recommended by manufacturer for use in masonry mortar of composition indicated.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- M. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- N. Water: Potable.

## 2.7 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: [Mill-] [Hot-dip] galvanized carbon steel.
  2. Exterior Walls: [Hot-dip galvanized carbon] [Stainless] steel.
  3. Wire Size for Side Rods: [0.148-inch] [0.187-inch] diameter.
  4. Wire Size for Cross Rods: [0.148-inch] [0.187-inch] diameter.
  5. Wire Size for Veneer Ties: [0.148-inch] [0.187-inch] diameter.
  6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  7. Provide in lengths of not less than 10 ft.[, with prefabricated corner and tee units].
- C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder[ or truss] type with single pair of side rods.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- D. Masonry-Joint Reinforcement for Multiwythe Masonry:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus [one side rod] [two side rods] at each wythe of masonry 4 inches wide or less.
  3. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.

4. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.[Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.]
- E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, [hot-dip galvanized carbon] [stainless] steel continuous wire.

## 2.8 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer 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 A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
  2. Stainless Steel Wire: ASTM A580/A580M, [Type 304] [Type 316].
  3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
  4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316].
  5. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
  1. Wire: Fabricate from [3/16-inch-] [1/4-inch-] diameter, [hot-dip galvanized steel] [stainless steel] wire.[ Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.]
- D. 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] [stainless steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]
  2. Tie Section: Triangular-shaped wire tie made from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized steel] [stainless steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]
- E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.



1. Connector Section: [Dovetail] [Channel] tabs for inserting into [dovetail] [channel] slots in concrete and attached to tie section; formed from [0.060-inch- thick steel sheet, galvanized after fabrication] [0.105-inch- thick steel sheet, galvanized after fabrication] [0.062-inch- thick, stainless steel sheet] [0.109-inch- thick, stainless steel sheet].
  - a. [0.064-inch-] [0.108-inch-] thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized steel] [stainless steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]
3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from [0.0635-inch- thick steel sheet, galvanized after fabrication] [0.0785-inch- thick steel sheet, galvanized after fabrication] [0.1084-inch- thick steel sheet, galvanized after fabrication] [0.0625-inch- thick, stainless steel sheet] [0.0781-inch- thick, stainless steel sheet] [0.1094-inch- thick, stainless steel sheet] with [dovetail] [channel] tabs for inserting into slots in concrete.
  - a. [0.064-inch-] [0.079-inch-] [0.108-inch-] thick galvanized sheet may be used at interior walls unless otherwise indicated.
- F. 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] [stainless steel].
- G. 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] [bent to configuration indicated].
  1. Corrosion Protection: [Hot-dip galvanized to comply with ASTM A153/A153M] [Epoxy coating 0.020 inch thick] [Rust-inhibitive paint].
- H. Adjustable Masonry-Veneer Anchors:
  1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
  2. Fabricate sheet metal anchor sections and other sheet metal parts from [0.0785-inch- thick steel sheet, galvanized after fabrication] [0.1084-inch- thick steel sheet, galvanized after fabrication] [0.0781-inch- thick, stainless steel sheet] [0.1094-inch- thick, stainless steel sheet].
  3. Fabricate wire ties from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized-steel] [stainless steel] wire unless otherwise indicated.
  4. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie[ and washer at face of insulation].
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

5. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.[ Provide with seismic tie, clip, and continuous wire in veneer.]
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
6. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie.[ Use self-adhering tape to seal penetration behind anchor plate.]
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
7. Masonry-Veneer Anchors; Slotted Plate with Prongs: Sheet metal anchor section, with screw holes at top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie.[ Use self-adhering tape to seal penetration behind anchor plate.]
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
8. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive wire tie. Screw has a smooth barrel the same thickness as insulation[ with factory-installed gasketed washer to seal at face of insulation and sheathing] [ and a coating to reduce thermal conductivity]. [ Provide with seismic tie, clip, and continuous wire in veneer.]
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
9. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with [wingnut head] [thermally resistant wingnut head] [thermally resistant clip] designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation[ with factory-installed gasketed washer to seal at face of insulation and sheathing] [ and a coating to reduce thermal conductivity]. [ Provide with seismic tie, clip, and continuous wire in veneer.]
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
10. Masonry-Veneer Anchors; Seismic-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting leg with slotted hole for vertical leg of seismic pintle tie. Tie is rib-stiffened, sheet metal bent plate with down-turned leg to fit in anchor slot and with integral tabs to hold continuous wire in veneer.
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

11. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.
12. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

## 2.9 EMBEDDED FLASHING

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

1. Stainless Steel: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316], 0.016 inch thick.
2. Copper: [ASTM B370, Temper H00, cold-rolled copper sheet, 16 oz./sq. ft. weight or 0.0216 inch thick] [or] [ASTM B370, Temper H01, high-yield copper sheet, 12 oz./sq. ft. weight or 0.0162 inch thick].
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees[ and hemmed].
5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
6. Fabricate metal expansion-joint strips from [stainless steel] [copper] to shapes indicated.

B. Flexible Flashing: Use[ one of] the following unless otherwise indicated:

1. Copper-Fabric Flashing: [3 oz./sq. ft.] [5 oz./sq. ft.] [7 oz./sq. ft.] [self-adhesive] copper sheet bonded between two layers of glass-fiber cloth.
  - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2-mil Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 40-mil.
  - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

3. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of [Type 304] [Type 316] stainless steel sheet, bonded to a layer of polymeric fabric with a [butyl adhesive] [permanent, clear adhesive], to produce an overall thickness of [10 mil] [40 mil].
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
    - b. Applications: Use 10-mil- thick flashing at windows, doors, and small wall penetrations; not at base of walls.[ Use 40-mil- thick flashing at base of walls.]
  4. 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 [30 mil] [40 mil] [60 mil].
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  5. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than [35 mil] [40 mil].
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  6. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
    - b. Monolithic Sheet: Elastomeric thermoplastic flashing, 40 mil thick.
    - c. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 25 mil thick, with a 15-mil- thick coating of adhesive.
      - 1) Color: [Gray] [White] [Tan/buff] [Black].
  7. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 40 mil thick.
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- C. Drainage Plane Flashing: Fabricate from [stainless steel] [copper] [rubberized asphalt] [elastomeric membrane] and drainage membrane to shapes indicated[, including weep tabs, termination bar, and drip edge]. Provide flashing materials as follows:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Stainless Steel: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316], 0.016 inch thick.
  3. Copper: [3 oz./sq. ft.] [5 oz./sq. ft.] thick.

4. Rubberized Asphalt: [40 mil] [60 mil] thick.
  5. Elastomeric Membrane: [EPDM complying with ASTM D4637/D4637M] [PVC] [PVC with Elvaloy Kee] [TPO], [40 mil] [60 mil].
  6. Fabricate continuous flashings in sections 60 inches long, minimum.
- D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- 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.
- G. Termination Bars for Flexible Flashing: [Aluminum] [Stainless steel] [Rigid PVC] bars [0.075 inch by 1 inch] [1/8 inch by 1 inch] [1/8 inch by 1-1/8 inch].
- H. Termination Bars for Flexible Flashing, Flanged: [Stainless steel sheet 0.019 inch by 1-1/2 inches] [Aluminum sheet 0.064 inch by 1-1/2 inches] with a 3/8-inch flange at top [and bottom].

## 2.10 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] [urethane] [or] [PVC].
- 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).
- D. Weep/Cavity Vents: Use[ one of] the following unless otherwise indicated:
1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
  2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
  3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
  4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
6. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Mortar Deflector: Strips, [full depth of cavity] [3/4 inch thick] [1 inch] [1-1/2 inches thick] [2 inches] <Insert thickness> and [10 inches] [16 inches] <Insert thickness> high, with [dovetail-shaped notches] [dimpled surface] that prevent clogging with mortar droppings.
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Rainscreen Drainage Mat: Sheets or strips not less than [full depth of cavity] [3/4 inch] [1 inch] [1-1/2 inches thick] [2 inches] <Insert thickness> thick and installed to full height of cavity, [with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity] to prevent weep holes from clogging with mortar.
- a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- F. Masonry Cell Fill: [Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation)] [Lightweight-Aggregate Fill: ASTM C331/C331M] [Foamed-in-place masonry cell fill].
- G. Proprietary Acidic Masonry 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. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
  2. Use [portland cement-lime] [or] [masonry cement] mortar unless otherwise indicated.
  3. For exterior masonry, use [portland cement-lime] [or] [masonry cement] mortar.
  4. For reinforced masonry, use [portland cement-lime] [or] [masonry 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, [Proportion] [Property] Specification. Provide the following types of mortar for applications stated unless another type is indicated[ or needed to provide required compressive strength of masonry].
1. For masonry below grade or in contact with earth, use Type M.
  2. For reinforced masonry, use [Type M] [Type S] [Type N].
  3. For mortar parge coats, use [Type S] [or] [Type N].
  4. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
  5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- 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 do not exceed 10 percent of portland cement by weight.
  2. Pigments do not exceed 5 percent of masonry cement by weight.
  3. Mix to match Architect's sample.
  4. Application: Use pigmented mortar for exposed mortar joints with the following units: <Insert masonry unit types>.
- E. 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 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C476, [Table 1] [or] [paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi].
  3. Provide grout with a slump of [8 to 11 inches] [10 to 11 inches] as measured in accordance with ASTM C143/C143M.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units: <Insert masonry unit types>.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. 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.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.2 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 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., or 1/2-inch maximum.
- 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 head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
  3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. [ Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.]

### 3.3 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] [stack bond] [one-third running bond] [Flemish bond] [English bond] [bond pattern indicated on Drawings]; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay [CMUs] [and] [hollow brick] 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.
  5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units[ and hollow brick] 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. Lay structural clay tile as follows:
1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.

2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
  3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch-thick joints.
- D. Rake out mortar joints at [pre-faced CMUs] [and] [glazed structural clay tile] to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
  - E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
  - F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

### 3.5 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together [using one of the following methods] [as follows]:
  1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft.] [2.67 sq. ft.] [1.77 sq. ft.] of wall area spaced not to exceed [36 inches] [24 inches] [16 inches] o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
  2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] [tab-type reinforcement].
    - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement [with continuous horizontal wire in facing wythe attached to ties].
- B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- C. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at [exterior walls, except cavity walls] [, and] [interior walls and partitions].
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:
  1. Provide individual metal ties not more than [8 inches] [16 inches] o.c.
  2. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
  3. Provide rigid metal anchors not more than [24 inches] [48 inches] o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

### 3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together [using one of the following methods] [as follows]:
1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft.] [2.67 sq. ft.] [1.77 sq. ft.] of wall area spaced not to exceed [36 inches] [24 inches] [16 inches] o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
  2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] [tab-type reinforcement].
    - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement [with continuous horizontal wire in facing wythe attached to ties].
    - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement [with continuous horizontal wire in facing wythe attached to ties] to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.
- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

### 3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to [wall framing] [and] [concrete and masonry backup] with [seismic] masonry-veneer anchors to comply with the following requirements:
1. Fasten [screw-attached] [and] [seismic] anchors [through sheathing to wall framing] [and] [to concrete and masonry backup] with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed [tie sections] [connector sections and continuous wire] in masonry joints.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each [2.67 sq. ft.] [3.5 sq. ft.] of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

### 3.8 MASONRY-CELL FILL

- A. Pour [loose-fill insulation] [lightweight-aggregate fill] into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 ft..
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.
- C. Drill holes in mortar bed joints at spacing as indicated by foamed-in-place masonry fill manufacturer, and inject foam to fill masonry cell voids.

### 3.9 MASONRY-JOINT REINFORCEMENT

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

### 3.10 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] [1 inch] [2 inches] 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.

### 3.11 FLASHING, WEEP HOLES, AND CAVITY 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.[ Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, 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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of [4 inches] [8 inches], and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
  3. At lintels and shelf angles, extend flashing 6 inches minimum[, to edge of next full unit] at each end. At heads and sills, extend flashing 6 inches minimum[, to edge of next full unit] and turn ends up not less than 2 inches to form end dams.
  4. Install metal [drip edges] [and] [sealant stops] with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- 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 weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use [specified weep/cavity vent products] [or] [open-head joints] to form weep holes.
  2. Space weep holes 24 inches o.c. unless otherwise indicated.
  3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

- E. Place cavity drainage material in [cavities] [airspace behind veneers] to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use [specified weep/cavity vent products] [or] [open-head joints] to form cavity vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.12 REINFORCED UNIT MASONRY

- 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 that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in 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 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] [12.67 ft.] <Insert height>.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform tests and inspections. 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 will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with [Level 2] [Level 3] in TMS 402.
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. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

- F. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- H. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for [mortar air content] [and] [compressive strength].
- I. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

### 3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

### 3.15 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. 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 nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
  7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

### 3.16 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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## SECTION 061000 - ROUGH CARPENTRY

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. Plywood backing panels.

## 1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
  1. NeLMA: Northeastern Lumber Manufacturers' Association.
  2. NLGA: National Lumber Grades Authority.
  3. SPIB: The Southern Pine Inspection Bureau.
  4. WCLIB: West Coast Lumber Inspection Bureau.
  5. WWPA: Western Wood Products Association.

## 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

## 2.1 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.

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## 2.2 MISCELLANEOUS LUMBER

- A. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- B. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.3 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. [ Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.]
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
  2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  3. ICC-ES evaluation report for fastener.
- M. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

### 3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

## SECTION 062023 - INTERIOR FINISH CARPENTRY

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Interior trim.
2. Paneling.
3. Shelving and clothes rods.

## 1.2 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.
- C. PVC: Polyvinyl chloride.

## 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
  1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
  2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

## 1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

## 2.1 MISCELLANEOUS MATERIALS

- A. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.

## 2.2 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
  - 1. Interior standing and running trim, except shoe and crown molds.
  - 2. Wood-board paneling.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours[ unless longer conditioning is recommended by manufacturer].

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
  - 1. Use concealed shims where necessary for alignment.
  - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.4 INSTALLATION OF INTERIOR TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
  - 1. Do not use pieces less than 24 inches long, except where necessary.

2. Stagger joints in adjacent and related standing and running trim.
3. [Cope] [Miter] at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
7. Install trim after gypsum-board joint finishing operations are completed.
8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
9. Fasten to prevent movement or warping.
10. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.5 INSTALLATION OF SHELVING AND CLOTHES RODS

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
  1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
  2. Space fasteners not more than 16 inches o.c. [ Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.]
  3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
  4. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- B. Install shelf brackets according to manufacturer's written instructions, spaced not more than [32 inches] [36 inches] o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.
- D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
  1. Install shelves, fully seated on cleats, brackets, and supports.
  2. Fasten shelves to cleats with finish nails or trim screws, set flush.
  3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
- F. Install rod flanges for rods as indicated.
  1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

2. Install rods in rod flanges.

3.6 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

## SECTION 070150.19 - PREPARATION FOR REROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. The Work of This Section Includes:

1. Full roof tear-off.
2. Partial roof tear-off.
3. Temporary roofing.
4. Roof re-cover preparation.
5. Base flashing removal.
6. Fastener pull-out testing.
7. Disposal.

## 1.2 DEFINITIONS

- A. EPS: Molded (expanded) polystyrene.
- B. Full Roof Tear-off: Removal of existing roofing system down to existing [roof deck] [concrete fill].
- C. OSB: Oriented strand board.
- D. Partial Roof Tear-off: Removal of selected components and accessories from existing roofing system.
- E. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- F. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

## 1.3 FIELD CONDITIONS

- A. Existing Roofing System: [Built-up asphalt] [Built-up coal-tar] [APP-modified bituminous] [SBS-modified bituminous] [EPDM] [CSPE] [KEE] [PVC] [TPO] [APP-modified bituminous protected membrane] [SBS-modified bituminous protected membrane] [Fluid-applied protected membrane] [Coated foamed] <Insert roof type> roofing.
- B. Owner will not occupy portions of building immediately below reroofing area.
  1. Conduct reroofing so Owner's operations are not disrupted.
  2. Provide Owner with not less than [72] <Insert number> hours' written notice of activities that may affect Owner's operations.
  3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
  4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
    - a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

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03/28/2023 6:52:36 PM



- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
1. A roof moisture survey of existing roofing system is available for Contractor's reference.
  2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
  3. Construction Drawings[ and Project Manual] for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to <Insert load> for rooftop equipment wheel loads and <Insert load> for uniformly distributed loads.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials:
1. It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
    - a. Hazardous materials will be removed by Owner before start of the Work.
    - b. Existing roof will be left no less watertight than before removal.
  2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
    - a. Hazardous materials will be removed by Owner under a separate contract.
  3. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
    - a. Hazardous material remediation is specified elsewhere in the Contract Documents.
    - b. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.
    - c. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

## 3.1 PREPARATION

## A. Protection of In-Place Conditions:

1. Protect existing roofing system that is not to be reroofed.
2. Loosely lay 1-inch- minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
  - a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.
3. Limit traffic and material storage to areas of existing roofing that have been protected.
4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
5. Comply with requirements of existing roof system manufacturer's warranty requirements.

## B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.

## C. Shut off rooftop utilities and service piping before beginning the Work.

## D. Test existing roof drains to verify that they are not blocked or restricted.

1. Immediately notify Architect of any blockages or restrictions.

## E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.

1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

## F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

## G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.

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

## 3.2 ROOF TEAR-OFF

- A. Notify Owner each day of extent of roof tear-off proposed for that day[ and obtain authorization to proceed].

- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Remove aggregate ballast from roofing.[ Store aggregate ballast for reuse in manner not to exceed structural loading limitations of roof deck.]
- D. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom.
- E. Remove pavers and accessories from roofing.
1. Store and protect pavers and accessories for reuse in manner not to exceed structural loading limitations of roof deck.
  2. Discard cracked pavers.
- F. Remove ballast, protection mat, and EPS insulation from protected roofing membrane.
1. Discard EPS insulation that is damaged or exceeds [8 lb/cu. ft.] <Insert value>.
  2. Store EPS insulation for reuse and protect it from physical damage.
  3. Store ballast for reuse in manner not to exceed structural loading limitations of roof deck.
- G. Full Roof Tear-off: [Where indicated on Drawings, remove] [Remove] existing roofing and other roofing system components down to the existing [roof deck] [concrete fill].
1. Remove [substrate board] [vapor retarder] [roof insulation] [and] [cover board].
  2. Remove base flashings and counter flashings.
  3. Remove perimeter edge flashing and gravel stops.
  4. Remove copings.
  5. Remove expansion-joint covers.
  6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
  7. Remove roof drains indicated on Drawings to be removed.
  8. Remove wood blocking, curbs, and nailers.
  9. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
    - a. Remove unadhered bitumen, unadhered felts, and wet felts.
  10. Remove excess asphalt from steel deck.
    - a. A maximum of 15 lb/100 sq. ft. of asphalt is permitted to remain on steel decks.
  11. Remove fasteners from deck[ or cut fasteners off slightly above deck surface].
- H. Partial Roof Tear-off: [Where indicated on Drawings, remove] [Remove] existing roofing down to [existing cover board] [existing insulation] <Insert substrate> and immediately check for presence of moisture.
1. [Engage] [Owner will engage] a qualified testing agency to perform the following test:

- a. Coordinate with Owner's testing agency to schedule times for tests and inspections immediately after removal.
2. Survey exposed substrate that is to remain using infrared color thermography according to ASTM C1153.
  - a. Prepare survey report of initial scan indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
3. Survey exposed substrate that is to remain using electrical capacitance/impedance testing according to ASTM D7954/D7954M.
  - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
4. Survey exposed substrate that is to remain using nuclear hydrogen detection testing according to SPRI/RCI NT-1.
  - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
5. Remove wet or damp materials below existing roofing and above deck as directed by Architect.
  - a. [Removal is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.]
6. Inspect wood blocking, curbs, and nailers for deterioration and damage.
  - a. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
  - b. [Removal is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.]
7. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
  - a. Remove unadhered bitumen, unadhered felts, and wet felts.
8. Remove excess asphalt from steel deck that is exposed by removal of wet or damp materials.
  - a. A maximum of 15 lb/100 sq. ft. of asphalt is permitted to remain on steel decks.
9. Remove fasteners from deck[ or cut fasteners off slightly above deck surface].

### 3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
  1. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
  1. Do not proceed with installation until directed by Architect.

- D. Provide additional deck securement as indicated on Drawings.
- E. Replace steel deck as indicated on Drawings.
- F. Replace steel deck as directed by Architect.
  - 1. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- G. Prepare and paint steel deck surface.
  - 1. Painting and preparation for painting is specified in Section 099113 "Exterior Painting."
- H. Replace plywood roof sheathing as indicated on Drawings.
- I. Replace plywood roof sheathing as directed by Architect.
  - 1. Roof sheathing replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

### 3.4 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.
- B. Install temporary roofing over area to be reroofed.
  - 1. [Install two glass-fiber felts] [Mechanically fasten base sheet and install a glass-fiber felt], lapping each sheet 19 inches over preceding sheet.
  - 2. Embed glass-fiber felt in a solid mopping of hot roofing asphalt applied within equiviscous temperature range.
  - 3. Glaze-coat completed surface with hot roofing asphalt.
- C. Remove temporary roofing before installing new roofing.
- D. Prepare temporary roof to receive new roofing [according to approved temporary roofing proposal] [by patching and repairing temporary roofing] <Insert preparation method>.
  - 1. Restore temporary roofing to watertight condition.
  - 2. Obtain approval for temporary roof substrate from roofing manufacturer and Architect before installing new roof.

### 3.5 ROOF RE-COVER PREPARATION

- A. Remove blisters, ridges, buckles, [mechanically attached roofing fastener buttons projecting above roofing,] and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.
  - 1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
  - 2. Scarify surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new recover boards.
  - 3. Broom clean existing substrate.
  - 4. Coordinate with Owner's inspector to schedule times for tests and inspections.
  - 5. Verify that existing substrate is dry.
    - a. Spot check substrates with an electrical capacitance moisture-detection meter.
  - 6. Remove materials that are wet or damp.

- a. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- B. Remove blisters, ridges, buckles, [mechanically attached roofing fastener buttons projecting above roofing,] and other substrate irregularities from existing roofing that inhibit new [recover boards] [roofing] from conforming to substrate.
1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
  2. Shave surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new [recover boards] [roofing].
  3. Broom clean existing substrate.
  4. Coordinate with Owner's inspector to schedule times for tests and inspections.
  5. Verify that existing substrate is dry before proceeding with installation.
    - a. Spot check substrates with an electrical capacitance moisture-detection meter.
  6. Remove materials that are wet and damp.
    - a. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- C. Remove blisters and areas of roofing not fully adhered.
- D. Remove [mechanically attached roofing fastener buttons projecting above roofing and other] substrate irregularities that inhibit new recover boards from conforming to substrate.
1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
  2. Clean substrate of contaminants, such as dirt, debris, oil, and grease, that can affect adhesion of coated foamed roofing.
  3. Power vacuum the existing roof surface.
    - a. If recommended by foam manufacturer, prime dried surface at recommended rate with recommended primer.
  4. Scarify surface of coated polyurethane roofing as necessary to achieve a suitable substrate for new roofing.
  5. Provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone at the following densities:
    - a. Field of roof, one fastener for each <Insert area>.
    - b. Corners of roof, one fastener for each <Insert area>.
    - c. Perimeters of roof, one fastener for each <Insert area>. Width of perimeter zone of roof is <Insert dimension>.
  6. Verify that surface is dry by pressing litmus paper to surface areas most likely to retain moisture, such as shaded areas and low spots.
    - a. If paper changes color, surface is too wet to apply foam.
  7. Build up isolated low spots on existing roofing with sprayed foam specified in Section 075700 "Coated Foamed Roofing" to prevent ponding.

### 3.6 BASE FLASHING REMOVAL

#### A. Remove existing base flashings.

1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

#### B. Do not damage metal counterflashings that are to remain.

1. Replace metal counterflashings damaged during removal with counterflashings [of same metal, weight or thickness, and finish as existing.] [specified in Section 076200 "Sheet Metal Flashing and Trim."] [specified in Section 077100 "Roof Specialties."]

#### C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.

1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

#### D. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing."

1. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

#### E. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with Section 061000 "Rough Carpentry."

### 3.7 FASTENER PULL-OUT TESTING

#### A. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to Architect and roofing manufacturer before installing new roofing system.

1. Obtain roofing manufacturer's approval to proceed with specified fastening pattern.

- a. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

### 3.8 DISPOSAL

#### A. Collect demolished materials and place in containers.

1. Promptly dispose of demolished materials.
2. Do not allow demolished materials to accumulate on-site.
3. Storage or sale of demolished items or materials on-site is not permitted.

#### B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

## SECTION 071113 - BITUMINOUS DAMPPROOFING

## PART 1 - GENERAL

## 1.1 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

## PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide [protection course] [drainage panels] [and] auxiliary materials recommended in writing by manufacturer of primary materials.

## 2.2 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products are to comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections[; cover with asphalt-coated glass fabric].

## 3.3 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.



1. Apply dampproofing to provide continuous plane of protection.
  2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
  2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
  2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.
- D. Where dampproofing interior face of above-grade, exterior [concrete] [and] [masonry] [single-wythe masonry] walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.
- 3.4 PROTECTION
- A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

END OF SECTION

## SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

## PART 1 - GENERAL

## 1.1 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials[, protection course,] [and] [molded-sheet drainage panels] from single source from single manufacturer.
- B. Source Limitations for Plaza-Deck Paving: Obtain plaza-deck pavers[ and paver pedestals] from single source from single manufacturer.

## 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 waterproofing.
1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
  2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
  3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing 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.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of [1/16 inch] [or] [1/8 inch for modified bituminous deck-paving waterproofing].
- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
  1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.
  1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
    - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

### 3.3 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

EEND OF SECTION

## SECTION 071900 - WATER REPELLENTS

## PART 1 - GENERAL

## 1.1 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than [24 hours] [seven days] have passed since surfaces were last wet.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.
8. <Insert restriction>.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents must meet the following performance requirements as determined by [preconstruction] testing on [manufacturer's standard] substrates representing those indicated for this Project.

B. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum [10] <Insert number> percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96/E96M.
2. Minimum [80] <Insert number> percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.

C. Water Penetration and Leakage through Masonry: Minimum [90] <Insert number> percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.

D. Durability: Maximum [5] <Insert number> percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.

E. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: [80] <Insert number> percent.
2. Reduction in Chloride Content: [80] <Insert number> percent.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in [three] <Insert number> representative locations by method recommended by manufacturer.
  2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
  3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions[ and as follows:][.]
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

### 3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using [15 psi pressure spray with a fan-type spray nozzle] [roller] [or] [brush] <Insert requirement> to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. : At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

#### 3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

## SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

## PART 1 - GENERAL

## 1.1 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.

## 1.2 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.

## 1.3 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.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to 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 to 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.] <Insert value>, when tested according to ASTM E2357.

## 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.[ Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.]
  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 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. Do not cover air barrier until it has been tested and inspected by testing agency.
- C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

#### 3.4 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.

E

END OF SECTION

## SECTION 073113 - ASPHALT SHINGLES

## PART 1 - GENERAL

## 1.1 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

## 1.2 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

## 1.3 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
  - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

## PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.
- C. Energy Performance, ENERGY STAR: Provide asphalt shingles that are listed on the DOE's "ENERGY STAR Roof Product List" for steep-slope roof products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
  - 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

## SECTION 076100 - SHEET METAL ROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes: Custom-fabricated sheet metal roofing.

## 1.2 COORDINATION

A. Coordinate sheet metal roofing layout and seams with sizes and locations of roof curbs, equipment supports, equipment provided, and roof penetrations.

B. Coordinate sheet metal roofing installation with rain drainage work, flashing, trim, and construction of roofing substrate, parapets, walls, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

## 1.3 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal roofing materials away from uncured concrete and masonry.

2. Protect stored sheet metal roofing materials from contact with water.

B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sheet metal roofing system, including, but not limited to, metal roof panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim[, battens], underlayment, and accessories, is to comply with requirements without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing is to remain watertight.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.

C. Copper Roofing Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are specified or indicated on Drawings.

D. Energy Performance: Provide sheet metal roofing according to one of the following when tested according to CRRC-1:

1. Three-year, aged, solar reflectance of not less than [0.55] <Insert value> and emissivity of not less than [0.75] <Insert value>.

2. Three-year, aged, Solar Reflectance Index of not less than [64] <Insert value> when calculated according to ASTM E1980.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces] <Insert temperature change>.

## 2.2 FABRICATION

- A. Custom-Fabricated Sheet Metal Roofing: Comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.
- B. Flat-Seam Sheet Metal Roofing: Form flat-seam panels from metal sheets [20 by 28 inches] <Insert dimensions> with 1/2-inch notched and folded edges.
- C. Standing-Seam Sheet Metal Roofing: Form standing-seam panels with finished seam height [of 1 inch] [of 1-1/2 inches] [as indicated] <Insert dimension>.
- D. Batten-Seam Sheet Metal Roofing: Form batten-seam panels with edges turned up [2-1/8 inches] [as indicated] <Insert dimension> and with 1/2-inch flange turned toward center of pan.
- E. Horizontal-Seam (Bermuda-Type) Sheet Metal Roofing: Form horizontal-seam (Bermuda-type) panels with upper edges of lower panels turned up and extending 1/2 inch above continuous horizontal steps in substrate.
- F. Fabrication Tolerances: [Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.] [Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Metal Roof Installation Manual."]
- G. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
1. Lay out sheet metal roofing, so transverse seams, if required, are made in direction of flow, with higher panels overlapping lower panels.
  2. Offset transverse seams from each other [12 inches] <Insert dimension> inches minimum.
  3. Fold and cleat eaves and transverse seams in shop.
  4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leakproof construction.
- H. Built-In Gutters (Integral Gutters): Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
1. Fabricate in minimum 96-inch- long sections.

2. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
  3. Fabricate gutters with built-in expansion joints.
- I. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- J. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to SMACNA's "Architectural Sheet Metal Manual."
- K. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.
1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  2. Seams: Fabricate nonmoving seams with flat-lock seams. [Tin edges to be seamed, form seams, and solder.] [Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.][ Rivet joints where necessary for strength.]
  3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant.
  4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces of accessories exposed to view.
  5. Fabricate cleats and attachment devices of sizes recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- L. Do not use graphite pencils to mark metal surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
  2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.

3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Lay out panel arrangement, and [nail battens to wood sheathing] [screw battens to wood sheathing] [screw battens to metal deck] before installation of sheet metal roofing.

1. Space fasteners not more than [18 inches] <Insert dimension> o.c.

### 3.3 INSTALLATION, GENERAL

- A. Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners[, solder], protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system.
2. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of [solder] [welds] [sealant].
3. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Do not field cut sheet metal roofing by torch.
5. Provide metal closures at [peaks] [rake edges] [rake walls] [eaves] [and] each side of ridge[ and hip] caps.
6. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
7. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
8. Install ridge[ and hip] caps as sheet metal roofing work proceeds.
9. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.
10. Do not use graphite pencils to mark metal surfaces.

- B. Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel.

1. Allow remainder of panel to move freely for thermal expansion and contraction.
2. Point of Fixity: Fasten each panel along a single common line of fixing located at [eave] [ridge] [center of panel length] [locations indicated on Drawings] <Insert location>.
3. Avoid attaching accessories through roof panels in manner that inhibits thermal movement.

- C. Fasteners: Use fastener sizes that penetrate [wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws] [substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance] <Insert size requirement>.
- D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended in SMACNA's "Architectural Sheet Metal Manual."
1. Coat concealed side of [uncoated-aluminum] [and] [stainless steel] sheet metal roofing with bituminous coating where roofing contacts wood, ferrous metal, or cementitious construction.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Fasciae:
1. Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws.
  2. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.4 INSTALLATION TOLERANCES

- A. Installation Tolerances: [Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.] [Shim and align sheet metal roofing within installed tolerances specified in MCA's "Metal Roof Installation Manual."]

### 3.5 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer.
- C. Clean and neutralize flux materials. Clean off excess solder.
- D. Clean off excess sealants.

### 3.6 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Prohibit traffic of any kind on installed sheet metal roofing.
- C. Maintain sheet metal roofing in clean condition during construction.
- D. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.



### 3.7 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: <Insert name>.
  2. Owner's Address: <Insert address>.
  3. Building Name/Type: <Insert information>.
  4. Building's Address: <Insert address>.
  5. Area of Work: <Insert information>.
  6. Acceptance Date: <Insert date>.
  7. Warranty Period: <Insert time>.
  8. Expiration Date: <Insert date>.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. Lightning;
    - b. Peak gust wind speed exceeding <Insert mph>;
    - c. Fire;
    - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. Faulty construction of parapet walls, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. Vapor condensation on bottom of roofing; and
    - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
  6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
  7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.
1. Authorized Signature: <Insert signature>.
  2. Name: <Insert name>.
  3. Title: <Insert title>.

END OF SECTION

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

## PART 1 - GENERAL

## 1.1 COORDINATION

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

## 1.2 DELIVERY, STORAGE, AND HANDLING

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

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with [NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing"] [and] [SMACNA's "Architectural Sheet Metal Manual"] requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install [copings] [roof edge flashings] tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure: [As indicated on Drawings] <Insert design pressure>.

- E. FM Approvals Listing: Manufacture and install [copings] [roof edge flashings] that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, [Class 1-60] [Class 1-75] [Class 1-90] [Class 1-105] [Class 1-120] <Insert class>. Identify materials with name of fabricator and design approved by FM Approvals.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces] <Insert temperature change>.

## 2.2 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
  4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
  2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard[ and by FM Global Property Loss Prevention Data Sheet 1-49] for application, but not less than thickness of metal being secured.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.[ Rivet joints where necessary for strength.]
  3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.[ Rivet joints where necessary for strength.]
- H. Do not use graphite pencils to mark metal surfaces.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners[, solder], protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of [solder] [welds] [sealant].
  3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
  4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
  5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
  6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
  8. Do not field cut sheet metal flashing and trim by torch.
  9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of [uncoated-aluminum] [and] [stainless steel] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of [10 feet] <Insert dimension> with no joints within 24 inches of corner or intersection.
  2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  3. Use lapped expansion joints only where indicated on Drawings.
- D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- E. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
    - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    - b. Form joints to completely conceal sealant.
    - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    - d. Adjust setting proportionately for installation at higher ambient temperatures.
      - 1) Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- F. Rivets: Rivet joints in [uncoated aluminum] [zinc] where necessary for strength.

### 3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

### 3.4 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements[, sheet metal manufacturer's written installation instructions,] and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
  2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
  2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at [staggered 3-inch] <Insert spacing> centers.
  3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

### 3.5 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.6 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

### 3.7 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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## SECTION 077100 - ROOF SPECIALTIES

## PART 1 - GENERAL

## 1.1 DELIVERY, STORAGE, AND HANDLING

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

## 1.2 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section <Insert Section number and title>.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
- C. FM Approvals' Listing: Manufacture and install [copings] [roof-edge specialties] that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, [Class 1-60] [Class 1-75] [Class 1-90] [Class 1-105] [Class 1-120] <Insert class>. Identify materials with FM Approvals' markings.
- D. SPRI Wind Design Standard: Manufacture and install [copings] [roof-edge specialties] tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: [As indicated on Drawings] <Insert design pressure>.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): [120 deg F, ambient; 180 deg F] <Insert temperature range>, material surfaces.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  4. Torch cutting of roof specialties is not permitted.
  5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  1. Coat concealed side of [uncoated aluminum] [and] [stainless steel] roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
  1. Space movement joints at a maximum of [12 feet] <Insert dimension> with no joints within [18 inches] <Insert dimension> of corners or intersections unless otherwise indicated on Drawings.
  2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

- D. Fastener Sizes: Use fasteners of sizes that penetrate [wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws] [substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance] <Insert size requirement>.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

### 3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

EEND OF SECTION

SECTION 077253 - SNOW GUARDS

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Rail-type, seam-mounted snow guards.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product.

## B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include details of rail-type snow guards.

## C. Samples:

## 1. Pad-Type Snow Guards: Full-size unit with installation hardware.

- a. For units with factory-applied finishes, submit manufacturer's standard color selections.

## 2. Rail-Type Snow Guards: Bracket, 12-inch- long rail, and installation hardware.

- a. For units with factory-applied finishes, submit manufacturer's standard color selections.

## D. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include calculation of number and location of snow guards.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the jurisdiction in which the Project is located.

## B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, applicable for attachment method, based on the following:

1. Roof snow load.
2. Snow drifting

3. Roof slope.
4. Roof type.
5. Roof dimensions.
6. Roofing substrate type and thickness.
7. Snow guard type.
8. Snow guard fastening method and strength.
9. Snow guard spacing.
10. Coefficient of Friction Between Snow and Roof Surface: 0.
11. Factor of Safety: 2.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

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

C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: As indicated on Drawings.

## 2.2 RAIL-TYPE SNOW GUARDS

A. Rail-Type, Flat-Mounted Snow Guards:

1. Description: Units fabricated from metal baseplate anchored to [adjustable] [fixed] bracket and equipped with [one] [two] [three] [four] bar(s), rail(s), or pipe(s).
2. Brackets and Baseplate: ASTM B209 aluminum; mill finish .
3. Bars: ASTM B221 aluminum; mill finish.
  - a. Profile: Round.
4. Seam clamps: ASTM B221 aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

B. Rail-Type, Seam-Mounted Snow Guards:

1. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with [one rail] [two rails] [three rails] [one rail with integral track to accept color-matching inserts of material and finish used for metal roof] two rails with integral track to accept color-matching inserts of material and finish used for metal roof] [three rails with integral track to accept color-matching inserts of material and finish used for metal roof].
2. Brackets and Baseplates: ASTM B209 aluminum; mill finish.
3. Bars: ASTM B221 aluminum; mill finish .
  - a. Profile: Round.

4. Seam clamps: ASTM B221 aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions.
  1. Space rows as indicated on Shop Drawings.
  2. Space rows as recommended by manufacturer.
- B. Attachment for Asphalt Shingle Roofing:
  1. Pad-Type, Flat-Mounted Snow Guards: Mechanically anchored through each factory-prepared hole with fasteners concealed by the shingles.
  2. Rail-Type, Flat-Mounted Snow Guards: Mounting plates bolted or screwed to the roof framing or roof deck.
- C. Attachment for Wood Shingle and Shake Roofing:
  1. Pad-Type, Flat-Mounted Snow Guards: Mechanically anchored through each factory-prepared hole with fasteners concealed by the shingles.
  2. Rail-Type, Flat-Mounted Snow Guards: Mounting plates bolted or screwed to the roof framing or roof deck.
- D. Attachment for Slate Shingle Roofing:
  1. Pad-Type, Flat-Mounted Snow Guards: Mechanically anchored through each factory-prepared hole with fasteners concealed by the shingles.
  2. Rail-Type, Flat-Mounted Snow Guards: Mounting plates bolted or screwed to the roof framing or roof deck.
- E. Attachment for Metal Shingle Roofing:
  1. Pad-Type, Flat-Mounted Snow Guards: Mechanically anchored through each factory-prepared hole with fasteners concealed by the shingles.
  2. Rail-Type, Flat-Mounted Snow Guards: Mounting plates bolted or screwed to the roof framing or roof deck.
- F. Attachment for Tile Roofing:
  1. Pad-Type, Flat-Mounted Snow Guards: Hooked to tile and roof batten with head of snow guard positioned over headlap of tile.
  2. Rail-Type, Flat-Mounted Snow Guards: Mounting plates bolted or screwed to the roof framing or roof deck.
- G. Attachment for Standing-Seam Metal Roofing:
  1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.
  2. Pad-Type, Flat-Mounted Snow Guards:
    - a. Mechanically attach to metal roofing according to manufacturer's instructions.
    - b. Solder to copper roofing according to manufacturer's instructions.
  3. Pad-Type, Seam-Mounted Snow Guards:

- a. Install snow guards in straight rows.
  - b. Secure in place using stainless steel set screws, incorporating round nonpenetrating point.
  - c. Torque set screw according to manufacturer's instructions.
4. Rail-Type, Seam-Mounted Snow Guards:
- a. Install brackets to vertical ribs in straight rows.
  - b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.
  - c. Torque set screw according to manufacturer's instructions.
  - d. Install cross members to brackets.
- H. Attachment for Exposed Fastened Metal Roofing:
1. Do not use fasteners that will void metal roofing finish warranty.
  2. Pad-Type, Flat-Mounted Snow Guards:
    - a. Adhere to metal roofing according to manufacturer's instructions.
    - b. Mechanically fasten to metal roofing, using fasteners identical to those used to secure metal roofing to substrate.
    - c. Solder to copper roofing according to manufacturer's instructions.
  3. Rail-Type, Flat-Mounted Snow Guards:
    - a. Install brackets in straight rows.
    - b. Mechanically fasten to metal roofing, using sealant and mechanical fasteners identical to those used to secure metal roofing to substrate.
    - c. Install cross members to brackets.

END OF SECTION

## SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

## 1.1 FIELD CONDITIONS

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

## PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer[ for each sealant type].

## PART 3 - EXECUTION

## 3.1 EXAMINATION

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

## 3.2 PREPARATION

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



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

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile at [locations indicated on Drawings] <Insert locations> in accordance with Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at [locations indicated on Drawings] <Insert locations> in accordance with Figure 8C in ASTM C1193.
  - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

#### 3.4 CLEANING

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

#### 3.5 PROTECTION

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

END OF SECTION

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

## 1.2 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

## 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[ and temperature-rise limits] indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
  2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  3. Temperature-Rise Limit: [Where indicated on Drawings] [At vertical exit enclosures and exit passageways], provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- C. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1] [2] [3] [4] for [basic] [enhanced] protection.
1. Large-Missile Test: For glazed openings located within [30 feet] <Insert dimension> of grade.
- D. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than [0.50 deg Btu/F x h x sq. ft.] [0.40 deg Btu/F x h x sq. ft.] [0.38 deg Btu/F x h x sq. ft.] <Insert U-factor> when tested in accordance with ASTM C1363 or ASTM E1423.

## 2.2 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25] <Insert value> percent.
- B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- H. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.3 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. [Sidelite] [and] [Transom Bar] Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding[, or by rigid mechanical anchors].
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  4. Terminated Stops (Hospital Stops): Terminate stops [6 inches] <Insert dimension> above finish floor with a [45] [90]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with [butted] [or] [mitered] hairline joints.
1. Provide stops and moldings flush with face of door, and with [beveled] [square] stops unless otherwise indicated.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
  4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
  5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with [ANSI/SDI A250.11] [NAAMM-HMMA 840].
  1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
  3. Solidly pack mineral-fiber insulation inside frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.[ Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.]
  6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
  1. Non-Fire-Rated Steel Doors: Comply with [ANSI/SDI A250.8] [NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated].
  2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
  3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

### 3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth, rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

## SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - <Double click here to submit questions, comments, or suggested edits to this Section.>GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames.[Use same designations indicated on Drawings.]

## 1.3 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

## 1.4 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
  1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[ and temperature-rise limit] ratings indicated, according to NFPA 252 or UL 10B.

## 2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges <Insert drawing designation>:
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
  3. Optional Features: [Gasketing] [Double-leaf doors] [Piano hinges] [Louvers] [Masonry anchors] [Removable doors] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Uncoated Steel Sheet for Door: [Nominal 0.060 inch, 16 gage] <Insert thickness>, factory [primed] [finished].
  6. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch, 16 gage] <Insert thickness>, factory [primed] [finished].



7. Stainless Steel Sheet for Door: [Nominal 0.062 inch, 16 gage] <Insert thickness>, ASTM A480/A480M No. 4 finish.
  8. Frame Material: [Same material, thickness, and finish as door] <Insert material, thickness, and finish>.
  9. Latch and Lock: [Cam latch, screwdriver operated] [Cam latch, key operated] [Cam latch, hex-head wrench operated] [Cam latch, pinned-hex-head wrench operated] [Cam latch, spanner-head wrench operated] [Latch bolt, knurled-knob operated] [Latch bolt, key operated] [Prepared for mortise cylinder] [As indicated on Drawings] [As indicated in schedule] <Insert operator>[ with interior release].
- B. Flush Access Doors with Concealed Flanges <Insert drawing designation>:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Face of door flush with frame; with concealed flange for [gypsum board] [plaster] installation and concealed hinge.
  3. Optional Features: [Gasketing] [Double-leaf doors] [Piano hinges] [Louvers] [Masonry anchors] [Removable doors] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Uncoated Steel Sheet for Door: [Nominal 0.060 inch, 16 gage] <Insert thickness>, factory [primed] [finished].
  6. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch, 16 gage] <Insert thickness> factory [primed] [finished].
  7. Stainless Steel Sheet for Door: [Nominal 0.062 inch, 16 gage] <Insert thickness>, ASTM A480/A480M No. 4 finish.
  8. Frame Material: [Same material and thickness as door] <Insert material, thickness, and finish>.
  9. Latch and Lock: [Cam latch, screwdriver operated] [Cam latch, key operated] [Cam latch, hex-head wrench operated] [Cam latch, pinned-hex-head wrench operated] [Cam latch, spanner-head wrench operated] [Latch bolt, knurled-knob operated] [Latch bolt, key operated] [Prepared for mortise cylinder] [As indicated on Drawings] [As indicated in schedule] <Insert operator>[ with interior release].
- C. Lightweight Flush Access Doors <Insert drawing designation>:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Face of door flush with exposed flange, with exposed piano hinge; frameless for surface installation.
  3. Optional Features: [Gasketing] [Double-leaf doors] [Piano hinges] [Louvers] [Masonry anchors] [Removable door] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Uncoated Steel Sheet for Door: [Nominal 0.018 inch, 26 gage] <Insert thickness>, factory [primed] [finished].
  6. Metallic-Coated Steel Sheet for Door: [Nominal 0.022 inch, 26 gage] <Insert thickness>, factory [primed] [finished].

7. Frame Material: [Aluminum, nominal 0.045 inch, mill finish] <Insert material, thickness, and finish>.
  8. Latch and Lock: [Cam latch, screwdriver operated] [Cam latch, key operated] [Cam latch, hex-head wrench operated] [Cam latch, pinned-hex-head wrench operated] [Cam latch, spanner-head wrench operated] [Latch bolt, knurled-knob operated] [Latch bolt, key operated] [Prepared for mortise cylinder] [As indicated on Drawings] [As indicated in schedule] <Insert operator>[ with interior release].
- D. Interior Flush GFRG Access Doors with Concealed Flanges <Insert drawing designation>:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Face of [drop-in] [concealed-hinge] door flush with frame, with concealed flange for gypsum board installation.
  3. Optional Features: [Gasketing] [Piano hinges] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Door Size: <Insert door size>.
  6. Door Type [Drop in, radius corner] [Drop in, square corner] [Concealed-hinge, radius corner] [Concealed-hinge, square corner].
  7. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
  8. Latch and Lock: [Cam latch, screwdriver operated] [Cam latch, key operated] [As indicated on Drawings] [As indicated in schedule] <Insert operator>.

### 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, [Flush] [Recessed] Access Doors with Exposed Flanges <Insert drawing designation>:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Door face flush with frame, [with a core of mineral-fiber insulation enclosed in sheet metal] [uninsulated]; with exposed flange, self-closing door, and concealed hinge.
  3. Optional Features: [Upward-opening doors for ceilings] [Gasketing] [Double-leaf doors] [Piano hinges] [Masonry anchors] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Fire-Resistance Rating: Not less than [that indicated] [that of adjacent construction] [45 minutes] [1 hour] [1-1/2 hours] [2 hours] [3 hours] <Insert requirement>.
  6. Temperature-Rise Rating: [450 deg F] [250 deg F] at the end of 30 minutes.
  7. Uncoated Steel Sheet for Door: [Nominal 0.036 inch, 20 gage] <Insert thickness>, factory [primed] [finished].
  8. Metallic-Coated Steel Sheet for Door: [Nominal 0.040 inch, 20 gage] <Insert thickness>, factory [primed] [finished].
  9. Stainless Steel Sheet for Door: [Nominal 0.038 inch, 20 gage] <Insert thickness>, ASTM A480/A480M No. 4 finish.

10. Frame Material: [Same material, thickness, and finish as door] <Insert material, thickness, and finish>.
11. Latch and Lock: Self-latching door hardware, [operated by knurled-knob] [operated by key] [prepared for mortise cylinder] [as indicated on Drawings] [as indicated in schedule] <Insert operator>[ with interior release].
- B. Fire-Rated, [Flush] [Recessed] Access Doors with Concealed Flanges <Insert drawing designation>:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Description: Door face flush with frame, [with a core of mineral-fiber insulation enclosed in sheet metal] [uninsulated]; with concealed flange for [gypsum board] [plaster] installation, self-closing door, and concealed hinge.
  3. Optional Features: [Upward-opening doors for ceilings] [Gasketing] [Double-leaf doors] [Piano hinges] [Masonry anchors] <Insert feature>.
  4. Locations: [Wall] [Ceiling] [Wall and ceiling] <Insert location or substrate>.
  5. Fire-Resistance Rating: Not less than [that indicated] [that of adjacent construction] [45 minutes] [1 hour] [1-1/2 hours] [2 hours] [3 hours] <Insert requirement>.
  6. Temperature-Rise Rating: [450 deg F] [250 deg F] at the end of 30 minutes.
  7. Uncoated Steel Sheet for Door: [Nominal 0.036 inch, 20 gage] <Insert thickness>, factory [primed] [finished].
  8. Metallic-Coated Steel Sheet for Door: [Nominal 0.040 inch, 20 gage] <Insert thickness>, factory [primed] [finished].
  9. Stainless Steel Sheet for Door: [Nominal 0.038 inch, 20 gage] <Insert thickness>, ASTM A480/A480M No. 4 finish.
  10. Frame Material: [Same material, thickness, and finish as door] <Insert material, thickness, and finish>.
  11. Latch and Lock: Self-closing, self-latching door hardware, [operated by knurled-knob] [operated by key] [prepared for mortise cylinder] [as indicated on Drawings] [as indicated in schedule] <Insert operator>[, with interior release].

## 2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316]. Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Flat Bars: ASTM A666, [Type 304] [Type 316]. Remove tool and die marks and stretch lines, or blend into finish.

- F. Frame Anchors: Same material as door face.
- G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

## 2.5 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- C. Latch and Lock Hardware:
  - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
  - 2. Keys: Furnish two keys per lock and key all locks alike.
  - 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in [Section 087100 "Door Hardware."] [Section 087111 "Door Hardware (Descriptive Specification)."]

## 2.6 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
  - 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
    - a. Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from full range of industry colors] <Insert color>.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

### 3.2 FIELD QUALITY CONTROL

- A. Inspection Agency: [Owner will engage] [Engage] a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
  - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in [NFPA 80] [and] [NFPA 101].

END OF SECTION

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## SECTION 088300 - MIRRORS

PART 1 - <Double click here to submit questions, comments, or suggested edits to this Section.>GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for adhesives.>

C. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

D. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

## 1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

B. Sample Warranty: For special warranty.

## 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

## 1.6 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

### 2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503[; manufactured using copper-free, low-lead mirror coating process].

B. Annealed Monolithic Glass Mirrors: Mirror [Select] [Glazing] Quality, [clear] [low-iron float glass with a minimum 91 percent visible light transmission].

1. Nominal Thickness: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness>.

C. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness>.

D. Laminated Mirrors: ASTM C1172, Type II.

1. Glass for Outer Lite: Annealed float glass, Mirror [Select] [Glazing] Quality, [clear] [low-iron float glass with a minimum 91 percent visible light transmission].
2. Nominal Thickness for Outer Lite: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness>.
3. Glass for Inner Lite: Annealed float glass; ASTM C1036, Type I (transparent flat glass), Quality-Q3; Class 1 (clear).
4. Nominal Thickness: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness>.
5. Interlayer: 0.030-inch- thick, clear polyvinyl-butylal.

E. Safety Glazing Products: For [film-backed] [laminated] [tempered] mirrors, provide products that comply with 16 CFR 1201, Category II.

### 2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. <Double click to insert sustainable design text for VOC content of adhesive.>
  3. <Double click to insert sustainable design text for adhesives.>
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

## 2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
1. Aluminum J-Channel Bottom[ and Side] Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Aluminum J-Channel Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
    - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  3. Finish: [Clear] [Gold] bright anodized.
- B. Mirror Bottom Clips: [As indicated] <Insert description and finish or product designation and manufacturer's name>.
- C. Mirror Top Clips: [As indicated] <Insert description and finish or product designation and manufacturer's name>.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

## 2.5 FABRICATION

- A. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.
- B. Mirror Edge Treatment: [Flat polished] [Rounded polished] [Flat high polished] [Rounded high polished] [Beveled polished edge of width shown].
1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.



- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

#### 3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

#### 3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Install mirrors with [mastic and] mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
  2. Install mastic as follows:
    - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.
- C. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION

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## SECTION 089516 - WALL VENTS

PART 1 - <Double click here to submit questions, comments, or suggested edits to this Section.>GENERAL

## 1.1 SUMMARY

A. Section includes wall vents.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for regional materials.>
3. <Double click to insert sustainable design text for EPDs and HPDs.>

C. Samples: For each type of metal finish required.

## 1.3 INFORMATIONAL SUBMITTALS

A. Research reports.

B. Sample warranties.

## 1.4 WARRANTY

A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: [Five] [10] [20] <Insert number> years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: [Five] [10] <Insert number> years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 WALL VENTS (BRICK VENTS)

A. Extruded-Aluminum Wall Vents:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Extruded-aluminum louvers and frames, not less than 0.125-inch nominal thickness, assembled by welding; with 18-by-14- mesh, aluminum insect screening on inside face.
3. Dampers: Aluminum blades and frames mounted on inside of wall vents.
4. Finish: [Mill] <Insert finish>.

B. Cast-Aluminum Wall Vents:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. One-piece, cast-aluminum louvers and frames; with 18-by-14 mesh, aluminum insect screening on inside face.
3. Dampers: Aluminum blades and frames mounted on inside of wall vents.
4. Finish: Mill.

## 2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B26/B26M, Alloy 319.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- E. <Double click to insert sustainable design text for recycled content.>
- F. <Double click to insert sustainable design text for recycled content of aluminum.>
- G. <Double click to insert sustainable design text for regional materials.>

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Protect unpainted surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.
- B. Build vents into masonry work as construction progresses; comply with requirements in Section 042000 "Unit Masonry."

END OF SECTION

## SECTION 096723-RESINOUS FLOORING

PART 1 - **GENERAL**

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This section includes the following:
  - 1. Resinous flooring system as shown on the drawings and in schedules.
- B. Related sections include the following:
  - 1. 1. Cast-in-Place Concrete, section 033000
  - 2. Concrete Curing, section 033900

## 1.3 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based trowel applied flooring system with epoxy topcoat. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/4 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- B. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

## 1.4 1.4 SUBMITTALS

- A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
- B. Manufacturer's Safety Data Sheet (SDS) for each product being used.
- C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

## 1.5 QUALITY ASSURANCE

- A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
- B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- C. No requests for substitutions shall be considered that would change the generic type of the specified System.
- D. System shall be in compliance with requirements of United States Department of Agriculture (USDA),

Food, Drug Administration (FDA), and local Health Department.

E. System shall be in compliance with the Indoor Air Quality requirements of California section

01350 as verified by a qualified independent testing laboratory.

F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

##### A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

##### B. Storage and Protection

1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the Engineer or other personnel.

##### C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

#### 1.7 PROJECT CONDITIONS

##### A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 90 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.

2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.

3. The Applicator shall ensure that adequate ventilation is available for the work area.

4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

##### B. Conditions of new concrete to be coated with epoxy material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.

2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).

3. Sealers and curing agents should not to be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

- A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
- B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 - **-PRODUCTS**

2.1 FLOORING

- A. Dur-A-Flex, Inc, Dur-A-Crete, Epoxy-Based seamless flooring system

1. System Materials:

- a. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 resin and hardener.
- b. Overlay: Dur-A-Flex, Inc, Dur-A-Glaze #4 resin, hardener and filler.
- c. Topcoat: Dur-A-Flex, Inc. Crete-Gard resin and hardener.

2. Patch Materials

- a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze #4 Cove Rez.
- b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2.2 MANUFACTURER

- A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
- B. Manufacturer of Approved System shall be single source and made in the USA.

2.3 PRODUCT REQUIREMENTS

A. Primer		Dur-A-Glaze #4
1. Percent Solids		100 %
2. VOC		3.8 g/L
3. Compressive Strength, ASTM D 695		11,200 psi
4. Tensile Strength, ASTM D 638		2,100 psi
5. Flexural Strength, ASTM D 790		5,100 psi
6. Abrasion Resistance, ASTM D 4060		
	C-10 Wheel, 1,000 gm load, 1,000 cycles	29 mg loss
7. Flame Spread/NFPA-101, ASTM E 84		Class A
8. Impact Resistance MIL D-24613		0.0007 inches, no cracking or delamination
9. Water Absorption. MIL D-24613		Nil

	10. Potlife @ 70 F	20 minutes	
	B. Overlay		Dur-A-Crete
	1. VOC	0 g/L	
	2. Compressive Strength, ASTM D 695	17,500 psi	
	3. Tensile Strength, ASTM D 638	2,500 psi	
	4. Flexural Strength, ASTM D 790	5,900 psi	
	5. Flexural Modulus of Elasticity, ASTM D 790	6.0 x 10 <sup>5</sup>	
	6. Abrasion Resistance, ASTM D 4060		
	CS-17 Wheel, 1,000 gm load, 1,000 cycles		18 mg
loss	7. Flame Spread/NFPA-101, ASTM E 84		Class A
	8. Flammability, ASTM D 635		Self Extinguishing
	9. Indentation, MIL D-3134		No indentation
	10. Impact Resistance MIL D-3134		Pass
	11. Water Absorption. ASTM D 570		0.04%
	C. Topcoat		Crete-Gard
	1. Percent Solids	100 %	
	2. VOC	59 g/L	
	3. Compressive Strength, ASTM D 695	16,000 psi	
	4. Tensile Strength, ASTM D 638	3,800 psi	
	5. Flexural Strength, ASTM D 790	4,000 psi	
	6. Abrasion Resistance, ASTM D 4060		
	C-10 Wheel, 1,000 gm load, 1,000 cycles		35 mg loss
	7. Flame Spread/NFPA-101, ASTM E 84		Class A
	8. Flammability, ASTM D 635		Self Extinguishing
	9. Impact Resistance MIL D-3134		0.025 inch Max
	10. Water Absorption. MIL D-3134		0.04 %
	11. Potlife @ 70 F	20-25 minutes	

### PART 3 - --EXECUTION

#### 3.1 EXAMINATION

A. A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. 1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

#### 3.2 3.2 PREPARATION

##### A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

2. Moisture Testing: Perform tests recommended by manufacturer and as follows.



- a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- a. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
  4. Mechanical surface preparation
    - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.
    - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
    - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
    - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
  5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturer's recommendations.

### 3.3 APPLICATION

#### A. General

1. The system shall be applied in four distinct steps as listed below:
  - a. Substrate preparation
  - b. Priming
  - c. Trowel applied overlay
  - d. Topcoat application
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

#### B. Primer

1. The primer shall consist of a liquid resin and hardener that is mixed at the ratio of 2 parts resin to 1 part hardener per the manufacturer's instructions.
2. The primer shall be applied by flat squeegee and back rolled at the rate of 150-200 sf/gal.

#### C. Overlay

1. The overlay coat shall be trowel applied onto the wet or tacky primer.
2. The overlay shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener and bag of prepackaged aggregate.
3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means into which the aggregate is then added.
4. The batch of mortar is then spread at the specified thickness with a screed box or gage rake.
5. Finish smooth with hand and/or power trowel.

#### D. Topcoat

1. The topcoat shall be comprised of a liquid resin and a liquid hardener that is mixed in the ratio of 1 part hardener to 2 parts resin and installed per the manufacturer's recommendations.
2. The topcoat shall be squeegee applied and back rolled with a coverage rate of 100 sf/gal.
3. The finish floor will have a nominal thickness of ¼ inch.

### 3.4 FIELD QUALITY CONTROL

#### A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
  - a. Temperature
2. Air, substrate temperatures and, if applicable, dew point.
  - a. Coverage Rates
3. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

### 3.5 CLEANING AND PROTECTION

- A. A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

Mountain Home Aquatic

Issue for Bid

April 01, 2022

2020/Dur-A-Crete STANDARD SPECIFICATION

Please recycle - Thank you!

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## SECTION 099113 - EXTERIOR PAINTING

PART 1 - <Double click here to submit questions, comments, or suggested edits to this Section.>GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.
3. Floor sealers and paints.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for VOC content of paints.>

C. Samples: For each type of topcoat product.

## 1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. <Double click to insert sustainable design text for VOC content of paints.>

C. Colors: [As selected by Architect from manufacturer's full range] [Match Architect's samples] [As indicated in a color schedule] <Insert requirements>.

## 2.3 PRIMERS

A. Exterior, Alkali-Resistant, Water-Based Primer: Pigmented, water-based primer formulated for use on alkaline surfaces, such as exterior plaster, vertical concrete, and masonry.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Exterior Wood Preservative: Solvent-based, zinc or copper naphthenate, penetrating antifungal treatment for exterior wood.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- C. Exterior, Latex Wood Primer: White, waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbes; for hiding stains; and for use on exterior wood subject to extractive bleeding.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- D. Exterior, Alkyd/Oil Wood Primer: Alkyd/oil-based primer that is resistant to extractive bleeding when applied to wood substrates with less than 15 percent moisture content; formulated for sag, mold, and microbial resistance; for hiding stains; and for use on exterior wood subject to extractive bleeding.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Exterior, Latex Block Filler: Water-based, pigmented, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Minimum Solids Content: [Manufacturer's standard percentage] [50 percent] <Insert requirements> solids by volume.
- F. Water-Based Bonding Primer: Pigmented, water-based-emulsion primer formulated for exterior use and to promote adhesion of subsequent specified coatings.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- G. Solvent-Based Bonding Primer: Pigmented, solvent-based primer formulated for exterior use and to seal substrates and promote adhesion of specified subsequent coatings.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- H. Zinc-Rich, Inorganic Primer: Corrosion-resistant, inorganic-based, zinc-rich primer formulated for use on prepared steel subject to severe industrial or marine environments.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- I. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- J. Quick-Drying, Alkyd Metal Primer: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, exterior steel surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- K. Alkyd Metal Primer: Corrosion-resistant, solvent-based, alkyd primer formulated for use on prepared ferrous metals subject to industrial and light marine environments.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- L. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- M. Epoxy Metal Primer: Corrosion-resistant, solvent-based, two-component epoxy primer formulated for use on prepared, exterior ferrous- and galvanized-metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- N. Vinyl Wash Primer: Two-component, vinyl butyral/phosphoric acid, wash primer formulated for use over cleaned metal surfaces and zinc-rich primers as a tie coat for subsequent corrosion-resistant primers or finish coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- O. Quick-Drying Aluminum Primer: Corrosion-resistant, solvent-based, alkyd or modified-alkyd primer formulated for quick-drying capabilities and for use on prepared exterior aluminum.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.4 FINISH COATINGS

- A. Exterior Latex Paint, Flat: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as portland cement plaster, concrete, and primed wood.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss and Sheen: [Manufacturer's standard flat finish] [Maximum gloss of 5 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.

- B. Exterior Latex Paint, Low Sheen: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as portland cement plaster, concrete, and primed wood.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard low-sheen finish] [Gloss of 10 to 35 units at 60 degrees and minimum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- C. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as masonry, portland cement plaster, and primed wood and metal.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard semigloss finish] [Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- D. Exterior Latex Paint, Gloss: Water-based, pigmented, acrylic-copolymer-emulsion coating formulated for alkali, mold, microbial, scrub, blocking (sticking of two painted surfaces), and water resistance and for use on exterior, primed, wood and metal trim, sashes, frames, and doors.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard gloss finish] [Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- E. Exterior, High-Build Latex Paint: Water-based, high-build, pigmented, emulsion coating; high-solids content improves filling, uniformity, and film build on concrete masonry surfaces. Formulated for abrasion, mold, microbial, and wind-driven rain resistance and for use on exterior masonry, concrete masonry unit, and concrete surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard low-gloss finish] [Maximum gloss of 20 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
  3. Minimum Solids Content: [Manufacturer's standard percentage] [47 percent] <Insert requirements> solids by volume.
- F. Textured Latex Coating, Flat: Water-based, pigmented coating that contains sand or other hard aggregate and is formulated for use on exterior masonry, concrete masonry unit, and concrete surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Gloss and Sheen Level: [Manufacturer's standard flat finish] [Maximum gloss of 5 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
  3. Aggregate Size: [Manufacturer's standard] [Fine] [Medium] [Coarse] <Insert requirements>.
- G. Textured Latex Coating, Low Sheen: Water-based, pigmented coating that contains sand or other hard aggregate and is formulated for use on exterior masonry, concrete masonry unit, and concrete surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard low-sheen finish] [Gloss of 5 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
  3. Aggregate Size: [Manufacturer's standard] [Fine] [Medium] [Coarse] <Insert requirements>.
- H. Exterior Alkyd Enamel, Flat: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard flat finish] [Maximum gloss of 5 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- I. Exterior Alkyd Enamel, Semigloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard semigloss finish] [Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- J. Exterior Alkyd Enamel, Gloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard gloss finish] [Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
  3. Fineness of Grind: [Manufacturer's standard] [Maximum fineness of pigment dispersion of 6 units when tested in accordance with ASTM D1210] <Insert requirements>.



- K. Quick-Drying Alkyd Enamel, Semigloss: Solvent-based, alkyd or modified-alkyd enamel formulated for quick-drying capabilities and for use on exterior, primed, metal and dimensionally stable wood surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard semigloss finish] [Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- L. Quick-Drying Alkyd Enamel, Gloss: Solvent-based, alkyd or modified-alkyd enamel formulated for quick-drying capabilities and for use on exterior, primed, metal and dimensionally stable wood surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard gloss finish] [Minimum gloss of 85 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- M. High-Build Epoxy Paint, Low Gloss: High-solids, two-component epoxy; formulated for use on exterior concrete, masonry, and primed-metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard low-gloss finish] [Maximum gloss of 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- N. Exterior, Water-Based, Light Industrial Coating, Low Sheen: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: [Manufacturer's standard low-sheen finish] [Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
- O. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: [Manufacturer's standard semigloss finish] [Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.

P. Exterior, Water-Based, Light Industrial Coating, Gloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss Level: [Manufacturer's standard gloss finish] [Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.

## 2.5 FLOOR SEALERS AND PAINTS

A. Latex Floor Paint, Low Gloss: Water-based, pigmented coating formulated to hide stains, for alkali and incidental water resistance, and for use on exterior, concrete and primed-wood surfaces subject to low to medium foot traffic.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss and Sheen Level: [Manufacturer's standard low-gloss finish] [Maximum gloss of 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523] <Insert requirements>.
3. Slip-Resistant Aggregate: [Manufacturer's standard additive] <Insert requirements>.

B. Latex Deck Coating: Water-based, high-solids, acrylic-emulsion coating; formulated for use on exterior, concrete and wood-board traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss Level: [Manufacturer's standard] <Insert requirements>.
3. Minimum Solids Content: [Manufacturer's standard percentage] [25 percent] <Insert requirements> solids by volume.
4. Surface Texture: [Smooth] [Slip resistant].

C. Alkyd Floor Enamel, Gloss: Solvent-based, alkyd enamel; self-priming where applied to bare wood; formulated to hide stains, for durability, for microbial and abrasion resistance, and for use on exterior, wood-board, traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss Level: [Manufacturer's standard gloss finish] [Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523] <Insert requirements>.
3. Slip-Resistant Aggregate: [Manufacturer's standard additive] <Insert requirements>.

D. Water-Based, Concrete-Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on exterior, concrete traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Solvent-Based, Concrete-Floor Sealer: Clear, acrylic, solvent-based sealer formulated for oil, gasoline, alkali, and water resistance and for use on exterior, concrete traffic surfaces.
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

### 3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 EXTERIOR PAINTING SCHEDULE

#### A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System <Insert drawing designation>:
  - a. Prime Coat: [Exterior, alkali-resistant, water-based primer] [Matching topcoat].
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex over Latex Aggregate System <Insert drawing designation>:
  - a. Prime Coat: Textured latex coating, flat.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
3. Latex Aggregate System <Insert drawing designation>:
  - a. Prime Coat: As recommended in writing by topcoat manufacturer.
  - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - c. Topcoat: Textured latex coating, [flat] [low sheen].
4. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
  - a. Prime Coat: As recommended in writing by topcoat manufacturer.
  - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - c. Topcoat: Exterior, high-build latex paint.
5. Water-Based, Light Industrial Coating System <Insert drawing designation>:
  - a. Prime Coat: Exterior, alkali-resistant, water-based primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].

#### B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Paint System <Insert drawing designation>:
  - a. Prime Coat: Matching topcoat.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Latex floor paint, low gloss.
2. Latex Deck Coating System <Insert drawing designation>:
  - a. Prime Coat: As recommended in writing by topcoat manufacturer.
  - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - c. Topcoat: Latex deck coating.
3. Alkyd Floor Enamel System <Insert drawing designation>:
  - a. Prime Coat: Matching topcoat.
  - b. Intermediate Coat: Matching topcoat.

- c. Topcoat: Alkyd floor enamel, gloss.
4. Clear, Water-Based Sealer System <Insert drawing designation>:
- Prime Coat: Matching topcoat.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Water-based, concrete-floor sealer.
5. Clear, Solvent-Based Sealer System <Insert drawing designation>:
- Prime Coat: Matching topcoat.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Solvent-based, concrete-floor sealer.
- C. Clay Masonry Substrates:
1. Latex System <Insert drawing designation>:
- Prime Coat: Exterior, alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex Aggregate System <Insert drawing designation>:
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - Topcoat: Textured latex coating, [flat] [low sheen].
3. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - Topcoat: Exterior, high-build latex paint.
4. Water-Based, Light Industrial Coating System <Insert drawing designation>:
- Prime Coat: Exterior, alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
- D. Concrete Masonry Unit Substrates:
1. Latex System <Insert drawing designation>:
- Prime Coat: Exterior, latex block filler.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex over Alkali-Resistant Primer System <Insert drawing designation>:
- Prime Coat: Exterior, alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
3. Latex Aggregate System <Insert drawing designation>:
- Prime Coat: As recommended in writing by topcoat manufacturer.

- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Textured latex coating, [flat] [low sheen].
4. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Exterior, high-build latex paint.
5. Water-Based, Light Industrial Coating System <Insert drawing designation>:
- a. Prime Coat: Exterior, latex block filler.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
- E. Steel and Iron Substrates:
1. Water-Based, Light Industrial Coating System <Insert drawing designation>:
- a. Prime Coat: [Zinc-rich, inorganic primer] [Alkyd metal primer] [Epoxy metal primer] [Shop primer specified in Section in which substrate is specified].
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
2. Water-Based, Light Industrial Coating over Epoxy System <Insert drawing designation>:
- a. Prime Coat: Epoxy metal primer.
- b. Intermediate Coat: High-build epoxy paint, low gloss.
- c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
3. Alkyd System <Insert drawing designation>:
- a. Prime Coat: [Alkyd metal primer] [Surface-tolerant metal primer] [Shop primer specified in Section in which substrate is specified].
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
4. Quick-Drying Enamel System <Insert drawing designation>:
- a. Prime Coat: Quick-drying, alkyd metal primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Quick-drying alkyd enamel, [semigloss] [gloss].
- F. Galvanized-Metal Substrates:
1. Latex System <Insert drawing designation>:
- a. Prime Coat: Water-based, galvanized-metal primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Water-Based, Light Industrial Coating System <Insert drawing designation>:

- a. Prime Coat: [Water-based, galvanized-metal primer] [Epoxy metal primer].
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].

G. Aluminum Substrates:

1. Latex System <Insert drawing designation>:
  - a. Prime Coat: Quick-drying aluminum primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Water-Based, Light Industrial Coating System <Insert drawing designation>:
  - a. Prime Coat: Quick-drying aluminum primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
3. Alkyd System <Insert drawing designation>:
  - a. Pretreatment Coat: Vinyl wash primer.
  - b. Prime Coat: Quick-drying aluminum primer.
  - c. Intermediate Coat: Matching topcoat.
  - d. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].

H. Glue-Laminated Wood Substrates:

1. Latex over Latex Primer System <Insert drawing designation>:
  - a. Prime Coat: Exterior, latex wood primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex over Alkyd/Oil Primer System <Insert drawing designation>:
  - a. Prime Coat: Exterior, alkyd/oil wood primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
3. Alkyd System <Insert drawing designation>:
  - a. Prime Coat: Exterior, alkyd/oil wood primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].

I. Exposed Wood-Framing Substrates:

1. Latex over Latex Primer System <Insert drawing designation>:
  - a. Prime Coat: Exterior, latex wood primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex over Alkyd Primer System <Insert drawing designation>:
  - a. Prime Coat: Exterior, alkyd/oil wood primer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].

3. Alkyd System <Insert drawing designation>:
- Prime Coat: Exterior, alkyd/oil wood primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- J. Dressed-Lumber Substrates: [Trim] [Architectural woodwork] [Doors] [Windows] [Board siding] [Railings] [Fences] <Insert requirements>:
1. Latex over Latex Primer System <Insert drawing designation>:
    - Prime Coat: Exterior, latex wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  2. Latex over Alkyd Primer System <Insert drawing designation>:
    - Prime Coat: Exterior, alkyd/oil wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  3. Water-Based, Light Industrial Coating System <Insert drawing designation>:
    - Prime Coat: Exterior, alkyd/oil wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior, water-based, light industrial coating, [semigloss] [gloss].
  4. Alkyd System <Insert drawing designation>:
    - Prime Coat: Exterior, alkyd/oil wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- K. Wood Shingle and Shake Siding Substrates:
1. Latex over Latex Primer System <Insert drawing designation>:
    - Prime Coat: Exterior, latex wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  2. Latex over Alkyd Primer System <Insert drawing designation>:
    - Prime Coat: Exterior, alkyd/oil wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  3. Alkyd System <Insert drawing designation>:
    - Prime Coat: Exterior, alkyd/oil wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- L. Wood-Based Panel Substrates:
1. Latex over Latex Primer System <Insert drawing designation>:
    - Prime Coat: Exterior, latex wood primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  2. Latex over Alkyd Primer System <Insert drawing designation>:



- a. Prime Coat: Exterior, alkyd/oil wood primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
3. Alkyd System <Insert drawing designation>:  
a. Prime Coat: Exterior, alkyd/oil wood primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- M. Wood-Board, Traffic-Surface Substrates:
1. Latex Floor Paint over Latex Primer System <Insert drawing designation>:  
a. Prime Coat: Exterior, latex wood primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Latex floor paint, low gloss.
2. Latex Floor Paint over Alkyd Primer System <Insert drawing designation>:  
a. Prime Coat: Exterior, alkyd/oil wood primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Latex floor paint, low gloss.
3. Latex Deck Coating System <Insert drawing designation>: For plywood decks.  
a. Prime Coat: As recommended in writing by topcoat manufacturer.  
b. Intermediate Coat: As recommending in writing by topcoat manufacturer.  
c. Topcoat: Latex deck coating.
4. Alkyd Floor Enamel System <Insert drawing designation>:  
a. Prime Coat: Matching topcoat.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Alkyd floor enamel, gloss.
5. Alkyd Floor Enamel over Wood Preservative System <Insert drawing designation>:  
a. Preservative Coat: Exterior wood preservative.  
b. Prime Coat: Matching topcoat.  
c. Intermediate Coat: Matching topcoat.  
d. Topcoat: Alkyd floor enamel, gloss.
- N. Cementitious Composition Board Substrates: [Siding] [Trim] [Panels] <Insert requirements>.
1. Latex System <Insert drawing designation>:  
a. Prime Coat: Matching topcoat.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex over Alkyd Primer System <Insert drawing designation>:  
a. Prime Coat: Exterior, alkali-resistant, water-based primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].

3. Alkyd System over Latex Wood Primer System <Insert drawing designation>
    - a. Prime Coat: Exterior, latex wood primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
  4. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
    - a. Prime Coat: As recommended in writing by topcoat manufacturer.
    - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    - c. Topcoat: Exterior, high-build latex paint.
  5. Water-Based, Light Industrial Coating System <Insert drawing designation>:
    - a. Prime Coat: Exterior, alkali-resistant, water-based primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
  6. Alkyd System <Insert drawing designation>:
    - a. Prime Coat: Exterior, latex wood primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- O. Fiberglass Substrates:
1. Latex System <Insert drawing designation>:
    - a. Prime Coat: Solvent-based bonding primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  2. Water-Based, Light Industrial Coating System <Insert drawing designation>:
    - a. Prime Coat: Solvent-based bonding primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
  3. Alkyd System <Insert drawing designation>:
    - a. Prime Coat: Solvent-based bonding primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- P. Plastic-Trim-Fabrication Substrates:
1. Latex System <Insert drawing designation>:
    - a. Prime Coat: [Solvent] [Water]-based bonding primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
  2. Water-Based, Light Industrial Coating System <Insert drawing designation>:
    - a. Prime Coat: [Solvent] [Water]-based bonding primer.
    - b. Intermediate Coat: Matching topcoat.

- c. Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
3. Alkyd System <Insert drawing designation>:
- Prime Coat: Solvent-based bonding primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].
- Q. Portland Cement Plaster Substrates:
1. Latex System <Insert drawing designation>:
- Prime Coat: [Matching topcoat] [Exterior, alkali-resistant, water-based primer].
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - Topcoat: Exterior, high-build latex paint.
3. Water-Based, Light Industrial Coating System <Insert drawing designation>:
- Prime Coat: Exterior, alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior, water-based, light industrial coating, [low sheen] [semigloss] [gloss].
- R. Exterior Gypsum Board Substrates:
1. Latex System <Insert drawing designation>:
- Prime Coat: Exterior, latex wood primer, reduced in accordance with manufacturer's written instructions for substrate and topcoat.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Exterior latex paint, [flat] [low sheen] [semigloss] [gloss].
2. Latex Aggregate System <Insert drawing designation>:
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - Topcoat: Textured latex coating, [flat] [low sheen].
3. High-Build Latex System <Insert drawing designation>: Dry film thickness of not less than 10 mils.
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - Topcoat: Exterior, high-build latex paint.
4. Alkyd System <Insert drawing designation>:
- Prime Coat: Exterior, latex wood primer.

- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior alkyd enamel, [flat] [semigloss] [gloss].

END OF SECTION

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SECTION 099123 - INTERIOR PAINTING

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.
4. Floor sealers and paints.
5. Dry fall coatings.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of topcoat product.
- C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

## 1.3 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.2 PAINT PRODUCTS, GENERAL

## A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

- B. <Double click to insert sustainable design text for paints.>

## C. Colors: As selected by Architect from manufacturer's full range.

1. Thirty percent of surface area will be painted with deep tones.

### 2.3 PRIMERS

- A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- C. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- D. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Interior Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbes; for hiding stains; and for use on interior wood subject to extractive bleeding.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- F. Interior Alkyd Primer Sealer: Solvent-based, alkyd-type, primer/sealer for new interior wood, plaster, and porous surfaces,
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- G. Water-Based Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, interior ferrous metals subject to mildly corrosive environments.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- H. Alkyd Quick-Dry Primer for Metal: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, interior steel surfaces.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- I. Anti-Corrosive Epoxy Primer: Corrosion-resistant, solvent-based, two-component epoxy primer formulated for use on prepared, interior ferrous- and galvanized-metal surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- J. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- K. Cementitious Galvanized Primer: Solvent-based primer composed of linseed oil/alkyd resin and portland cement for cleaned galvanized metal prior to finish coating.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- L. Water-Based Galvanized-Metal Primer: Corrosion-resistant, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- M. Quick-Drying Aluminum Primer: Corrosion-resistant, solvent-based, alkyd or modified-alkyd primer formulated for quick-drying capabilities and for use on prepared exterior aluminum.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- N. Vinyl Wash Primer: Two-component, vinyl butyral/phosphoric acid, wash primer formulated for use over cleaned metal surfaces and zinc-rich primers as a tie coat for subsequent corrosion-resistant primers or finish coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- O. Water-Based Bonding Primer: Water-based-emulsion primer formulated to promote adhesion of subsequent specified coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- P. Solvent-Based Bonding Primer: Solvent-based primer formulated to seal substrates and promote adhesion of specified subsequent coatings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- ## 2.4 WATER-BASED FINISH COATS
- A. Interior, Latex, Flat: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Gloss and Sheen Level: Manufacturer's standard flat finish.

- B. Interior, Latex, Low Sheen: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- C. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- D. Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- E. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: Manufacturer's standard semigloss finish.
- F. Interior, Latex, Gloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: Manufacturer's standard gloss finish.
- G. Interior, Latex, Institutional Low Odor/VOC, Flat: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard flat finish.
- H. Interior, Latex, Institutional Low Odor/VOC, Low Sheen: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.



- I. Interior, Latex, Institutional Low Odor/VOC, Eggshell: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- J. Interior, Latex, Institutional Low Odor/VOC, Satin: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- K. Interior, Latex, Institutional Low Odor/VOC, Semigloss: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. Gloss Level: Manufacturer's standard semigloss finish.
- L. Interior, Latex, Institutional Low-Odor/VOC, Gloss: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. Gloss Level: Manufacturer's standard gloss finish.
- M. Interior, Water-Based Light-Industrial Coating, Eggshell: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- N. Interior, Water-Based Light-Industrial Coating, Semigloss: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
1. Gloss Level: Manufacturer's standard semigloss finish.
- O. Interior, Water-Based Light-Industrial Coating, Gloss: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
1. Gloss Level: Manufacturer's standard gloss finish.
- P. Interior, Latex, High-Performance Architectural Coating, Low Sheen: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

- Q. Interior, Latex, High-Performance Architectural Coating, Eggshell: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- R. Interior, Latex, High-Performance Architectural Coating, Satin: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- S. Interior, Latex, High-Performance Architectural Coating, Semigloss: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
1. Gloss Level: Manufacturer's standard semigloss finish.
- T. Textured Latex Coating, Flat: Pigmented, water-based coating, containing a coarse or medium-sized sand or other hard aggregate, for use on exterior masonry, concrete, and concrete block.
1. Gloss and Sheen Level: Manufacturer's standard flat finish.
  2. Aggregate Size: Manufacturer's standard.
- U. Textured Latex Coating, Nonflat: Pigmented, water-based coating, containing a coarse or medium-sized sand or other hard aggregate, for use on exterior masonry, concrete, and concrete block.
1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
  2. Aggregate Size: Manufacturer's standard.

## 2.5 SOLVENT-BASED FINISH COATS

- A. Interior, Alkyd, Flat: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.
1. Gloss and Sheen Level: Manufacturer's standard flat finish.
- B. Interior, Alkyd, Eggshell: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.
1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- C. Interior, Alkyd, Semigloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.
1. Gloss Level: Manufacturer's standard semigloss finish.

D. Interior, Alkyd, Gloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Gloss Level: Manufacturer's standard gloss finish.

E. Aluminum Paint: Aliphatic, solvent-based coating consisting of varnish or alkyd binder combined with aluminum pigment that is formulated for use as a stain-blocking coating and sealer on wood, metal, bituminous-coated, and prepared masonry surfaces and to be able to be recoated with conventional alkyd and latex paints.

## 2.6 FLOOR SEALERS AND PAINTS

A. Interior Concrete Stain: Penetrating semitransparent stain specifically manufactured for interior and exterior concrete horizontal and vertical surfaces.

B. Latex Floor Paint, Low Gloss: Water-based, pigmented coating formulated to hide stains, for alkali and incidental water resistance, and for use on concrete and primed-wood surfaces subject to low to medium foot traffic.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Gloss and Sheen Level: Manufacturer's standard low-gloss finish.

3. Slip-Resistant Aggregate: Manufacturer's standard additive.

C. Alkyd Floor Enamel, Gloss: Solvent-based, alkyd enamel; self-priming where applied to bare wood; formulated to hide stains, for durability, for microbial and abrasion resistance, and for use on wood-board, traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Gloss Level: Manufacturer's standard gloss finish.

3. Slip-Resistant Aggregate: Manufacturer's standard additive.

D. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

E. Solvent-Based Concrete Floor Sealer: Clear, acrylic, solvent-based sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.7 DRY FALL COATINGS

A. Dry Fall, Latex, Flat: Pigmented, water-based, emulsion-type, fast-drying coating for use on interior plaster, concrete, gypsum board, primed wood, and metal ceilings.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard flat finish.
- B. Dry Fall, Latex, Eggshell: Pigmented, water-based, emulsion-type, fast-drying coating for use on interior plaster, concrete, gypsum board, primed wood, and metal ceilings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- C. Dry Fall, Latex, Semigloss: Pigmented, water-based, emulsion-type, fast-drying coating for use on interior plaster, concrete, gypsum board, primed wood, and metal ceilings.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: Manufacturer's standard semigloss finish.
- D. Water Based, Dry Fall for Galvanized Steel, Flat: Pigmented, water-based coating for direct application to cleaned, interior galvanized-metal ceiling surfaces and adjacent primed metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard flat finish.
- E. Water Based, Dry Fall for Galvanized Steel, Eggshell: Pigmented, water-based coating for direct application to cleaned, interior galvanized-metal ceiling surfaces and adjacent primed metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- F. Water Based, Dry Fall for Galvanized Steel, Semigloss: Pigmented, water-based coating for direct application to cleaned, interior galvanized-metal ceiling surfaces and adjacent primed metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: Manufacturer's standard semigloss finish.
- G. Alkyd, Dry Fall, Flat: Pigmented, solvent-based, fast-setting, alkyd interior paint for use on ceiling surfaces, such as plaster, gypsum wallboard, primed wood, and primed metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard flat finish.
- H. Alkyd, Dry Fall, Eggshell: Pigmented, solvent-based, fast-setting, alkyd interior paint for use on ceiling surfaces, such as plaster, gypsum wallboard, primed wood, and primed metals.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- I. Alkyd, Dry Fall, Semigloss: Pigmented, solvent-based, fast-setting, alkyd interior paint for use on ceiling surfaces, such as plaster, gypsum wallboard, primed wood, and primed metals.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Gloss Level: Manufacturer's standard semigloss finish.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
- C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

#### 3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- C. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Paint the following work where exposed in equipment rooms:
    - a. Equipment, including panelboards[ and switch gear].
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.
    - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

i. <Insert mechanical items to be painted>.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System :

- a. Prime Coat: Alkali-resistant, water-based primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior latex paint, low sheen .

2. Latex over Latex Aggregate System :

- a. Prime Coat: Textured latex coating, flat.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior latex paint, low sheen .

3. Latex Aggregate System:

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Textured latex coating, [flat] [nonflat].

4. Institutional Low-Odor/VOC Latex System <Insert drawing designation>:

- a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior latex, institutional low odor/VOC, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].

5. High-Performance Architectural Latex System <Insert drawing designation>:

- a. Prime Coat: Alkali-resistant, water based primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior latex, high-performance architectural coating, [low sheen] [eggshell] [satin] [semigloss].

6. Water-Based Light-Industrial Coating System <Insert drawing designation>:

- a. Prime Coat: Alkali-resistant, water-based primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].

7. Alkyd System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior alkyd, [flat] [eggshell] [semigloss] [gloss].
8. Concrete Stain System <Insert drawing designation>:
- First Coat: Matching topcoat.
  - Topcoat: Interior concrete stain.
- B. Concrete Substrates, Traffic Surfaces:
1. Latex Floor Enamel System <Insert drawing designation>:
    - Prime Coat: Matching topcoat
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Latex floor paint, low gloss.  2. Alkyd Floor Enamel System <Insert drawing designation>:
    - Prime Coat: Matching topcoat.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Alkyd floor enamel, gloss.  3. Concrete Stain System <Insert drawing designation>:
    - First Coat: Matching topcoat.
    - Topcoat: Interior concrete stain.  4. Water-Based Concrete Floor Sealer System <Insert drawing designation>:
    - First Coat: Matching topcoat.
    - Topcoat: Water-based concrete floor sealer.  5. Solvent-Based Concrete Floor Sealer System <Insert drawing designation>:
    - First Coat: Matching topcoat.
    - Topcoat: Solvent-based concrete floor sealer.
- C. Cement Board Substrates:
1. Latex System <Insert drawing designation>:
    - Prime Coat: Alkali-resistant, water-based primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Interior, latex, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].  2. Institutional Low-Odor/VOC Latex System <Insert drawing designation>:
    - Prime Coat: Interior, institutional low-odor/VOC primer sealer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Interior, latex, institutional low odor/VOC, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].  3. High-Performance Architectural Latex System <Insert drawing designation>:
    - Prime Coat: Alkali-resistant, water-based primer.
    - Intermediate Coat: Matching topcoat.
    - Topcoat: Interior, latex, high-performance architectural coating, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].

4. Water-Based Light-Industrial Coating System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
5. Alkyd System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].
- D. Clay Masonry Substrates:
1. Latex System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, low sheen .
2. Latex Aggregate System <Insert drawing designation>:
- Prime Coat: As recommended in writing by topcoat manufacturer
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Textured latex coating, nonflat.
3. Institutional Low-Odor/VOC Latex System :
- Prime Coat: Interior, institutional low-odor/VOC primer sealer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, institutional low odor/VOC, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].
4. High-Performance Architectural Latex System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, high-performance architectural coating, [low sheen] [eggshell] [satin] [semigloss].
5. Water-Based Light-Industrial Coating System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
6. Alkyd System <Insert drawing designation>:
- Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [eggshell] [semigloss] [gloss].
- E. CMU Substrates:
1. Latex System :
- Block Filler: Interior/exterior latex block filler.
  - Intermediate Coat: Matching topcoat.



- c. Topcoat: Interior, latex, low sheen .
2. Latex Aggregate System:
- Prime Coat: As recommended in writing by topcoat manufacturer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Textured latex coating, nonflat.
3. Institutional Low-Odor/VOC Latex System :
- Block Filler: Interior/exterior latex block filler.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, institutional low odor/VOC, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].
4. High-Performance Architectural Latex System <Insert drawing designation>:
- Block Filler: Interior/exterior latex block filler.
  - Prime Coat: Alkali-resistant, water-based primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, high-performance architectural coating, [low sheen] [eggshell] [satin] [semigloss].
5. Water-Based Light-Industrial Coating System <Insert drawing designation>:
- Block Filler: Interior/exterior latex block filler.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
6. Alkyd System <Insert drawing designation>:
- Block Filler: Interior/exterior latex block filler.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [eggshell] [semigloss] [gloss].
- F. Steel Substrates:
1. Latex System, Alkyd Primer :
- Prime Coat: Alkyd quick-dry primer for metal.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, low sheen .
2. Latex over Shop-Applied Quick-Drying Shop Primer System <Insert drawing designation>:
- Prime Coat: Quick-dry primer for shop application.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, low sheen .
3. Institutional Low-Odor/VOC Latex System :
- Prime Coat: Water-based rust-inhibitive primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, latex, institutional low odor/VOC, low sheen.
4. High-Performance Architectural Latex System:
- Prime Coat: Alkyd quick-dry primer for metal.
  - Intermediate Coat: Matching topcoat.

- c. Topcoat: Topcoat: Interior, latex, high-performance architectural coating, low sheen.
5. Water-Based Light-Industrial Coating System <Insert drawing designation>:
- Prime Coat: Primer, rust-inhibitive, water based.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
6. Water-Based Light-Industrial Coating System over Epoxy Primer System <Insert drawing designation>:
- Prime Coat: Anticorrosive epoxy primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
7. Water-Based Dry-Fall System <Insert drawing designation>:
- Prime Coat: [Alkyd quick-dry primer for metal] [Alkyd anticorrosive primer] [Shop primer specified in Section where substrate is specified].
  - Topcoat: [Dry fall, latex, flat] [Water-based dry fall for galvanized steel, flat] [Dry fall, latex, eggshell] [Dry fall, latex, semigloss].
8. Water-Based Dry Fall over Shop-Applied Quick-Drying Shop Primer System <Insert drawing designation>:
- Prime Coat: Quick-dry primer for shop application.
  - Topcoat: [Dry fall, latex, flat] [Water-based dry fall for galvanized steel, flat] [Dry fall, latex, eggshell] [Dry fall, latex, semigloss].
9. Alkyd System <Insert drawing designation>:
- Prime Coat: [Alkyd quick-dry primer for metal] [Alkyd anticorrosive primer] [Shop primer specified in Section where substrate is specified].
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [eggshell] [semigloss] [gloss].
10. Alkyd over Surface-Tolerant Primer System <Insert drawing designation>:
- Prime Coat: Surface-tolerant metal primer.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [eggshell] [semigloss] [gloss].
11. Quick-Dry Enamel System <Insert drawing designation>:
- Prime Coat: Alkyd quick-dry primer for metal.
  - Intermediate Coat: Matching topcoat.
  - Topcoat: Interior, alkyd, [flat] [eggshell] [semigloss] [gloss].
12. Alkyd Dry-Fall System <Insert drawing designation>:
- Prime Coat: [Alkyd quick-dry primer for metal] [Alkyd anticorrosive primer] [Shop primer specified in Section where substrate is specified].
  - Topcoat: Alkyd, dry fall, [flat] [eggshell] [semigloss].
13. Alkyd Dry Fall over Quick-Drying Primer System <Insert drawing designation>:

- a. Prime Coat: Quick-dry primer for shop application.  
b. Topcoat: Alkyd, dry fall, [flat] [eggshell] [semigloss].
14. Aluminum Paint System:  
a. Prime Coat: Alkyd quick-dry primer for metal.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Aluminum paint.
- G. Galvanized-Metal Substrates:
1. Latex System :
- a. Prime Coat: Cementitious galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Interior, latex, low sheen .
2. Institutional Low-Odor/VOC Latex System :
- a. Prime Coat: Water-based galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Interior, latex, institutional low odor/VOC, low sheen.
3. High-Performance Architectural Latex System :
- a. Prime Coat: Water-based galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.
4. Water-Based Light-Industrial Coating System :
- a. Prime Coat: Cementitious galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Interior, water-based, light-industrial coating, eggshell.
5. Water-Based Dry-Fall System :
- a. Prime Coat: Matching topcoat.  
b. Topcoat: Water-based dry fall for galvanized steel, flat.
6. Alkyd over Cementitious Primer System :
- a. Prime Coat: Cementitious galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Interior, alkyd, eggshell.
7. Alkyd Dry-Fall System (Cementitious Primer) <Insert drawing designation>:
- a. Prime Coat: Cementitious galvanized primer.  
b. Topcoat: Alkyd, dry fall, [flat] [eggshell] [semigloss].
8. Aluminum Paint System <Insert drawing designation>:
- a. Prime Coat: Cementitious galvanized primer.  
b. Intermediate Coat: Matching topcoat.  
c. Topcoat: Aluminum paint.
- H. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Latex System <Insert drawing designation>:
- a. Prime Coat: Quick-dry primer for aluminum.

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03/28/2023 6:52:46 PM

- b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].
2. Institutional Low-Odor/VOC Latex System <Insert drawing designation>:
    - a. Prime Coat: Quick-dry primer for aluminum.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, institutional low odor/VOC, [flat] [low sheen] [eggshell] [satin] [semigloss] [gloss].
  3. High-Performance Architectural Latex System <Insert drawing designation>:
    - a. Prime Coat: Quick-dry primer for aluminum.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, high-performance architectural coating, [low sheen] [eggshell] [satin] [semigloss].
  4. Water-Based Light-Industrial Coating System <Insert drawing designation>:
    - a. Prime Coat: Quick-dry primer for aluminum.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, water-based, light-industrial coating, [eggshell] [semigloss] [gloss].
  5. Alkyd System <Insert drawing designation>:
    - a. Prime Coat: Primer, [Vinyl wash primer] [Quick-dry primer for aluminum].
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, alkyd, eggshell.
- I. Exposed Wood Framing:
1. Latex over Latex Primer System :
    - a. Prime Coat: Interior latex primer for wood.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, low sheen .
  2. Latex over Alkyd Primer System :
    - a. Prime Coat: Interior alkyd primer sealer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, low sheen .
  3. Institutional Low-Odor/VOC Latex System :
    - a. Prime Coat: Interior latex primer for wood.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, institutional low odor/VOC, low sheen.
  4. High-Performance Architectural Latex System:
    - a. Prime Coat: Interior latex primer for wood.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.
  5. Alkyd System :

- a. Prime Coat: Interior alkyd primer sealer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, alkyd, eggshell.

J. Finish Carpentry: Wood trim.

1. Latex over Latex Primer System:

- a. Prime Coat: Interior latex primer for wood.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, low sheen .

2. Latex over Alkyd Primer System:

- a. Prime Coat: Interior alkyd primer sealer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, low sheen .

3. Institutional Low-Odor/VOC Latex System :

- a. Prime Coat: Interior latex primer for wood.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, institutional low odor/VOC, low sheen.

4. High-Performance Architectural Latex System:

- a. Prime Coat: Interior latex primer for wood.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

5. Water-Based Light-Industrial Coating System Insert drawing designation:

- a. Prime Coat: Interior alkyd primer sealer.
- b. Topcoat: Interior, water-based, light-industrial coating, eggshell.

6. Water-Based Alkyd System :

- a. Prime Coat: Interior latex primer for wood.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Water-based alkyd, gloss.

7. Alkyd System :

- a. Prime Coat: Interior alkyd primer sealer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, alkyd, eggshell.

K. Spray-Textured Ceiling Substrates:

1. Latex, Flat System: Spray applied :

- a. Prime Coat: Matching topcoat.
- b. Topcoat: Interior, latex, flat.

2. Latex System: Spray applied:

- a. Prime Coat: Matching topcoat.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Interior, latex, low sheen .

3. Latex over Alkyd Sealer System:

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03/28/2023 6:52:46 PM

- a. Prime Coat: Interior alkyd primer sealer
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, low sheen .
4. Alkyd, Flat System:
- a. Prime Coat: Matching topcoat.
  - b. Topcoat: Interior, alkyd, flat.
5. Alkyd over Alkyd Sealer System:
- a. Prime Coat: Interior alkyd primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, alkyd, eggshell.
- L. Plaster Substrates:
1. Latex over Latex Sealer System:
- a. Prime Coat: Interior latex primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, eggshell .
2. Latex over Alkyd Primer System (for Plaster Only):
- a. Prime Coat: Interior alkyd primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, eggshell .
3. Institutional Low-Odor/VOC Latex System:
- a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.
4. High-Performance Architectural Latex System:
- a. Prime Coat: Interior latex primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.
5. Water-Based Light-Industrial Coating System:
- a. Prime Coat: Interior latex primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, water-based, light-industrial coating, eggshell.
6. Alkyd over Latex Sealer System :
- a. Prime Coat: Interior latex primer sealer.
  - b. Intermediate Coat: Matching topcoat.
  - c. Topcoat: Interior, alkyd, eggshell.

END OF SECTION

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SECTION 099600 - HIGH-PERFORMANCE COATINGS

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## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

## 1. Exterior Substrates:

- a. Concrete, vertical surfaces.
- b. Clay masonry.
- c. Concrete masonry units (CMUs).
- d. Steel.
- e. Galvanized metal.
- f. Aluminum (not anodized or otherwise coated).
- g. Wood.

## 2. Interior Substrates:

- a. Concrete, vertical surfaces.
- b. Cement board.
- c. Clay masonry.
- d. Concrete masonry units (CMUs).
- e. Steel.
- f. Galvanized metal.
- g. Aluminum (not anodized or otherwise coated).
- h. Wood.
- i. Gypsum board.
- j. Plaster.

## 1.2 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

## 1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
  - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
  - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Fiber-Cement Board: 12 percent.
  3. Masonry (Clay and CMUs): 12 percent.
  4. Wood: 15 percent.
  5. Gypsum Board: 12 percent.
  6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.



D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

### 3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

### 3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy System MPI EXT 3.1D:

- a. Prime Coat: Epoxy, matching topcoat.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.

2. Epoxy-Modified Latex System MPI EXT 3.1E:

- a. Prime Coat: Epoxy-modified latex, matching topcoat.
- b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
- c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
- d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.

3. Pigmented Polyurethane over Epoxy System MPI EXT 3.1M:

- a. Prime Coat: Epoxy, matching intermediate coat.
- b. Intermediate Coat: Epoxy, gloss, MPI #77.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

B. Concrete Substrates, Horizontal Surfaces:

1. Epoxy Non-Slip Deck Coating System MPI EXT 3.2C:

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Epoxy deck coating (slip resistant), MPI #82.

C. Clay Masonry Substrates:

1. Epoxy System MPI EXT 4.1D:

- a. Prime Coat: Epoxy, matching topcoat.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.

2. Pigmented Polyurethane over Epoxy System MPI EXT 4.1J:

- a. Prime Coat: Epoxy, matching intermediate coat.
- b. Intermediate Coat: Epoxy, gloss, MPI #77.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

D. CMU Substrates:

1. Epoxy System MPI EXT 4.2E:

- a. Block Filler: Block filler, epoxy, MPI #116.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.

2. Pigmented Polyurethane over High-Build Epoxy System MPI EXT 4.2G:

- a. Block Filler: Block filler, epoxy, MPI #116.
- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

E. Steel Substrates:

1. Epoxy System MPI EXT 5.1F:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. Topcoat: Epoxy, gloss, MPI #77.

2. Epoxy Deck Coating over Epoxy Primer and High-Build Epoxy System MPI EXT 5.1V:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. Topcoat: Epoxy deck coating, MPI #82.

3. Pigmented Polyurethane over Epoxy System MPI EXT 5.1H:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Epoxy, gloss, MPI #77.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

4. Pigmented Polyurethane over High-Build Epoxy System MPI EXT 5.1J:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
5. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System MPI EXT 5.1P:
- a. Prime Coat: Primer, zinc rich, epoxy, MPI #20.
- b. Intermediate Coat: Epoxy, gloss, MPI #77.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
6. Pigmented Polyurethane over Epoxy Zinc-Rich Primer and High-Build Epoxy System MPI EXT 5.1G:
- a. Prime Coat: Primer, zinc rich, epoxy, MPI #20.
- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- F. Galvanized-Metal Substrates:
1. Epoxy System MPI EXT 5.3C:
- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.
2. Pigmented Polyurethane over Epoxy Primer System MPI EXT 5.3L:
- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- b. Intermediate Coat: Polyurethane, two component, pigmented, gloss matching topcoat.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
3. Pigmented Polyurethane over Vinyl Wash Primer and Epoxy Primer System MPI EXT 5.3D:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
- b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- G. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Epoxy System MPI EXT 5.4E:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.
2. Pigmented Polyurethane over Epoxy System MPI EXT 5.4B:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
- b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- H. Wood Substrates: Glued-laminated construction.

1. Pigmented Polyurethane System MPI EXT 6.1J:
- Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- I. Wood Substrates: Exposed framing.
1. Pigmented Polyurethane System MPI EXT 6.2J:
- Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- J. Wood Substrates: Wood trim
1. Pigmented Polyurethane System MPI EXT 6.3H:
- Prime Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.
  - Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- 3.5 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE
- A. Concrete Substrates, Vertical Surfaces:
1. Epoxy System MPI INT 3.1F:
- Prime Coat: Epoxy, matching topcoat.
  - Intermediate Coat: Epoxy, matching topcoat.
  - Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy, High-Build System MPI INT 3.1P:
- Prime Coat: High-build epoxy, matching topcoat (reduced).
  - Intermediate Coat: High-build epoxy, matching topcoat.
  - Topcoat: High-build epoxy, low gloss, MPI #108.
  - Topcoat: High-build epoxy, gloss, MPI #98.
3. Epoxy-Modified Latex System MPI INT 3.1G:
- Prime Coat: Epoxy-modified latex, matching topcoat.
  - Intermediate Coat: Epoxy-modified latex, matching topcoat.
  - Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
  - Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.
- B. Concrete Substrates, Horizontal Surfaces.
1. Epoxy System MPI INT 3.2C:
- Prime Coat: Epoxy, matching topcoat.

- b. Intermediate Coat: Epoxy, matching topcoat.  
c. Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy, High-Build System MPI INT 3.2L:  
a. Prime Coat: High-build epoxy, matching topcoat (reduced).  
b. Intermediate Coat: High-build epoxy, matching topcoat.  
c. Topcoat: High-build epoxy, low gloss, MPI #108.  
d. Topcoat: High-build epoxy, gloss, MPI #98.
3. Pigmented Polyurethane System MPI INT 3.2D:  
a. Prime Coat: Epoxy, gloss, MPI #77.  
b. Intermediate Coat: Polyurethane, two component, pigmented, gloss, matching topcoat.  
c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
4. Clear (Two-Component) Polyurethane System MPI INT 3.2K:  
a. Prime Coat: Two-component polyurethane matching topcoat.  
b. Intermediate Coat: Two-component polyurethane, matching topcoat.  
c. Topcoat: Varnish, aliphatic polyurethane, two component (MPI Gloss Level 6 or MPI Gloss Level 7), MPI #78.
- C. Cement Board Substrates:
1. Epoxy System MPI INT 3.3E:  
a. Prime Coat: Epoxy, matching topcoat.  
b. Intermediate Coat: Epoxy, matching topcoat.  
c. Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy-Modified Latex System MPI INT 3.3D:  
a. Prime Coat: Epoxy-modified latex, matching topcoat.  
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.  
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.  
d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.
- D. Clay Masonry Substrates:
1. Epoxy System MPI INT 4.1F:  
a. Prime Coat: Epoxy, matching topcoat.  
b. Intermediate Coat: Epoxy, matching topcoat.  
c. Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy-Modified Latex System MPI INT 4.1G:  
a. Prime Coat: Epoxy-modified latex, matching topcoat.  
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.  
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.  
d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.
3. Clear (Two-Component) Polyurethane System MPI INT 4.1K:  
a. Prime Coat: Two-component polyurethane, matching topcoat.  
b. Intermediate Coat: Two-component polyurethane, matching topcoat.  
c. Topcoat: Varnish, aliphatic polyurethane, two component (MPI Gloss Level 6 or MPI Gloss Level 7), MPI #78.

## E. CMU Substrates:

1. Epoxy System MPI INT 4.2F:
  - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
  - b. Block Filler: Block filler, epoxy, MPI #116.
  - c. Intermediate Coat: Epoxy, matching topcoat.
  - d. Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy, High-Build System MPI INT 4.2R:
  - a. Prime Coat: Epoxy block filler, MPI #116.
  - b. Intermediate Coat: High-build epoxy, matching topcoat.
  - c. Topcoat: High-build epoxy, low gloss, MPI #108.
  - d. Topcoat: High-build epoxy, gloss, MPI #98.
3. Epoxy-Modified Latex System MPI INT 4.2J:
  - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
  - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
  - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
  - d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.

## F. Steel Substrates:

1. Epoxy System MPI INT 5.1L:
  - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.
2. High-Build Epoxy over Epoxy Zinc-Rich Primer System MPI INT 5.1P:
  - a. Prime Coat: Primer, zinc-rich, epoxy, MPI #20.
  - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
  - c. Topcoat: Epoxy, gloss, MPI #77.
  - d. Topcoat: Epoxy, high-build, low gloss, MPI #108.
3. Epoxy, High-Build System MPI INT 5.1Y:
  - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - b. Intermediate Coat: High-build epoxy, matching topcoat.
  - c. Topcoat: High-build epoxy, low gloss, MPI #108.
  - d. Topcoat: High-build epoxy, gloss, MPI #98.
4. Epoxy Deck Coating System MPI INT 5.1LL:
  - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - b. Intermediate Coat: Epoxy, gloss, MPI #77.
  - c. Topcoat: Epoxy deck coating (slip resistant), MPI #82.
5. Epoxy-Modified Latex System MPI INT 5.1K:
  - a. Prime Coat: Primer, rust inhibitive, water based, MPI #107.
  - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
  - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
  - d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.
6. Pigmented Polyurethane over Epoxy Primer System MPI INT 5.1F:
  - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

- b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
  - c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
7. Pigmented Polyurethane over High-Build Epoxy System MPI INT 5.1G:
- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - b. Intermediate Coat: Epoxy, high build, MPI #108.
  - c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
8. Pigmented Polyurethane over Epoxy Zinc-Rich and Epoxy System MPI INT 5.1J:
- a. Prime Coat: Primer, zinc rich, epoxy, MPI #20.
  - b. Intermediate Coat: Epoxy, gloss, MPI #77.
  - c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- G. Galvanized-Metal Substrates:
1. Epoxy over Epoxy Primer System MPI INT 5.3D:
- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.
2. Epoxy over Vinyl Wash Primer and Epoxy Primer System MPI INT 5.3E:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
  - b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
  - c. Topcoat: Epoxy, gloss, MPI #77.
- H. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Epoxy System MPI INT 5.4B:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.
2. Pigmented Polyurethane System MPI INT 5.4C:
- a. Prime Coat: Primer, vinyl wash, MPI #80.
  - b. Intermediate Coat: Epoxy, gloss, MPI #77.
  - c. Topcoat: Polyurethane, two-component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
- I. Wood Substrates: Glued-laminated construction.
1. Epoxy System MPI INT 6.1L:
- a. Prime Coat: Epoxy, matching topcoat.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.
2. Pigmented Polyurethane System MPI INT 6.1E:
- a. Prime Coat: Polyurethane, two component, pigmented, matching topcoat.

- b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

J. Wood Substrates: Wood trim .

- 1. Epoxy System MPI INT 6.3L:
  - a. Prime Coat: Epoxy, matching topcoat.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.

K. Plaster Substrates:

- 1. Epoxy System MPI INT 9.2E:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Intermediate Coat: Epoxy, matching topcoat.
  - c. Topcoat: Epoxy, gloss, MPI #77.
- 2. Epoxy, High-Build System MPI INT 9.2N:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Intermediate Coat: High-build epoxy, matching topcoat.
  - c. Topcoat: High-build epoxy, low gloss, MPI #108.
  - d. Topcoat: High-build epoxy, gloss, MPI #98.
- 3. Epoxy-Modified Latex System MPI INT 9.2F:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
  - c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
  - d. Topcoat: Epoxy-modified latex, gloss (MPI Gloss Level 6), MPI #115.

END OF SECTION



## SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - <Double click here to submit questions, comments, or suggested edits to this Section.>GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Dimensional characters.
  - a. Cast dimensional characters.
  - b. Cutout dimensional characters.
  - c. Fabricated channel dimensional characters.
  - d. Illuminated, fabricated channel dimensional characters.
  - e. Molded-plastic dimensional characters.
  - f. Illuminated, molded-plastic dimensional characters.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product.

## B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for adhesives.>

## C. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least [half size] <Insert scale>.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

## D. Samples: For each exposed product and for each color and texture specified.

## E. Delegated Design Submittal: For [signs indicated in "Performance Requirements" Article] &lt;Insert sign designations&gt;.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

## A. Maintenance data.

## 1.5 WARRANTY

## A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

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

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of [rooftop] [dimensional character] <Insert description> sign type(s) <Insert drawing designation of sign(s)> according to structural performance requirements.
- B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
- C. Thermal Movements: For exterior [fabricated channel dimensional characters] <Insert item>, allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces] <Insert temperature change>.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters <Insert drawing designation>: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Character Material: Cast [aluminum] [brass] [bronze] [zinc] <Insert material>.
  3. Character Height: [As indicated on Drawings] <Insert dimension>.
  4. Finishes:
    - a. Integral Metal Finish: [Mill] [Antique oxidized] [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from full range of industry finishes] <Insert finish>.
    - b. Integral Aluminum Finish: [Clear anodized] [Light bronze anodized] [Medium bronze anodized] [Match Architect's sample] [Anodized color as selected by Architect from full range of industry colors and color densities] <Insert finish>.
    - c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert color>.
    - d. Overcoat: [Manufacturer's standard baked-on clear coating] <Insert requirement>.
  5. Mounting: [As indicated on Drawings] [Concealed studs] [Projecting studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] <Insert requirement>.

- B. Cutout Characters <Insert drawing designation>: Characters with uniform faces; square-cut, smooth[, eased] edges; precisely formed lines and profiles; and as follows:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Character Material: Sheet or plate [aluminum] [brass] [bronze] [copper] [stainless steel] [zinc] [acrylic] <Insert material>.
  3. Character Height: [As indicated on Drawings] <Insert dimension>.
  4. Thickness: [As indicated on Drawings] [Manufacturer's standard for size of character] [0.125 inch] [0.25 inch] <Insert dimension>.
  5. Finishes:
    - a. Integral Metal Finish: [Mill] [Antique oxidized] [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from full range of industry finishes] <Insert finish>.
    - b. Integral Aluminum Finish: [Clear anodized] [Light bronze anodized] [Medium bronze anodized] [Match Architect's sample] [Anodized color as selected by Architect from full range of industry colors and color densities] <Insert finish>.
    - c. Integral Stainless Steel Finish: [No. 4] [No. 8] [Match Architect's sample] [As selected by Architect from full range of industry finishes] <Insert description>.
    - d. Integral Acrylic Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from full range of industry colors] <Insert color>.
    - e. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert color>.
    - f. Overcoat: [Manufacturer's standard baked-on clear coating] <Insert requirement>.
  6. Mounting: [As indicated on Drawings] [Concealed studs] [Projecting studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Concealed, painted aluminum back bar or bracket assembly] [Concealed, stainless steel back bar or bracket assembly] [Adhesive] <Insert requirement>.
- C. Fabricated Channel Characters <Insert drawing designation>: [Metal face and side returns] [Open face with metal side returns] [Translucent face with metal side returns], formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Illuminated Characters: [Backlighted] [Frontlighted] character construction with [fluorescent tube] [fiber-optic] [LED] [neon tube] <Insert requirement> lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
    - a. Power: [As indicated on electrical Drawings] [120 V, 60 Hz, 1 phase, 15 A] <Insert requirement>.
  3. Character Material: Sheet or plate [aluminum] <Insert material>.
  4. Translucent Face Sheet: Acrylic sheet with integral color [matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert color>.
  5. Character Height: [As indicated on Drawings] <Insert dimension>.
  6. Character Depth: [As indicated on Drawings] <Insert dimension>.
  7. Finishes:
    - a. Integral Metal Finish: [Mill] [Antique oxidized] [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from full range of industry finishes] <Insert finish>.
    - b. Integral Aluminum Finish: [Clear anodized] [Light bronze anodized] [Medium bronze anodized] [Match Architect's sample] [Anodized color as selected by Architect from full range of industry colors and color densities] <Insert finish>.
    - c. Integral Stainless Steel Finish: [No. 4] [No. 8] [Match Architect's sample] [As selected by Architect from full range of industry finishes] <Insert description>.
    - d. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert color>.
    - e. Overcoat: [Manufacturer's standard baked-on clear coating] <Insert requirement>.
  8. Mounting: [As indicated on Drawings] [Manufacturer's standard for size and design of character] [Projecting studs] [Concealed, painted aluminum back bar or bracket assembly] [Concealed, stainless steel back bar or bracket assembly] <Insert requirement>.
    - a. Hold characters at [2-inch distance] [manufacturer's recommended distance] [distance as selected by Architect] <Insert dimension> from wall surface.
- D. Molded-Plastic Characters <Insert drawing designation>: Characters having uniform faces and profiles, and as follows:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Illuminated Characters: Characters with concealed [fluorescent tube] [fiber-optic] [LED] [neon tube] lighting, including transformers, insulators, and other accessories; with provision for servicing and concealing connections to building electrical system. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
  - a. Power: [As indicated on electrical Drawings] [120 V, 60-Hz, 1 phase, 15 A] <Insert requirement>.
3. Color: Manufacturer's standard [integral color] [painted finish] process, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert color>.

### 2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Brass Castings: ASTM B584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C85200 (high-copper yellow brass)] <Insert requirement>.
- B. Brass Sheet (Yellow Brass): ASTM B36/B36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C26000 (yellow brass)] <Insert requirement>.
- C. Bronze Castings: ASTM B584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C86500 (No. 1 manganese bronze)] <Insert requirement>.
- D. Bronze Plate: ASTM B36/B36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C22000 (commercial bronze)] <Insert requirement>.
- E. Copper Sheet: ASTM B152/B152M.
- F. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [Type 304,] [Type 316,] stretcher-leveled standard of flatness.
- G. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

### 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. For exterior exposure, furnish [nonferrous-metal] [stainless steel] [or] [hot-dip galvanized] <Insert requirement> devices unless otherwise indicated.
  3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  4. Sign Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
  - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
  - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
1. <Double click to insert sustainable design text for VOC content of adhesive.>
  2. <Double click to insert sustainable design text for low emitting adhesives.>
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
  5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [to match sign-background color] [to match Architect's sample] <Insert requirement> color unless otherwise indicated.

2. Stainless Steel Brackets: Factory finish brackets [to match sign background] [to match Architect's sample] [with No. 4] <Insert finish> finish unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
  - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
  - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
  - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
  - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.

5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION



SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

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## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.
- B. Related Requirements:
  - 1. Section 101416 "Plaques" for one-piece, solid metal signs, with or without frames, that are used for high-end room-identification.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. <Double click to insert sustainable design text for adhesives.>
- C. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- D. Samples: For each exposed product and for each color and texture specified.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

## 2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to phenolic backing sheet to produce composite sheet.

- a. Composite-Sheet Thickness: 0.25 inch.
  - b. Surface-Applied Graphics: Applied vinyl film .
  - c. Subsurface Graphics: Reverse halftone or dot-screen image.
  - d. Color(s): As selected by Architect from manufacturer's full range.
2. Sign-Panel Perimeter: Finish edges smooth.
    - a. Edge Condition at Vertical Edges: Beveled.
    - b. Corner Condition in Elevation: Square.
  3. Mounting: Manufacturer's standard method for substrates indicated with countersunk flathead through fasteners .

### 2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

### 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
  3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
  4. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
  1. <Double click to insert sustainable design text for VOC content of adhesive.>
  2. <Double click to insert sustainable design text for low emitting adhesives.>
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

### 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION

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SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Phenolic-core toilet compartments.

## B. Related Requirements:

1. Section 061000 "Rough Carpentry" for overhead support of floor-and-ceiling-anchored compartments.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

## 1.2 ACTION SUBMITTALS

## A. Product data.

## B. Shop Drawings:

1. Plans, elevations, sections, details, and attachment details.

## C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

## D. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

## 1.3 CLOSEOUT SUBMITTALS

## A. Operation and maintenance data.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

## B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

## 2.2 PHENOLIC-CORE TOILET COMPARTMENTS

A. Toilet-Enclosure Style: Overhead braced .

B. Entrance-Screen Style: Overhead braced .

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).

E. Entrance-Screen Construction: Matching panel construction.

F. Urinal-Screen Construction: Matching panel construction.

G. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

H. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

I. Urinal-Screen Post: Manufacturer's standard post design of monolithic phenolic-core urinal screen cutout at bottom to form a post; with shoe and sleeve (cap) matching that on the pilaster.

J. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

2. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.

K. Phenolic Compartment Finish: Two colors in each room.

1. Dark-Core Phenolic: Manufacturer's standard dark color core and edge.

a. Facing Sheet Color: As selected by Architect from manufacturer's full range.

2. Through-Color Phenolic: Manufacturer's standard solid through-color.

a. Color: As selected by Architect from manufacturer's full range.

## 2.3 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.

1. Hinges: Manufacturer's stainless steel, surface-mounted, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

2. Latch and Keeper: Manufacturer's standard stainless steel, surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

3. Coat Hook: Manufacturer's standard stainless steel combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
  4. Door Bumper: Manufacturer's standard stainless steel, rubber-tipped bumper at outswinging doors.
  5. Door Pull: Manufacturer's standard stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

## 2.5 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- E. Floor-and-Ceiling-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

- F. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls, with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- G. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
    - a. Pilasters and Panels or Screens: 1/2 inch.
    - b. Panels or Screens and Walls: 1 inch.
  2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
  3. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- E. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.



F. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

### 3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

## SECTION 102116.17 - PHENOLIC-CORE SHOWER AND DRESSING COMPARTMENTS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Solid, phenolic-core compartments.
2. Shower receptors.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product.

## B. Shop Drawings: For shower and dressing compartments.

1. Include plans, elevations, sections, and attachment details.

## C. Samples: For each exposed product and for each color and texture specified.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Product certificates.

## 1.4 CLOSEOUT SUBMITTALS

## A. Maintenance data.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

## B. &lt;Double click to insert sustainable design text for recycled content.&gt;

## C. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for shower and dressing compartments designated as accessible.

## 2.2 PHENOLIC-CORE COMPARTMENTS

## A. Configuration: Shower and dressing compartments.

## B. Enclosure Style: Overhead braced.

## C. Panel and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused together during panel manufacture (not separately laminated) and with eased and polished edges. Provide minimum 3/4-inch- thick pilasters and minimum 1/2-inch- thick panels.

## D. Door Construction: Match panels; 3/4-inch minimum thickness.

## E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 3 inches high, finished to match hardware.

## F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
2. Stirrup Type: Ear or U-brackets; clear-anodized aluminum .

3. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Section 102113.17 "Phenolic-Core Toilet Compartments."

G. Phenolic-Panel Finish:

1. Facing Sheet Finish: Two colors and patterns in each room.
2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.

## 2.3 SHOWER RECEPTORS

- A. General: Manufacturer's standard, prefabricated, terrazzo receptor complete with integral drain.

1. Provide each unit with a ramped entrance surface for accessible compartments.
2. Drain Strainer: Manufacturer's standard; removable.
3. Drain Gasket: Manufacturer's standard gasket sized to fit waste pipe.

- B. Finish: Manufacturer's standard finish on exposed surfaces, as selected by Architect from manufacturer's full range and with slip-resistant floor surface texture.

## 2.4 ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's standard design, heavy-duty, operating hardware and accessories.

1. Material: Clear-anodized aluminum.
2. Hinges: Manufacturer's standard, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard, recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at each compartment, accessible or not.
4. Clothing Hooks: Manufacturer's standard clothing hooks in each dressing compartment; include one combination hook and rubber-tipped bumper at inswinging doors, sized to prevent door from hitting wall panel or compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard, rubber-tipped bumper at outswinging doors.
6. Door Pull: Manufacturer's standard unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

- B. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with antigrip profile; in manufacturer's standard finish.

- C. Headrail with Hooks: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.

- D. Curtain Rod with Hooks: Manufacturer's standard, 1-inch- diameter, stainless steel curtain rod with matching hooks.

- E. Curtain: Flame-resistant, polyester-reinforced vinyl fabric that is stain resistant, self-sanitizing, antistatic, antimicrobial, and launderable to a temperature of not less than 90 deg F.
1. Flame Resistance: Passes NFPA 701 tests when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
  2. Labeling: Identify fabrics with appropriate markings of applicable testing and inspecting agency.
  3. Length: Where curtain extends to a floor surface, size so that bottom hem clears finished floor by not more than 1 inch and not less than 1/2 inch above floor surface. Where curtains extend to a shower-receptor curb, size so that bottom hem hangs above curb line and clears curb line by not more than 1/2 inch.
  4. Color and Pattern: As selected by Architect from manufacturer's full range.
- F. Soap Holder: Surface-mounted, seamless stainless steel soap dish.
- G. Seats: Manufacturer's standard, wall-mounted benches.
1. Material: Solid phenolic.
  2. Operation: Fixed.
  3. Finish: As selected by Architect from manufacturer's full range.
- H. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel, chrome-plated steel, or solid brass, finished to match the items they are securing; with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications.

## 2.5 FABRICATION

- A. Overhead-Braced Compartments: Manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.
- B. Floor-and-Ceiling-Anchored Compartments: Manufacturer's standard, corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Door Sizes and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard shower and dressing compartments, and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.
1. Clearances for Dressing Compartments: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.

2. Stirrup Brackets for Dressing Compartments: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
  3. Full-Height (Continuous) Brackets for Dressing Compartments: Secure panels to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Curtains: Install curtains to specified length, and verify that they hang vertically without stress points or diagonal folds.
- C. Shower Receptors: Install prefabricated shower receptors with drain gasket compression fit to OD of waste pipe.

### 3.2 ADJUSTING

- A. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.
- B. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.
4. Underlavatory guards.
5. Custodial accessories.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each finish specified, full size.
  1. Approved full-size Samples will be returned and may be used in the Work.
- C. Delegated Design Submittal: For grab bars and shower seats.
  1. Include structural design calculations indicating compliance with specified structural-performance requirements.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.5 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: 15 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 250 lbf applied in any direction and at any point.

## 2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser :

1. Description: Double-roll dispenser.
2. Mounting: Partition mounted, serving two adjacent toilet compartments.
3. Operation: Noncontrol delivery with theft-resistant spindle.
4. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Paper Towel (Folded) Dispenser :

1. Mounting: Surface mounted.
2. Minimum Capacity: 600 C-fold or 800 multifold towels.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Lockset: Tumbler type.
5. Refill Indicator: Pierced slots at sides or front.

C. Waste Receptacle:

1. Mounting: Wall mounted for corner installation.
2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
3. Lockset: Tumbler type for waste receptacle.

D. Soap Dispenser :

1. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
2. Mounting: Vertically oriented, surface mounted.
3. Lockset: Tumbler type.
4. Refill Indicator: Window type.

E. Grab Bar :

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
3. Outside Diameter: 1-1/4 inches.
4. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit :

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Mirror Unit :

1. Frame: Stainless steel channel.
  - a. Corners: Welded and ground smooth.
2. Size: As indicated on Drawings.
3. Shelf:
  - a. Type: Integral, welded.
  - b. Depth: 5 inches.

#### H. Fixed Height Adult Changing Station :

1. Description: Horizontal unit that opens by folding down from stored position and with adjustable strap.
  - a. Engineered to support minimum of 400-lb static load when opened.
2. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
3. Operation: By pneumatic shock-absorbing mechanism.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.

### 2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

#### A. Shower Curtain Rod :

1. Description: 1-1/4-inch- outside diameter, straight rod.
2. Mounting Flanges: Concealed fasteners; in manufacturer's standard material and finish.
3. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

#### B. Shower Curtain:

1. Size: Minimum 6 inches wider than opening by 72 inches high.
2. Material: Nylon-reinforced vinyl, minimum 9 oz. or 0.008-inch- thick vinyl, with integral antibacterial and flame-retardant agents.
3. Color: As selected from manufacturer's full range.
4. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
5. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

#### C. Folding Shower Seat :

1. Configuration: L-shaped seat, designed for wheelchair access.
2. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect .
3. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

#### D. Soap Dish:

1. Description: Surface mounted, with the following features:
  - a. Washcloth bar.
2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).



## E. Robe Hook :

1. Description: Single-prong unit.
2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

## 2.4 CHILDCARE ACCESSORIES

## A. Diaper-Changing Station :

1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
  - a. Engineered to support minimum of 250-lb static load when opened.
2. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
3. Operation: By pneumatic shock-absorbing mechanism.
4. Material and Finish: HDPE in manufacturer's standard color.
5. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

## 2.5 UNDERLAVATORY GUARDS

## A. Underlavatory Guard :

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

## 2.6 CUSTODIAL ACCESSORIES

## A. Custodial Utility Shelf :

1. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
2. Size: .
3. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, ASTM A480/A480M No. 4 finish (satin).

## B. Custodial Mop and Broom Holder :

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
  - b. Rod: Approximately 1/4-inch- diameter stainless steel.

## 2.7 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION

## SECTION 104413 - FIRE PROTECTION CABINETS

## PART 1 - GENERAL

## 1.1 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Miter corners and grind smooth.
  - 3. Provide factory-drilled mounting holes.
  - 4. Prepare doors and frames to receive locks.
  - 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  - 2. Fabricate door frames of one-piece construction with edges flanged.
  - 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.

- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for hose valves and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  2. Provide inside latch and lock for break-glass panels.
  3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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## SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

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

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

## 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

- B. Stored-Pressure Water Type: UL-rated 2-A, 2.5-gal. nominal capacity, with water in stainless-steel container; with pressure-indicating gage.

- C. Stored-Pressure Antifreeze Water Type: UL-rated 2-A, 2.5-gal. nominal capacity, with water and approved antifreeze solution mixed for temperatures as low as minus 40 deg F in stainless-steel container; with pressure-indicating gage.

- D. Stored-Pressure Water-Mist Type: UL-rated 2-A:C, 2.5-gal. nominal capacity, with water in enameled-steel container; with pressure-indicating gage.
- E. Regular Dry-Chemical Type: UL-rated nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.
- F. Multipurpose Dry-Chemical Type: UL-rated nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
- G. Carbon Dioxide Type: UL-rated 10-B:C, 10-lb nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal container.
- H. Clean-Agent Type in Steel Container: UL-rated 1-A:10-B:C, 10-lb nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

### 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION

SECTION 105113 - METAL LOCKERS

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## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Welded athletic lockers.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product.

## B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Include locker identification system and numbering sequence.

## C. Samples: For each color specified.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

## A. Maintenance data.

## 1.5 WARRANTY

## A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

## 2.2 WELDED ATHLETIC LOCKERS

## A. &lt;Double click here to find, evaluate, and insert list of manufacturers and products.&gt;

## B. Perforated Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.



- C. Expanded-Metal Doors: Fabricated from 0.090-inch nominal-thickness expanded metal; welded to 0.105-inch nominal-thickness steel angle frame; with 0.090-inch nominal-thickness, steel sheet lock panel backed by 0.060-inch nominal-thickness, steel sheet retainer welded to door frame.
- D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops and Bottoms: 0.060-inch nominal thickness, with single bend at edges.
  2. Backs: 0.048-inch nominal thickness.
  3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.
- E. Unperforated Sides: Fabricated from [0.048-inch] [0.060-inch] nominal-thickness steel sheet.
- F. Perforated Sides: Fabricated from 0.060-inch nominal-thickness steel sheet with manufacturer's standard diamond perforations.
- G. Expanded-Metal Sides: Fabricated from 0.090-inch nominal-thickness expanded metal; welded to 0.105-inch nominal-thickness steel angles or 0.060-inch nominal-thickness steel channel frames.
- H. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet or 0.097-inch nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
- I. Reinforced Bottoms: Structural channels, formed from [0.060-inch] [0.075-inch] nominal-thickness steel sheet; welded to front and rear of side-panel frames.
- J. Hinges:
1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
  2. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
  3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- K. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking.
    - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
    - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism.
  2. Single-Point Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

- a. Latch Hook: Equip each door with one latch hook.
- L. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- M. Door Handle and Latch for Box Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
- N. Locks: Cylinder locks.
- O. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- P. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.
- Q. Coat Rods: Manufacturer's standard.
- R. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
1. Provide closed front and end bases.
- S. Continuous Zee Base: 4 inches high; fabricated from 0.075-inch nominal-thickness steel sheet.
- T. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
1. Closures: Vertical -end type.
- U. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- V. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- W. Boxed End Panels: Fabricated from 0.060-inch nominal-thickness steel sheet.
- X. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- Y. Materials:
1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
  2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.
  3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch steel mesh, with at least 70 percent open area.
  4. <Double click to insert sustainable design text for recycled content.>
- Z. Finish: Baked enamel or powder coat.
1. Color: As selected by Architect from manufacturer's full range.

## 2.3 LOCKS

- A. Cylinder Lock: Built-in, flush, cam lock with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two master keys.
1. Key Type: Flat , with minimum 2- by 2.68-inch key head for accessible lockers.
  2. Bolt Operation: automatically locking spring bolt.

B. Built-in, Card-Operated Lock: Self-contained units mounted on interior of door with replaceable lock cylinders keyed separately and master keyed. Mount instruction decals on both door faces. Furnish one change card key for each lock and one master card key.

1. Bolt Operation: automatically locking spring bolt.

C. Digital Keypad Lock: Battery-powered electronic keypad with reprogrammable manager and owner codes that override access. Three consecutive incorrect code entries will disable lock for three minutes.

1. Designed for permanently assigned access via entry of user's four-digit code.

2. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

## 2.4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

3. Triple-Tier Units: One double-prong ceiling hook.

4. Coat Rods: In lieu of ceiling hook for metal lockers 24 inches high or more.

D. Knocked-Down Construction: Fabricate metal lockers by preassembling at plant prior to shipping, using manufacturer's nuts, bolts, screws, or rivets.

E. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

F. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

G. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

- I. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.
- J. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- L. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
- M. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- N. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
  - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach recess trim to recessed metal lockers with concealed clips.
  - 2. Attach filler panels with concealed fasteners.
  - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
  - 4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
  - 5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart.

END OF SECTION

## SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Roll-up rail mats.
2. Resilient entrance mats.
3. Surface-mounted frames.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product.

## B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings and frames.
4. Custom Graphics: Scale drawing indicating colors.

## C. Samples: For each exposed product and for each color and texture specified.

## 1.3 CLOSEOUT SUBMITTALS

## A. Maintenance data.

## PART 2 - PRODUCTS

## 2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

## A. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

## 2.2 ROLL-UP RAIL MATS

## A. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 3/8 inch thick, sitting on continuous vinyl cushions.

1. Tread Inserts: Textured-surface, resilient vinyl.
2. Colors, Textures, and Patterns of Inserts: As selected by Architect from full range of industry colors.
3. Rail Color: As selected by Architect from full range of industry colors and color densities.
4. Hinges: Aluminum.

## B. Roll-up, Vinyl-Rail Hinged Mats: Vinyl-acrylic tread rails 1-1/2 inches wide by 3/8 inch thick, with slotted or perforated hinges.

1. Tread Inserts: Ribbed-design-surface, resilient vinyl.
2. Colors, Textures, and Patterns of Inserts: As selected by Architect from full range of industry colors.
3. Rail Color: As selected by Architect from full range of industry colors.
4. Hinges: Aluminum.

### 2.3 RESILIENT ENTRANCE MATS

- A. Resilient Link Mats: Reversible rubber link mats, 7/16 inch thick, with stainless-steel wire link rods, vulcanized edge-nosing trim, steel-reinforced end trim, and links consisting of rectangular units or continuous strips in an open-weave pattern.
1. Color: As selected by Architect from full range of industry colors.
- B. Rubber Mats: 3/8-inch- thick mats; with beveled edges for surface applications and with perforated style, 1/4-inch diameter on standard spacing, standard wide-wale corrugated top profile, and standard knob-base bottom surface.
1. Color: As selected by Architect from full range of industry colors.
- C. Cocoa Mats: Constructed from cocoa fiber yarn permanently bonded to PVC backing for dimensional stability and resistance to shedding; 1-inch overall thickness; 2.0-lb/sq. ft. weight.
1. Color: As selected by Architect from full range of industry colors.
- D. Rubber-Tire Mats: Units of edge-grain-laminated and chenille-buffed, rubber-tire wall cuts; bonded to sheet rubber or other durable flexible backing sheet to form 3/8- to 7/16-inch- thick, 12-inch- wide, continuous linear strip up to 25 feet long.
- E. Carpet-Type Mats: Nylon carpet bonded to 1/8- to 1/4-inch- thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.
1. Colors, Textures, and Patterns: As selected by Architect from full range of industry colors.
- F. Graphics: Custom inlaid or woven-in graphic logo, as indicated.

### 2.4 FRAMES

- A. Recessed Frames: Manufacturer's standard extrusion.
1. Extruded Aluminum: ASTM B221.
    - a. Color: As selected by Architect from full range of industry colors and color densities.
- B. Surface-Mounted Frames:
1. Tapered Frames: Tapered aluminum frame members, not less than 1-1/2 inches wide, attached to mat at all four edges, with welded mitered corners.
    - a. Vinyl Color: As selected by Architect from full range of industry colors.
    - b. Aluminum Color: As selected by Architect from full range of industry colors and color densities.

## 2.5 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
- B. Install surface-type units to comply with manufacturer's written instructions; coordinate with entrance locations and traffic patterns.

### 3.2 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

## SECTION 131100 - SWIMMING POOL CONTRACTOR GENERAL REQUIREMENTS

## PART 1 - GENERAL

## 1.1 REFERENCE

- A. Requirements in Addenda, Alternates and Conditions collectively apply to this work.

## 1.2 SUMMARY

- A. Principal Work Items Are:

1. Pool Contractor Qualifications and Responsibilities.

- B. Related Work Specified Elsewhere:

1. Section 131105 - Swimming Pool Required Testing and Inspections
2. Section 131109 - Start-Up
3. Section 131110 - Swimming Pool Recirculation Equipment
4. Section 131111 - Swimming Pool Piping
5. Section 131115 - Swimming Pool Deck Equipment
6. Section 131116 - Swimming Pool Underwater Lights
7. Section 131120 - Swimming Pool Cast-In-Place Concrete
8. Section 131121 - Swimming Pool Cast-In-Place Deck Concrete
9. Section 131122 - Swimming Pool Shotcrete
10. Section 131125 - Swimming Pool Cementitious Waterproofing
11. Section 131130 - Swimming Pool Sealants and Caulking
12. Section 131140 - Swimming Pool Plaster
13. Section 131145 - Swimming Pool Trim Tile

## 1.3 CONTRACTOR'S ALTERNATE PROPOSAL

- A. Contractor shall submit his bid to the owner based on materials, equipment and methods as specified in this section. No substitutions of material will be allowed.
- B. It is the intent of the contract documents to encourage competition. The base proposal must be on providing the construction methods and equipment as specified and detailed. Any proposed system substitution must have prior written approval by the Architect.
- C. If there is any deviation from the basis of design equipment it is the responsibility of the contractor to confirm that all engineering criteria are appropriate for the substituted equipment.
- D. All proposed substitutions of specified construction methods and equipment shall include a complete submittal as required by these specifications and drawings of appropriate scale incorporating all required changes. The Contractor shall provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.



E. Any changes or modifications to the contract documents that are not authorized by the Owner or Architect shall be the sole responsibility of the Contractor.

#### 1.4 SUBMITTALS

A. Refer to Division 1 for submittal requirements.

#### 1.5 POOL CONTRACTOR QUALIFICATIONS

A. It is the intent of the Owner to award this Contract based on the specific experience and financial means required to complete the specified swimming pool system. The successful bidder must be regularly engaged in the construction of commercial pools. Each bidding Contractor shall demonstrate their specific experience and competency by complying with the following requirements.

1. The Pool Contractor must provide a written statement from an approved bonding company certifying that the Contractor can qualify for 100% Performance and Labor - Material Bonds on this Project.
2. The Pool Contractor shall provide evidence of having a Contractor's License A or higher in the state of the project location.
3. The Pool Contractor shall show evidence of having adequate experience in constructing commercial pools. In order to be considered for this Project the Pool Contractor must have completed within the last five years at least five (5) public use 25-Yard size pools with a shotcrete structure with tile and plaster finish and a perimeter overflow gutter in conjunction with a self-modulating surge and balance tank system. All these pools shall have been in operation for at least one year. Submit a list of such projects with the name, address, and current telephone number of the Owner and Architect for reference.
4. The Pool Contractor shall have completed at least three (3) additional major commercial pool projects (no less than 25-Yards) within the last 5 years. Submit a list of such projects with the name, address, project cost, and current telephone number of the Owner and Architect for reference.
5. Cast-In-Place Concrete construction in lieu of Shotcrete construction is not acceptable and pools built of Cast-In-Place Concrete will not be considered in assessing the required experience of the Pool Contractor.

#### 1.6 POOL CONTRACTOR RESPONSIBILITIES

A. It is the intent of this section to place the entire responsibility for the construction of the pool (including the construction of the pool shell and structures) under one vested Contractor. Under this section the Pool Contractor will provide but is not necessarily limited to the following:

1. Providing labor, material, management and coordination of own personnel and specialty subcontractors experienced in commercial pool building to produce a functioning Swimming Pool including structure and equipment ready for public use upon completion of the Work. Remove equipment from premises when no longer required.

2. Provide, at a minimum, final fine excavation and maintaining the integrity of the vertical cut where utilized. If a vertical cut is not possible or where the integrity of the vertical cut is compromised, the pool contractor shall be responsible for costs associated with back fill and placement of materials.
3. Construct the shotcrete pool shell(s) as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, main drain sumps and all embedded items (piping, anchors, etc.) for the pool. Reference Section 131120 - Cast-in-Place Concrete and 131122 - Shotcrete. Before commencing the placement of concrete, verify electrical bonding of the pools embedded items and reinforcing steel. Also, coordinate and arrange any required electrical, plumbing and or building inspections. Provide any structure drainage around the pool as shown on the drawings. Backfill and compact fill around the pool structure, piping trenches and excavations required by this work. Reference Division 31 - Earthwork.
4. If the integrity of the pool shell is in question due to the placement of shotcrete or concrete, prior to pool finish installation, the pool may be tested for water tightness according to procedures stated in ACI 350.1 / AWWA 400. Owner is responsible for providing water for the initial fill. The Contractor shall be responsible for associated costs of providing water for any subsequent fillings due to failure of water tightness test. Reference Section 131105 - Swimming Pool Required Testing and Inspections.
5. Furnish and install a plaster finish in the pool with a slip resistant surface per Specification Section 131140 - Swimming Pool Plaster. Furnish and install specialty tile for the perimeter tile deck band, gutter nosing, wall targets, recessed steps, floor lane markings, depth markings and warning signs, and all other tile installation within the pool structures. Reference Section 131146 - Swimming Pool Finish Tile - including the tolerance requirements for the concrete substrate.
6. Provide Swimming Pool sealants and caulking. Reference Section 131130 - Swimming Pool Sealants and Caulking
7. Provide Cementitious Waterproofing for pool main drain sumps, gutter trough, surge tank.. Reference Section 131125 - Cementitious Waterproofing.
8. Provide deck equipment, anchor inserts, gutter grating, grating support angle, corner gutter grating support angles and fasteners.
9. Provide pool filtration system and circulation system, valves, pumps, chemical feed equipment, water level control system, and all items necessary to operate the entire system properly for each pool.
10. Provide the heating system for each pool. Include all piping, heaters, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation line, heat the water and return it back to the recirculation line and interlock with pool recirculation pumps.

11. Provide Swimming Pool and related equipment Start-Up as stated in Section 131109, Article 3.03 including minimum consecutive 14-day trouble-free operation. Start, test, calibrate and adjust all mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose, maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.
  12. Provide initial pool water fill and initial chemical balancing, Ryznar Stabilization, Langelier Index.
  13. Provide all equipment and services required for erection and delivery onto the premises of any equipment or apparatus furnished. Remove equipment from premises when no longer required.
  14. Provide all electrical conduit, wiring, junction boxes etc. to all low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)
  15. Coordinate for all required bonding and grounding of the pool shell, fittings, and equipment.
  16. Provide all necessary piping and valving as shown on the drawings and specified herein.
  17. Provide the main drain hydrostatic relief system and/or a sight sump as shown on the drawings.
  18. Assemble and install the cleaning and maintenance equipment for the pool as specified herein.
  19. Provide for the storage of all pool related equipment, materials and systems. All items are the responsibility of the Contractor until accepted by owner.
  20. Obtain final acceptance by jurisdictional health department(s).
  21. USA Swimming Certification
    - a. The Contractor shall provide the services of a registered engineer or land surveyor who shall measure and certify the elevations of the gutter lip at 10 foot centers as well as the length of each lane for each possible racing course. Course length survey must be made with the pool filled with water between 78 and 82 degrees Fahrenheit. Forms for the lane measurements are available from USA Swimming (719-866-3522) and must be submitted to USA Swimming by the Contractor.
- B. Related work specified in other sections
1. The following work related to the swimming pools shall be completed by other contractors.
    - a. Provide, erect and maintain all necessary barricades, signs, lights and flares for pool construction to protect workers and the public.
    - b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations. Reference Division 31 - Earthwork.

- c. Provide the under-drain system beneath the pool if required by the geotechnical report.
- d. Provide sub-surface drainage beneath the pump pit and backwash pit. Reference Division 31 - Earthwork if required by the geotechnical report.
- e. Construct pump pit, backwash pit, and mechanical room building including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Division 3 - Concrete.
- f. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction, and provide sub-surface drainage beneath the surge tank as needed or required in the project geotechnical report. Reference Division 31 - Earthwork.
- g. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange any required electrical, plumbing and or building inspections to be performed on embedded items. Reference Division 26 - Electrical.
- h. Provide sanitary sewer and storm drain connections as shown on the drawings. Reference Division 22 - Mechanical/Plumbing.
- i. Layout and install all deck mounted anchors, sockets, and inserts for the pool(s).
- j. Provide deck finish beyond back of the pool bond beam. Reference Section 131121 - Swimming Pool Deck Concrete.
- k. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.
- l. Provide chlorine resistant caulking (sealant) and backer rod on pool decks. Reference Section 131130 - Swimming Pool Sealants and Caulking.
2. Related work specified in Plumbing section. Reference Division 22 -Mechanical/Plumbing and Section 131111 - Swimming Pool Piping. Work to be completed by other contractors.
- a. Furnish and install deck drainage system for pool deck.
- b. Furnish and install sanitary sewer piping from the filter room including floor drains, sumps, and sump pump as necessary.
- c. Furnish and install water service to all hose bibbs, flush hydrant boxes and auto-fill bypass to air gap above fill funnel. Install the slow closing solenoid valve in the bypass auto-fill piping.
3. Related work specified in Mechanical section. Reference Division 23 - Mechanical/HVAC. Work to be completed by other contractors.
- a. Provide the ventilation system including air intake and exhaust duct for the pool heating system in accordance with manufacturer recommendations. Provide natural gas utility connection to the pool heating system in accordance with manufacturer recommendations.
- b. Furnish and install air recirculation systems for pool related spaces.

4. Related work specified in Electrical sections. Reference Division 26 Electrical. Work to be completed by other contractors.
- a. Furnish and install motor starters, auxiliary contacts, magnetic relays and other electrical control devices necessary for the complete operation of the pool systems.
  - b. Provide maintenance overhead lighting in the pool/mechanical building.
  - c. Ground and bond all pool structures, fittings and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.
  - d. Obtain permits, inspections, and approvals of all wiring including grounding and bonding of all metal components associated with the pool in accordance with Local, State and National Electrical Codes.
  - e. Confirm all electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

## PART 2 - UNUSED

## PART 3 - EXECUTION

## 3.1 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

- A. The completed structures shall be constructed level and to the dimensions, elevation, depths and thickness as shown on the plans.
- B. The elevation tolerance of the pool shell and gutter lip shall be plus or minus 1/8 inch.
- C. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface shall be plus or minus 1/4 inch from plumb measured with a 6 foot straight edge.
- D. For competitive race courses, the following pool shell tolerances shall apply:
 

<b>Course</b>	<b>Tolerance</b>	<b>Minimum</b>	<b>Maximum</b>
<b>25 yard</b>	<b>+ 1 3/16"</b>	<b>/ -0"</b>	<b>75' - 3/4"</b>
<b>75'</b>	<b>- 1 15/16"</b>		
- E. The above dimensions include allowances for a touchpad at each end of the course. The maximum dimension includes the construction tolerance. These above tolerances also apply to courses utilizing moveable bulkhead(s).
- F. The above dimensions apply to a vertical plane extending 1'-0" above and 3'-0" below the surface of the water at all points of both end walls.
- G. Ground wires or grade pins, if used, shall be installed in such a manner that they accurately outline the section of the pool shell as indicated on the plans. They shall be located at intervals sufficient to insure proper thickness throughout and shall be maintained tight. Grade pins or grounding wires shall not be permanently embedded in the pool shell.

## 3.2 AS-BUILT DOCUMENTS

- A. Refer to Division 1 for As-Built Documentation requirements.

- B. Contractor shall provide As-built engineering construction drawings that depict actual as-built conditions of the completed construction as a permanent record of each project feature.
- C. Contractor shall provide engineering construction drawings depicting actual routing, size and placement of all pool piping, valves, supports.
- D. Contractor shall provide engineering construction drawings depicting actual routing, sizing and placement of all pool electrical conduits and note circuitry and conductor routing.
- E. Contractor shall provide engineering construction drawings depicting actual routing, sizing, and placement of all utilities, including sanitary sewer, storm sewer, fresh water, and natural gas lines.
- F. Contractor shall provide engineering construction drawings depicting actual routing, sizing and placement of timing system conduits.

### 3.3 CLOSE OUT SUBMITTALS

- A. Refer to Division 1 for Close Out Submittal requirements.

### 3.4 CONCLUSION

- A. It is the intention of these specifications to provide a complete installation. All accessory construction and apparatus necessary in the operation or testing of the performance of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving the Contractor from furnishing and installing such parts. Any such omission or clarification shall be brought to the attention of the Architect prior to bidding as provided in this section.

END OF SECTION

## SECTION 131105 - SWIMMING POOL REQUIRED TESTING AND INSPECTIONS

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Work in this section. Principal work items include:

1. The work under this section shall include all labor, materials, and equipment required to complete the required testing and inspections to be performed by the Swimming Pool Contractor.
2. Required testing and inspections to be performed by the Swimming Pool Contractor shall include:
  - a. Below Grade Hydrostatic Pipe Pressure Test;

B. Not included in this section is testing and inspections required for construction materials not listed above. Other testing and inspections shall be required as listed in other specification sections.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, the Contractor shall notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date or as required in bidding documents.

## 1.2 SUBMITTALS

A. All submittals shall be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. Schedule of Testing and Inspections:

1. Contractor shall provide prior to the start of construction within the general construction schedule when tests and inspections listed in the specification shall be performed.
2. Hydrostatic Water Tightness testing shall not be scheduled for a period when the forecast is for a difference of more than 35 degrees Fahrenheit between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall not be schedule when the weather forecast indicates the water surface could freeze before the test is completed.

C. Product Data:

1. Provide product data for each type of product indicated. Include any technical data and installation requirements.

D. Test Reports:

1. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All products listed are required to perform the testing. All products that are being tested (i.e. Concrete, piping, etc.) shall conform with the respective specification section.

### 2.2 HYDROSTATIC PIPE PRESSURE TEST PRODUCTS

#### A. Domestic Water

1. Contractor shall utilize the existing domestic fresh water service to fill pipes. The Owner shall assume costs of the water for the initial tests. In the case where the installation fails the initial test and subsequent tests are required, the Contractor shall assume costs of supplying water for each subsequent test, but may still use the domestic fresh water service available.

#### B. Pressure Gauge

1. Gauges shall be bourdon tube type with a minimum 2-inch diameter dial. Gauge case shall be made of high impact polypropylene, ABS, or stainless steel with an acrylic gauge lens. Socket material shall be brass. Gauge sensor material shall be bronze. Scale shall be white with black divisions and numerals measured in psi with a black enameled balanced Micrometer pointer. Gauge range shall be 0 psi to 100 psi. Accuracy shall be +/-1.5% (3-2-3). Connection shall be either back or lower with ¼" NPT connection.
2. Basis of Design: Gauges shall be Ashcroft 8008A Commercial Pressure Gauge or approved equal.

#### C. Pipe Caps / Plugs

1. All pipe caps and plugs shall be of similar material of the adjoining piping that is being capped. Pipe caps and plugs shall be installed in a similar manner to all pipe fittings.

#### D. Pressure Amplification Pump

1. A pressure amplification pump is only necessary if the domestic water pressure is incapable of providing and sustaining 1.25 times the pressures required within the specification for the duration required within this specification.
2. The pressure amplification pump shall be capable of providing and sustaining 1.25 times the required pressure for the duration of the test.
3. Basis of Design: Pressure Amplification Pump shall be 115V AC Booster Pump, single phase, maximum 117 psi, 3/8-inch NPT inlet size, manufactured by SHURFLO or approved equal

#### E. Air Relief Valve

1. Air Relief Valve shall be a brass ASME Safety Relief Valve with stainless steel spring with ¼" NPT connection.
2. Basis of Design: Air Relief Valves shall be ST25, ST Series Soft Seat Safety Valve by Control Devices, LLC or approved equal.



PART 3 - EXECUTION

3.1 HYDROSTATIC PIPE PRESSURE TEST PROCEDURE

- A. Pipe test procedure is based on AWWA C605-13. For further clarification, refer to AWWA C605-13.
- B. Hydrostatic testing described in this section shall be conducted with water or other environmentally safe, incompressible fluids, because of the inherent safety hazard potential associated with testing components and systems with compressed or other compressed gases.
- C. All pipes shall be capped and sufficiently extend beyond the swimming pool finishes to allow for cutting and installation of any fittings including return inlets, main drain sumps.
- D. Each system of piping shall be tested for its entirety that it is below grade. The return piping shall be tested from within 15 feet of the footprint of the equipment room slab or pump pit to the return inlets within the finish swimming pool surface. The suction piping shall be tested from within 15 feet of the footprint of the equipment room slab or pump pit to the main drain sumps within the finish swimming pool surface. For constructability purposes, if a surge tank is included in the design, the suction lines may be tested from the main drain sumps within the finish swimming pool surface and within the surge tank finish and then again from within the surge tank finish to within 15 feet of the footprint of the equipment room slab or pump pit.
- E. The Contractor shall provide measurement gauges and recording devices for the test, including pump, pipe, connections, and other necessary apparatus and shall conduct the test. Before testing, the Contractor shall place sufficient backfill to prevent pipe movement, typically embedding 1/3 of the pipe.
- F. When the existing domestic water supply is utilized, the domestic water supply shall be protected from backflow contamination.
- G. Pressure gauges shall be provided at the highest elevation possible and the lowest elevation possible, typically at the shallow end return lines and the main drain lines respectively.
- H. Air relief valves shall be installed at all high points within the system to be tested to allow for proper purging of entrapped air. Taps may be installed at all return inlet piping and a single air relief valve can be utilized to remove entrapped air. This is critical not only for the accuracy of the test but for the safety of the workers that may be within the vicinity of the pressurized pipes.
- I. Tests shall be performed only after the pipeline has been properly filled, flushed, and purged of air. The specified test pressure shall be applied utilizing the existing domestic fresh water supply. If the existing domestic fresh water supply is incapable of providing sufficient pressure for the tests, a pressure amplification pump shall be installed to provide and maintain proper pressures for the duration of the tests.

- J. During tests, the system and exposed pipe, fittings, valves, and hydrants shall be carefully examined for leakage. Visible leaks shall be repaired and the test re-administered in its entirety. Defective elements shall be repaired or removed and replaced and the test repeated until the test requirements have been met.
- K. The duration of the hydrostatic test shall be 1 hour.
- L. The hydrostatic test pressure shall not be less than 80 psi at the highest elevation along the test section but shall not exceed 150 psi at any point. This pressure shall be maintained for the duration of the hydrostatic test.
- M. The testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than the following
1. For pipes less than 8 inches in diameter, make up water shall not exceed ½ gallon per 1,000 linear feet of piping.
  2. For pipes 10 inches or greater, make up water shall not exceed ¾ gallon per linear feet of piping.
  3. Visible leaks shall be repaired, regardless of the amount of leakage.
- N. Notice of Nonconformance
1. If the installation does not meet the requirements of this standard, the installation shall be made satisfactory by the Contractor at the Contractor's expense.
- O. Affidavit of Compliance
1. The Contractor shall provide a sworn statement that the installation complies with the requirements of this specification.

END OF SECTION

## SECTION 131109 - SWIMMING POOL START UP

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Principal work items are:

1. Operation and Maintenance Manuals and Closeout Submittals
2. Pool Fill and Chemical Balance
3. Installation & Operation Certification
4. Owner System Training
5. Project Turnover

## B. Related work specified elsewhere:

1. Section 131110 - Swimming Pool Recirculation Equipment
2. Section 131111 - Swimming Pool Piping
3. Section 131115 - Swimming Pool Deck Equipment
4. Section 131116 - Swimming Pool Underwater Lights
5. Section 131140 - Swimming Pool Plaster

## 1.2 COORDINATION AND CLARIFICATION

- A. Coordinate with other contractors or subcontractors all work relating to this section.
- B. The Contractor must establish with other contractors or subcontractors, having related work in this section, that all work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.
- C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, the Contractor shall notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

## 1.3 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

- A. Submit to the Engineer Start-up Chemical Dosing procedure with listed chemicals and quantities.
- B. Detailed operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment supplier and/or Contractor shall prepare an operation and maintenance manual for all equipment. Parts lists and operating and maintenance instructions shall be provided.
- C. Each operation and maintenance manual shall include the following:
  1. Equipment function and calibration, normal operating characteristics, and limiting conditions.
  2. Assembly, installation, alignment, adjustment and checking instructions.
  3. Operating instructions for start-up, routine and normal operation, regulation and control, shut down and emergency conditions.
  4. One (1) copy of all instructional videos.

5. Operating cycles shall be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram shall be provided in the pool equipment room. The diagram shall be engraved on laminated plastic with color-coded piping to match color of coding on piping, and including valves identified with number on tags. The minimum size shall be 11 inch x 17 inch.
6. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for all pool mechanical equipment.
7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures to be followed for the following:
  - a. Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty;
  - b. Water level control adjustment and chemical control operation;
  - c. Normal surge tank operation and balancing;
  - d. Filter operation and backwashing; and
  - e. Super chlorination.
8. Lubrication and maintenance instructions.
9. Guide to "trouble-shooting".
10. Parts list and predicted life of parts subject to wear.
11. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.
12. Test data and performance curves, where applicable.
13. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during any period that the pool will be empty. Include furnishing and installing a yellow warning sign 8-1/2 in. x 11 in., to be mounted in the filter room, that reads:

#### WARNING

Prior to Emptying Pool

Consult O & M Manuals for Procedures

Another sign shall read:

Keep all Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

14. One set of applicable submittals shall be included in each manual.
- D. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the Contractor.
- E. Manuals and other data shall be printed on heavy, first quality paper, 8-1/2 in x 11 in size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams shall be reduced to 8-1/2 in x 11 in or 11 in x 17 in. Where reduction is not practical, larger drawings shall be folded separately and placed in envelopes that are bound into the manuals. Each envelope shall bear suitable identification on the outside.

- F. Six (6) bound volumes of each manual shall be submitted. All parts lists and information shall be assembled in substantial manuals and permanent, three-ring or three-post binders. Material shall be assembled and bound in the same order as specified, and each volume shall have a table of contents and suitable index tabs.
- G. All material shall be marked with project identification. Non-applicable information shall be marked out or deleted.
- H. Shipment of equipment will not be considered complete until all required manuals and data have been received.

1.4 RECORD DRAWINGS

- A. Provide a complete set of record drawings of the entire pool system(s) including all sub-systems. All record drawings shall be prepared in accordance with the requirements of Section 017839 and shall be a complete, stand-alone set. The Contractor shall be permitted to obtain original documents and copy them for this purpose only. Provide the record set on compact disk (AutoCAD Release 2015 or compatible software).

1.5 POOL FILL WATER QUALITY

- A. The Owner shall bear the cost of the water required for two (2) complete fillings of the pool (the initial water tightness test and the final filling). Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the Contractor, at its own expense.
- B. The Contractor shall provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10 degree F.
- C. The Contractor shall provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.2 - 7.4
Calcium Hardness	200 - 400 PPM
Total Alkalinity (Calcium Hypochlorite)	60 - 80 PPM
Total Alkalinity (Sodium Hypochlorite)	80 - 120 PPM
Langelier Saturation Index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.6 START-UP CHEMICALS

- A. The Contractor shall maintain the chemical balance of the pool water (including the cost of all chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.
- B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation for minimum of thirty (30) days from substantial completion or the Owner begins using the pool.

- C. Chemicals to be provided to the Owner shall include those required by the chemical feed systems installed.

## PART 2 - PRODUCTS (UNUSED)

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

### 3.2 INSTALLATION CERTIFICATION

- A. The Contractor shall obtain certification of manufacturer's approved installation on the following components or systems for each pool:
1. Recirculation Pump
  2. Filtration System
  3. Heating System
  4. Chemical Delivery and Monitoring/Alarm Systems
  5. Competitive Deck Equipment
  6. Diving Platforms, Stands, and Boards
  7. Competitive Timing and Scoring Systems
  8. USA Swimming Facility Certification

### 3.3 START UP

- A. Upon plastering of pool, refer to Specification 131140 for pool plaster curing process requirements.
- B. Provide Swimming Pool and related equipment Start-Up. Start, test, calibrate and adjust all mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems.
- C. Provide proof of minimum consecutive 14-day trouble-free operation. Lack of chemicals or other non-critical items shall not require a re-start of the trouble-free period but may result in a pause of the trouble free period.
- D. Provide certification that that entirety of pool systems operate and function correctly through all phases of operation.

### 3.4 SYSTEM TRAINING

- A. A qualified representative of the Contractor performing work under this section shall put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.

- B. The Contractor's training representative shall have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.
- C. The representative from the Contractor shall be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.
- D. Training periods shall consist of 8 hours of on-site training and scheduled as follows:
1. 4 hours of initial training on the complete swimming pool system. The 4 hours of initial training is to be comprised of at least 1 hour of training on water chemistry analysis and adjustment. The water chemistry training will include in depth review of the use of the Langelier index and its computation.
  2. The initial 4 hours of training shall include information on the care, operation, adjustment, and maintenance of all items provided by the Contractor under the "Part 2 - Products" section of specification 131110 and related specifications
  3. 4 hours of training after the Owner's staff has had experience operating the system. This time may be requested any time after the pool has been placed in operation within a period of one (1) year from the time the pool was accepted by the Owner. The additional training shall contain at least 1 hour of review of water chemistry.

### 3.5 PROJECT TURNOVER

- A. Prior to leaving the job, the Swimming Pool Contractor shall obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and all necessary operating information provided. The Swimming Pool Contractor shall, in his contract, include the cost of one (1) additional days (total 4 hours) of instruction and operational check out by the qualified representative of the Swimming Pool Contractor during the first year of operation.
- B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments shall be submitted to the Owner and Architect/Engineer within one (1) week after each visit.
- C. The Contractor shall provide specific written procedures to be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION

## SECTION 131111 - SWIMMING POOL PIPING SYSTEMS

## PART 1 - GENERAL

## 1.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in manufacturer's original, unopened containers and crates with all labels intact and legible.
- B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.
- C. Handle materials in a manner to prevent damage.
- D. Store all materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.
- E. Remove damaged materials from site.

## 1.2 WARRANTIES

- A. The Contractor warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The Contractor's warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the Contractor or improper wear and tear under normal use. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified.
- B. The Contractor shall agree to repair or replace any defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.
- C. Submit all warranties covering, but not limited to the following:
  1. Defects in material, workmanship, and installation of the pool piping system for a period of three (3) years.

## PART 2 - PRODUCTS

## 2.1 PIPING MATERIALS

## A. General

1. Provide all recirculating piping between the pool(s) and the equipment room, fill receptor and all interconnecting piping to and from the chemical feed systems and chemical controller.
2. Provide all necessary pipe supports and support systems required to support all associated piping and valves.



3. Provide all other tubing, conduit, or piping associated with equipment specified herein. Coordinate with other trades.

#### B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required to be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.
2. All PVC swimming pool piping shall be NSF approved and conform to the requirements of ASTM D-1785.
3. All PVC pipes shall be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.
4. Swimming pool piping above the floor or deck in the equipment room shall be Schedule 80 PVC.
5. Swimming pool piping below the equipment room floor or deck shall be NSF approved, Schedule 80 PVC.
6. All swimming pool piping under the pool floor shall be NSF approved, Schedule 80 PVC that is backfilled within a 3/4" minus fine crushed aggregate conforming to ASTM C136, and per recommendations indicated in the project geotechnical report. Fill material shall be submitted to the Architect for review and approval prior to placement of any below grade pool pipe.
7. All below grade swimming pool piping not located beneath the pool floor shall be backfilled with native granular material free of ice, clay, debris, organic matter, and rocks not larger than 4" across their greatest dimension, and per recommendations indicated in the project geotechnical report.
8. The influent and effluent lines to the heating system shall be schedule 80 CPVC. Connections between metallic piping and/or equipment and PVC shall be flanged.
9. All PVC and CPVC fittings shall be the product of one manufacturer. Molded fittings shall be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute. Fabricated fittings shall be as manufactured by Harrison Machine, Plastinetics, or acceptable substitute.
10. Vertical sight sump piping shall be NSF approved, Schedule 40 PVC. Horizontal sight sump piping shall be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and have 3/8" diameter holes located top and bottom on 4 ft centers. Horizontal sight sump piping shall extend 1 ft minimum beyond the main drain.
11. Chemical feed tubing from chemical feeders to recirculation piping shall be encased in Schedule 80 PVC piping. Piping shall be hard piped until the injection quill at the recirculation plumbing. All required valves shall be of all PVC construction.
12. All flanged plumbing connection hardware shall be stainless steel.

13. All materials shall be installed by workmen thoroughly skilled in their trades and all work shall present a neat and mechanical appearance when complete. The Contractor, at no additional expense to the Owner, shall replace or correct any work not judged acceptable by the Architect or Owner's testing agency, or their consultants.
14. All support hardware, brackets, fasteners, hangers, etc. installed in the surge tank shall be 316L stainless steel.
15. No installation shall be made that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.
16. All piping shall be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness per specification 131105. Pneumatic (air) pressure testing is not allowed.
17. The Contractor shall provide 1/4" PVC water stops for this work for watertight penetration of concrete walls. Water stops shall be round and the O.D. shall be sized to 150% of the O.D. of the pipe. The water stops shall be thermo-welded to the pipe from both sides and shall be located at the centerline of the wall being penetrated prior to placing the concrete to assure a watertight seal.
18. Contractor must adhere to all the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.
19. All mechanical equipment to be connected into the recirculation piping system shall be done so using flanged or union connections.
20. Provisions shall be made to purge all pipes in the system.
21. Concentric reducers at the recirculation pumps shall be fiberglass by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction.

#### C. Pipe Hangers and Supports

##### 1. Manufacturer

- a. Subject to compliance with these specifications, pipe hanger and support systems shall be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.

##### 2. See Structural Drawings for Pipe Hangers and Supports

##### 3. Hangers

###### a. Pipes 2 inches and smaller

- 1) Adjustable steel clevis hanger, B-Line models B3100 or B3104.
- 2) Adjustable steel swivel ring (band type) hanger, B-Line model B3170.

###### b. Pipes 2-1/2 inches and larger

- 1) Adjustable steel clevis hanger, B-Line model B3100.
- 2) Adjustable steel yoke pipe roll, B-Line model B3114.

##### 4. Multiple or Trapeze Hangers

- a. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
- b. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe, B-Line B-2000 series.

#### 5. Wall Supports

- a. Pipes 2-1/2 inches and smaller
  - 1) Steel offset "J" hook hanger, B-Line model B3600.
- b. Pipes 3 inches and larger
  - 1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series.
  - 2) Welded steel bracket B-Line model B3066 or B3067 with roller chair or adjustable steel yoke pipe roll. B-Line model B3120 or B3110.

#### 6. Floor Supports

- a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3093 and B3088T or B3090 and B8088. Pipe saddle shall be screwed or welded to appropriate base stand.

#### 7. Vertical Supports

- a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.

#### 8. Plastic Pipe Supports

- a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, B-Line models B3106 and B3106V, to form a continuous support system for all plastic pipes smaller than 1 inch or flexible tubing.
- b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

- 9. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

### D. Hanger Attachments

#### 1. Upper Attachments

##### a. Beam Clamps

- 1) Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.

- 2) C-Clamps shall be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps shall be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturers recommendations for set screw torque. Retaining straps shall be used to maintain the clamp position on the beam where required.
- 3) Center load beam clamps shall be used where specified. Steel clamps shall be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt shall be B-Line B3291-B3297 series or approved equal as required to fit beams.

b. Concrete Inserts

- 1) Cast in place spot concrete inserts shall be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes, B-line models N2500 or B3014N series.
- 2) Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs/ft. in concrete, B-Line models B22I, 32I, or 52I or approved equal. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods shall be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes

- a. Hangers shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish.
- b. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR shall have an electro-deposited green epoxy finish.
- c. Zinc Plated hardware is not acceptable for use in chemical rooms.

2. Outdoor Finishes

- a. Hanger and strut subject to weathered conditions shall be hot dipped galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dipped galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
- b. Hangers and strut located in corrosive areas shall be type 316L stainless steel with stainless steel hardware.

G. Valves

1. Valves 3 inches and larger shall be butterfly type valves, with PVC body, 150# SWP with stainless steel shaft, polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27 inch vacuum to 150 PSI. Extended neck 2 inch beyond flanges for any insulated piping shall be provided with handle for manual operation. All valve components shall be suitable for swimming pool chlorinated water service. Butterfly valves shall be Georg Fischer Type 563, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.
2. Valves smaller than 3 inches shall be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.
3. Check valves shall be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Install check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves shall be either by Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless steel spring; or approved equal, for installation between 150 lb flanges.
4. Modulating float valve in the surge tank(s) shall have PVC body and stainless steel wafer disc. All hardware shall be non-corrodible. The float-operated valves shall be provided horizontally on the main drain lines in the surge tank(s). Valve shall consist of all non-corrosion components including shaft, float arm, pins and floats. Valve shall be suitable for mounting on a 125E class standard PVC flange. The float arm leverage weight and pivot lengths shall be adjustable to obtain desired ratio of surge tank level change to pool gutter overflow level change. Two floats and stabilizer required. Valve shall be Model FV-D XWB (Extra Weight Ball) as manufactured by MerMade Filter, Inc. or approved equal manufactured by EPD.
5. Submerged valves up to 3 inches shall be PVC true union ball valves. Submerged valves over 3 inches shall be PVC bodied, wafer type, butterfly valves with stainless steel handle extensions as required. Valves shall be by approved manufacturers listed above. Submerged valves must be provided with all stainless steel connectors. The stem housing extensions shall be properly supported and braced.
6. All butterfly type valves 8 inches and larger shall be fitted with a watertight gear operator.
7. All valves located 7 feet or greater off the floor shall be fitted with a chain operator.
8. All submerged valves, valves buried below grade, or valves not readily accessible, shall be provided with a stainless steel reach rod and handle.

#### H. Pipe and valve identification

1. All exposed pool piping shall be equipped with color-coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. The Contractor shall verify that all pool piping identification is in accordance with all local and state health regulations.
2. All valves shall be identified with minimum 1-1/2 inch diameter brass tags stamped with minimum 1/2-inch high numbers and attached to valves with #16 brass jack chain (plastic laminate engraved tags with nylon attachment acceptable). Valves shall be described as to their function and referenced in the operating instruction manual and

### PART 3 - EXECUTION

#### 3.1 EXISTING CONDITIONS, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

#### 3.2 PIPING INSTALLATION

- A. General

1. Provide and erect, according to the best practices of the trade, all piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings shall be considered as diagrammatic in indicating the general run and connections, and may or may not in all parts be shown in its true position. The piping may have to be off set, lowered or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. All changes in direction shall be made with fittings. All open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. All piping shall be arranged so as not to interfere with removal and maintenance of equipment, filters or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to ensure noiseless circulation. All valves and specialties shall be so placed to permit easy operation and access.

#### B. Pipe Hangers and Supports

1. All piping shall be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Refer to Part to for further specification of pipe hangers and supports.
2. All piping in a service tunnel, if required shall be supported by a structure of the Contractor's design. The structure shall be non-corrodible and shall be of a size and configuration to rigidly support all the piping as shown in the plans at a minimum spacing as shown below.
3. Hanger rods shall be galvanized steel unless otherwise noted on the plans. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.

4. Where piping is installed side by side, the Contractor will support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be non-metallic channel. The Contractor shall provide heavier members as required for the load to be supported for the entire span distance. Hanger rods shall be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.
5. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.
6. Attachment of piping hangers to the building structure shall be provided in a manner approved by the Architect. The Contractor shall provide concrete inserts to be installed by the General Contractor in the building construction at the time the concrete is poured and hangers shall be attached to these inserts.
7. Piping hangers shall be spaced per the below schedule and shall have hangers not more than one foot on each side of every change in direction. The piping systems shall be installed in an approved manner and shall not overload the building structural frame. The Contractor shall provide additional hangers and miscellaneous steel supports as required to distribute the piping system load over several structural members where required or directed. Maximum allowable spacing for piping shall be as follows:

PVC Piping	Maximum Spacing
3/4" thru 2"	5'-0"
2 1/2" thru 4"	6'-0"
6" thru 10"	9'-0"
12" thru 14"	12'-0"

8. Round rods supporting the pipe hangers shall be of the following dimensions:

Pipe Size	Round Rod Size
1/2" to 2"	3/8" rod
2-1/2" to 3"	1/2" rod
4" to 5"	5/8" rod
6"	3/4" rod

9. Horizontal PVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120 degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1-1/4" and less	5	3/8"
1-1/2" to 3"	6	1/2"
4" to 6"	8	5/8"
8" to 12"	10	7/8"
Greater than 12"	12	1"



10. Horizontal CPVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140 degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1/2" and less *	4	3/8"
3/4" to 2"	6	3/8"
2-1/2" to 3"	7	1/2"
4" to 8"	8	7/8"
Greater than 12"	10	1"

11. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.
12. Install hangers to provide a minimum of 1-inch space between finished covering and adjacent work.
13. Place a hanger within 12 inches of each horizontal elbow.
14. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
15. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.05.C.3. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to the support spacing schedules.
16. Attachment of piping hangers to the building structure shall be provided in a manner approved by the Architect. The Contractor shall provide concrete inserts to be installed by the General Contractor in the building construction at the time the concrete is poured and hangers shall be attached to these inserts.
17. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.
18. Hanger rods shall be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.
19. Where piping is installed side by side, the Contractor will support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be non-metallic channel. The Contractor shall provide heavier members as required for the load to be supported for the entire span distance. Hanger rods shall be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

20. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

#### C. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

Where concrete slabs form finished ceilings, provide inserts to be flush with the slab surface.

Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

#### D. Piping Installation

1. Trench bottoms shall be smooth and free of rocks and debris. If the trench is dug in ledge rock, hardpan or where large boulders are not removed, place 3 inches of sand or compacted fine-grained soil below pipe. Pipe must be supported over its entire length with firm, stable material. Blocking will not be used to change pipe grade or provide intermittent support over low sections in the trench. Surround the pipe with backfill meeting the requirements of Section 312000 with a particle size of 1-1/2 inch or less and in accordance with the project geotechnical report. Compact in layers not to exceed 6 inches with vibratory method. Follow installation methods of ASTM D2774 "Underground Installation of Thermoplastic Pressure Piping".
2. Installations are to be installed in a straight run of pipe, with a minimum 10 pipe diameters upstream and minimum 5 pipe diameters downstream of any pipe fitting.

#### E. Flushing, Draining and Cleaning Pipe Systems

1. The Contractor shall flush out all water systems with water before placing them in operation. Other systems shall be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, all strainer screens shall be removed and thoroughly cleaned.

#### F. Expansion and Contraction

1. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections and anchors as required to prevent undue strain. The Contractor shall provide shop drawings for proposed method and arrangement for control of expansion and contraction of piping.

#### G. Swimming Pool Pipe Pressure Testing

1. Contractor is responsible for the maintenance of a sustained 30 PSI pressure on all pool related piping throughout the course of construction.
2. All pool related piping shall be hydraulically pressure tested (with water, not air) to a pressure of not less than 80 PSI for a period of no less than one (1) hour.

- a. All piping installation and pressure testing shall be reviewed by the Owner's testing agency before commencement of backfilling and any pool concrete or shotcrete placement. A minimum notice of one (1) week is required prior to review. Results of review shall be documented.
  - b. The pressure test shall encompass all piping that will be below grade or below the pool shell. The test shall occur prior to any pool finish fittings are installed, including main drains and return inlets. Skimmers may be in place if required.
  - c. The pressure test may be separated by piping branch such as suction lines, return lines, gravity lines, etc. and may be performed at different times.
3. The Contractor shall adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

END OF SECTION

## SECTION 131120 - SWIMMING POOL CAST-IN-PLACE POOL CONCRETE

## PART 1 - GENERAL

## 1.1 DESCRIPTION

A. Work in this section. Principal items include:

1. The work under this section shall include all labor, materials, and equipment required to complete the concrete work for the following: swimming pool floor.
2. Materials and/or methods specified in this section as "I.B.C.", "I.B.C. Standards", or similar wording refer to the International Building Code, 2018 Edition.
3. Except as otherwise specified herein, the work of this section shall be in accordance with Chapter 19 "Concrete" of the International Building Code, 2018 Edition.

## 1.2 SUBMITTALS

A. Product Data: Provide product data for each type of product indicated. Include any technical data and installation requirements.

B. Concrete Mix Design: Provide a mix design for each strength and type of concrete. Furnish a complete list of materials including type, brand, source, and amount of cement, pozzolan, and admixtures. Obtain approval before concrete placement. Any concrete work placed prior to approval of the concrete mix design is not acceptable, is rejected and shall be removed at no cost to the owner.

1. Provide alternate design mixtures when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
2. Indicate amounts of mixing water to be withheld for later addition at project site in the submittal.

C. Steel Reinforcement Shop Drawings: Provide placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, materials, and grades; bar schedules; stirrup spacing; bent bar diagrams; bar arrangements, splices and laps; mechanical connections; tie spacing; hoop spacing; and supports for concrete reinforcement.

D. Formwork Shop Drawings: Provide formwork shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Material Test Reports: Provide reports from a qualified testing agency, indicating compliance with requirements for the following:

1. Aggregates - Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

F. Material Certificates: Provide certificates for each of the following, signed by the manufacturers:

1. Cementitious materials
2. Admixtures
3. Form materials and form-release agents
4. Steel reinforcement and accessories
5. Curing compounds
6. Bonding agents
7. Repair materials

G. Provide field quality control test and inspection reports.

H. Provide minutes of pre-installation conference.

### 1.3 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and complies with ASTM C94 / C94M requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated and as documented according to ASTM E548.

1. Personnel conducting field tests shall be qualified as an ICC Certified Reinforced Concrete Technician according to the International Code Council or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI Certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI Certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the contract documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

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, forms and form removal limitations, shoring and reshoring procedures, steel reinforcement installation, concrete repair procedures, and concrete protection.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Keep waterstops covered during storage to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Products are subject to compliance with requirements. Products that may be incorporated in the work include, but are not limited to, the products specified.
  2. Available Manufacturers: Manufacturers are subject to compliance with requirements. Manufacturers offering products that may be incorporated in the work include, but are not limited to, the manufactures specified.

#### 2.2 CONCRETE MATERIALS

- A. Cementitious Materials: Use the same type, brand, and source throughout the project. The following cementitious materials are recommended:
  1. Portland Cement: ASTM C150, Standard Specification for Portland Cement.
  2. Fly Ash: ASTM C618, Class C or F.
- B. Normal Weight Aggregate: ASTM C33, Class 5S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  1. Maximum Coarse-Aggregate Size: 1 in (25 mm) nominal size.
  2. Fine Aggregate: Fine aggregate to be free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C94 / C94M, Clean and potable.

### 2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494 / C494M, Type A.
  - 2. Retarding Admixture: ASTM C494 / C494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494 / C494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017 / C1017M, Type II.

### 2.4 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.
  - 2. Limit use of fly ash to not exceed, in combination, 15% of portland cement by weight.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing 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 admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.45.

### 2.5 CONCRETE MIXES

- A. All concrete: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 4,500 psi at 28 days
  - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
  - 3. Minimum Cement Content: 600 lb/yd<sup>3</sup>
  - 4. Slump Limit:
    - a. 3 in +/- 1 in (75 mm +/- 25 mm) or 8 in (200 mm) for concrete with verified slump of 2 to 4 in (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, +/- 1 in (25 mm).
  - 5. Use Type II/V Cement.
  - 6. Cement to aggregate, in dry weight, shall not be less than one to five.
- B. Shrinkage Tests:

1. Prior to placing any concrete for walls or horizontal surfaces, a trial batch of each mix design of structural concrete shall be prepared using the aggregates, cement and admixture (if any) proposed for the project. From each trial batch at least three (3) specimens for determining drying shrinkage shall be prepared. The drying shrinkage specimens shall be a 4 in x 4 in x 11 in prisms fabricated, cured, dried, and measured in accordance with the requirements of Tentative Method of Test for Length Change of Cement Mortar and Concrete, ASTM C157. The measurements shall be made and reported separately for 7 and 28 days of drying after 7 days of moist curing. The effective gage length of the specimens shall be 10 in, and except for the foundation concrete, the average drying shrinkage at 35 days shall not exceed .054%.
  2. Previous Test: Ready-mixed concrete manufacturer may furnish certified test reports from an approved testing laboratory as proof of meeting shrinkage requirements, provided aggregate used and concrete covered by such test report conform to mix design approved for use on this project. Use an independent testing facility for preparing and reporting proposed mix designs.
- C. Ready-Mix Concrete
1. Comply with ASTM C94 / C94M.
  2. Before using trucks for batching, mixing, and transporting concrete, thoroughly clean the trucks and equipment of materials capable of contaminating concrete.
  3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 is required.
  4. When air temperature is between 85 °F and 90 °F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 °F, reduce mixing and delivery time to 60 minutes.
  5. Do not add water to ready-mix concrete at project site except when slump is below specified limits and total water does not exceed the design water-cement ratio; inject added water into mixer and mix thoroughly before discharging.
- D. Provide certificate signed by authorized official of supplier with each load of concrete stating following:
1. Time truck left plant.
  2. Mix of concrete, identify with code number of mix design.
  3. Amount of water and cement in mix.
  4. Amount and type of admixtures.
  5. Amount of water added at project site.
  6. Time truck is unloaded at project site.
- E. Truck mixers without batch tickets will be rejected.
- F. Retain certificates at project site. Submit to the owner/architect for review upon request.



## 2.6 FORM-FACING MATERIALS

- A. Forming Materials: Forming materials shall be new. Materials may be reused during the progress of the work provided they are completely cleaned and reconditioned, recoated for each reuse, capable of producing formwork of the required quality and are structurally sound.
- B. Smooth-Formed Finished Concrete: Form-facing panels shall be used to provide continuous, true, and smooth concrete surfaces. Furnish panels in the largest practicable sizes to minimize the number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better, mill-release agent treated and edge sealed.
- C. 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.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 in x 3/4 in (19 mm x 19 mm) minimum
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect the concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 in (25 mm) to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 in (25 mm) in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

## 2.7 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615 / A615M, Grade 60 deformed.
- B. Plain-Steel Wire: ASTM A82, as drawn.

## 2.8 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.
- B. Mechanical Splices (Optional): Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements.

1. Lenton Form Saver; Erico Corp.

## 2.9 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, 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 I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

- A. Concrete Patching Mortar: Chemical treatment for waterproofing concrete.
  1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    - a. Xypex Concentrate.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before placing new concrete against existing shotcrete/concrete, remove unsound or loose materials and contaminants that may inhibit concrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1 in (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before placing concrete.
  1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper concrete bonding.
- B. Earth: Compact and trim to line and grade before placing concrete. Do not place concrete on frozen surfaces. Dampen surfaces before concrete placement. Expansive soils shall be maintained in a moist condition during construction.
- C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken concrete bonding.

### 3.2 FORMWORK

- 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 347R as abrupt or gradual, as follows:
  1. Class A, 1/8 in (3.2 mm) for smooth-formed finished surfaces.
  2. Class C, 1/2 in (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate 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 recesses, pipe sleeves 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. See drawings for other required profiles.
- 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.
- M. Contract shall not use permanent markers on finished form materials.

### 3.3 EMBEDDED ITEMS

- 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.

### 3.4 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of 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 °F (10 °C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
1. Leave formwork for beam soffits, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70% of 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 will not be 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 the owner/architect.

### 3.5 STEEL REINFORCEMENT

- A. General: Fabrication and placement of reinforcing for concrete construction shall be in accordance with the requirements of Title 24, Part 2, International Building Code (California Building Code), and as shown.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.6 JOINTS

- A. Construction Joints in Pool Floor: No construction joints shall be placed in pool floor.
- B. Contraction Joints in Pool Floor: No contraction joints shall be placed in pool floor.
- C. Expansion Joints in Pool Floor: No expansion joints shall be placed in pool floor.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water withheld from the concrete mixture at the plant may be added at project site, subject to limitations of ACI 301.

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 will be 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 to not 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 in (150 mm) 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 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 dobies 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.
- E. 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 low temperature is expected to fall below 40 °F (4.4 °C) 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.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 °F (32 °C) 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.

### 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, 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 SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen 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 exposed to view or to be covered with ceramic tile, paint, or another thin-film-finish coating system.
  2. Finish surfaces to the following tolerances, according to ASTM E1155 / ASTM E1155M, for a randomly trafficked floor surface:

- a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

### 3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. 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.

1. All patches shall be watertight.

B. Contractor shall not use permanent markings on any concrete finishes or finish facing formwork.

### 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 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/ft<sup>2</sup> x h (1 kg/m<sup>2</sup> x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. 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 the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. 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 in (300 mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 in (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. 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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by methods recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of tile used on project.

### 3.12 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 one part Portland Cement to two and one-half parts fine aggregate passing a No.16 (1.18 mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include 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 in (13 mm) in any dimension in solid concrete, but not less than 1 in (25 mm) in depth. 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 concealed formed surfaces that affect concrete's durability and structural performance as determined by owner/architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as 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 in (0.25 mm) 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. Repair defective areas, except random cracks and single holes 1 in (25 mm) 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 in (19 mm) 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.
  5. Repair random cracks and single holes 1 in (25 mm) 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.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.
  5. 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 C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 yd<sup>3</sup> (4 m<sup>3</sup>), but less than 25 yd<sup>3</sup> (19 m<sup>3</sup>), plus one (1) set for each additional 50 yd<sup>3</sup> (38 m<sup>3</sup>) or fraction thereof.
    - a. When frequency of testing will provide fewer than five (5) 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 C143 / C143M; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Concrete Temperature: ASTM C1064 / C1064M; one (1) test hourly when air temperature is 40 °F (4.4 °C) and below and when 80 °F (27 °C) and above, and one (1) test for each composite sample.
4. Compression Test Specimens: ASTM C31 / C31M.
  - a. Cast and laboratory cure two (2) sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure two (2) sets of two standard cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C39 / C39M; test one (1) set of two laboratory-cured specimens at 7 days and one (1) set of two specimens at 28 days.
  - a. Test one (1) set of two field-cured specimens at 7 days and one (1) set of two specimens at 28 days.
  - 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.
6. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, the contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
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 the Owner/Architect, 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 both 7-day 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 C42 / C42M or by other methods as directed by engineer.
11. Additional testing and inspecting, at the 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 ASTM E1155 / ASTM E1155M within 24 hours of finishing.
- E. Watertightness Testing
1. Pool shall be tested for watertightness according to procedures stated in ACI 350.1-01 / AWWA 400 / Specification 131105 at the discretion of the Engineer upon visual observation of the placement of concrete, inserts, removal of formwork, and all procedures that may cause concern for long term water tightness of the finish. Refer to Specification 131105.

END OF SECTION

## SECTION 131121 - SWIMMING POOL CAST-IN-PLACE DECK CONCRETE

## PART 1 - GENERAL

## 1.1 DESCRIPTION

A. Work in this section. Principal items include:

1. The work under this section shall include all labor, materials, and equipment required to complete the concrete work for the following: pool deck(s), utility pedestal(s), and associated foundations.
2. Materials and/or methods specified in this section as "I.B.C.", "I.B.C. Standards", or similar wording refer to the International Building Code, 2018 Edition.
3. Except as otherwise specified herein, the work of this section shall be in accordance with Chapter 19 "Concrete" of the International Building Code, 2018 Edition.

## 1.2 SUBMITTALS

A. Product Data: Provide product data for each type of product indicated. Include any technical data and installation requirements.

B. Concrete Mix Design: Provide a mix design for each strength and type of concrete. Furnish a complete list of materials including type, brand, source, and amount of cement, pozzolan, and admixtures. Obtain approval before concrete placement. Any concrete work placed prior to approval of the concrete mix design is not acceptable, is rejected and shall be removed at no cost to the owner.

1. Provide alternate design mixtures when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
2. Indicate amounts of mixing water to be withheld for later addition at project site.

C. Steel Reinforcement Shop Drawings: Provide placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, materials, and grades; bar schedules; stirrup spacing; bent bar diagrams; bar arrangements, splices and laps; mechanical connections; tie spacing; hoop spacing; and supports for concrete reinforcement.

D. Formwork Shop Drawings: Provide formwork shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Material Test Reports: Provide reports from a qualified testing agency, indicating compliance with requirements for the following:

1. Aggregates - Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

- F. Material Certificates: Provide certificates for each of the following, signed by the manufacturers:
1. Cementitious materials
  2. Admixtures
  3. Form materials and form-release agents
  4. Steel reinforcement and accessories
  5. Curing compounds
  6. Bonding agents
  7. Repair materials
- G. Provide field quality control test and inspection reports.
- H. Contractor shall provide three (3) 4 FT X 4 FT deck finish test panels with light, medium and heavy broom finishes three weeks prior to placing the finished pool deck concrete. Test panels shall include sample contraction joint.
- I. Contractor shall provide joint spacing plan to Engineer for review 4 weeks prior to first concrete pour.
- J. Provide minutes of pre-installation conference.

### 1.3 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and complies with ASTM C94 / C94M requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated and as documented according to ASTM E548.
1. Personnel conducting field tests shall be qualified as an ICC Certified Reinforced Concrete Technician according to the International Code Council or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI Certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI Certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the contract documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
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, forms and form removal limitations, shoring and reshoring procedures, steel reinforcement installation, concrete repair procedures, and concrete protection.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Keep waterstops covered during storage to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Products are subject to compliance with requirements. Products that may be incorporated in the work include, but are not limited to, the products specified.
  2. Available Manufacturers: Manufacturers are subject to compliance with requirements. Manufacturers offering products that may be incorporated in the work include, but are not limited to, the manufactures specified.

#### 2.2 CONCRETE MATERIALS

- A. Cementitious Materials: Use the same type, brand, and source throughout the project. The following cementitious materials are recommended:
  1. Portland Cement: ASTM C150, Standard Specification for Portland Cement.
  2. Fly Ash: ASTM C618, Class C or F.
- B. Normal Weight Aggregate: ASTM C33, Class 5S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 in (25 mm) nominal size.
  2. Fine Aggregate: Fine aggregate to be free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C94 / C94M, Clean and potable.

### 2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494 / C494M, Type A.
  2. Retarding Admixture: ASTM C494 / C494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C494 / C494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C1017 / C1017M, Type II.

### 2.4 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.
  2. Limit use of fly ash to not exceed, in combination, 15% of portland cement by weight.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing 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 admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.45.

### 2.5 CONCRETE MIXES

- A. All concrete: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4,500 psi at 28 days
  2. Maximum Water-Cementitious Materials Ratio: 0.45.
  3. Minimum Cement Content: 600 lb/yd<sup>3</sup>
  4. Slump Limit:

a. 3 in +/- 1 in (75 mm +/- 25 mm) or 8 in (200 mm) for concrete with verified slump of 2 to 4 in (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, +/- 1 in (25 mm)

5. Use Type II/V Cement.

6. Cement to aggregate, in dry weight, shall not be less than one to five.

#### B. Shrinkage Tests:

1. Prior to placing any concrete for walls or horizontal surfaces, a trial batch of each mix design of structural concrete shall be prepared using the aggregates, cement and admixture (if any) proposed for the project. From each trial batch at least three (3) specimens for determining drying shrinkage shall be prepared. The drying shrinkage specimens shall be a 4 in x 4 in x 11 in prisms fabricated, cured, dried, and measured in accordance with the requirements of Tentative Method of Test for Length Change of Cement Mortar and Concrete, ASTM C157. The measurements shall be made and reported separately for 7 and 28 days of drying after 7 days of moist curing. The effective gage length of the specimens shall be 10 in, and except for the foundation concrete, the average drying shrinkage at 35 days shall not exceed .054%.

2. Previous Test: Ready-mixed concrete manufacturer may furnish certified test reports from an approved testing laboratory as proof of meeting shrinkage requirements, provided aggregate used and concrete covered by such test report conform to mix design approved for use on this project. Use an independent testing facility for preparing and reporting proposed mix designs.

#### C. Ready-Mix Concrete

1. Comply with ASTM C94 / C94M.

2. Before using trucks for batching, mixing, and transporting concrete, thoroughly clean the trucks and equipment of materials capable of contaminating concrete.

3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 is required.

4. When air temperature is between 85 °F and 90 °F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 °F, reduce mixing and delivery time to 60 minutes.

5. Do not add water to ready-mix concrete at project site except when slump is below specified limits and total water does not exceed the design water-cement ratio; inject added water into mixer and mix thoroughly before discharging.

#### D. Provide certificate signed by authorized official of supplier with each load of concrete stating following:

1. Time truck left plant.

2. Mix of concrete, identify with code number of mix design.

3. Amount of water and cement in mix.

4. Amount and type of admixtures.



5. Amount of water added at project site.
  6. Time truck is unloaded at project site.
- E. Truck mixers without batch tickets will be rejected.
- F. Retain certificates at project site. Submit to the owner/architect for review upon request.

## 2.6 FORM-FACING MATERIALS

- A. Forming Materials: Forming materials shall be new. Materials may be reused during the progress of the work provided they are completely cleaned and reconditioned, recoated for each reuse, capable of producing formwork of the required quality and are structurally sound.
- B. Smooth-Formed Finished Concrete: Form-facing panels shall be used to provide continuous, true, and smooth concrete surfaces. Furnish panels in the largest practicable sizes to minimize the number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better, mill-release agent treated and edge sealed.
- C. 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.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 in x 3/4 in (19 mm x 19 mm) minimum
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect the concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 in (25 mm) to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 in (25 mm) in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

## 2.7 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615 / A615M, Grade 60 deformed.
- B. Plain-Steel Wire: ASTM A82, as drawn.

## 2.8 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.

B. Mechanical Splices (Optional): Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements.

1. Lenton Form Saver; Erico Corp.

## 2.9 RELATED MATERIALS

A. Epoxy Bonding Adhesive: ASTM C881, 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 I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

A. Concrete Patching Mortar: Chemical treatment for waterproofing concrete.

1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
  - a. Xypex Concentrate.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before placing new concrete against existing shotcrete/concrete, remove unsound or loose materials and contaminants that may inhibit concrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1 in (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before placing concrete.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper concrete bonding.

- B. Earth: Compact and trim to line and grade before placing concrete. Do not place concrete on frozen surfaces. Dampen surfaces before concrete placement. Expansive soils shall be maintained in a moist condition during construction.
- C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken concrete bonding.

### 3.2 FORMWORK

- 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 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 in (3.2 mm) for smooth-formed finished surfaces.
  - 2. Class C, 1/2 in (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate 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 recesses, pipe sleeves 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. See drawings for other required profiles.
- 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.
- M. Contract shall not use permanent markers on finished form materials.

### 3.3 EMBEDDED ITEMS

- 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.

### 3.4 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of 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 °F (10 °C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
1. Leave formwork for beam soffits, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70% of 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 will not be 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 the owner/architect.

### 3.5 STEEL REINFORCEMENT

- A. General: Fabrication and placement of reinforcing for concrete construction shall be in accordance with the requirements of Title 24, Part 2, International Building Code and as shown.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Joints may not intersect any anchors, embeds or other deck features.
- B. Construction Joints: Install construction joints so strength and appearance of concrete is not impaired at locations indicated or as approved by the owner/architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless noted otherwise on drawings. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 in (38 mm) into concrete, unless noted on drawings otherwise.
  3. Locate horizontal joints in walls at underside of floors and at the top of floor slabs.
  4. Locate vertical joints in walls at 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.
- C. Contraction Joints in Slab-on-Grade (Pool Deck): Contraction joints shall be placed as soon as possible to provide a clean joint with no raveled edges. Contraction joints must be placed within the first 6 hours.
1. Contraction joints shall be placed to produce panels as square as possible. Panels shall not exceed a length to width ratio of 1.5 to 1. Contraction joints shall be spaced between 8 feet and 12 feet.
  2. Contraction joints shall not intercept or traverse any embeds or tile.
  3. Contractor shall provide joint spacing plan to engineer for review 4 weeks prior to first concrete pour.
  4. Contraction joints shall have a minimum depth of one quarter of the thickness of the slab.
  5. Contraction joints may be tooled or sawcut.
- D. Expansion Joints in Slab-on-Grade (Pool Deck): Expansion joints shall be installed in the pool deck where indicated in the project plans. Expansion joints shall be 1/2 in wide and extend through the entire slab.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at project site, subject to limitations of ACI 301.
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 will be 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 to not 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 in (150 mm) 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 dobies 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.
- E. 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 low temperature is expected to fall below 40 °F (4.4 °C) 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.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 °F (32 °C) 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.

### 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, 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 SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Medium - Heavy Broom Finish: After applying float finish, provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic and uniform in texture and appearance. Grind smooth any surface defect.
1. Coarseness of finish shall be similar to approved test finish as described in paragraph 1.02.
  2. Finish surfaces to the following tolerances, according to ASTM E1155 / ASTM E1155M, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

### 3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. 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.

1. All patches shall be watertight.
- B. Contractor shall not use permanent markings on any concrete finishes or finish facing formwork.

### 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 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/ft<sup>2</sup> x h (1 kg/m<sup>2</sup> x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. 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 the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. 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 in (300 mm) lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 in (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.



3. 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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by methods recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of tile used on project.

### 3.12 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 one part Portland Cement to two and one-half parts fine aggregate passing a No.16 (1.18 mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include 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 in (13 mm) in any dimension in solid concrete, but not less than 1 in (25 mm) in depth. 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 concealed formed surfaces that affect concrete's durability and structural performance as determined by owner/architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as 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 in (0.25 mm) 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. Repair defective areas, except random cracks and single holes 1 in (25 mm) 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 in (19 mm) 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.
  5. Repair random cracks and single holes 1 in (25 mm) 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.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.
  5. 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 C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 yd<sup>3</sup> (4 m<sup>3</sup>), but less than 25 yd<sup>3</sup> (19 m<sup>3</sup>), plus one (1) set for each additional 50 yd<sup>3</sup> (38 m<sup>3</sup>) or fraction thereof.
    - a. When frequency of testing will provide fewer than five (5) 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 C143 / C143M; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Concrete Temperature: ASTM C1064 / C1064M; one (1) test hourly when air temperature is 40 °F (4.4 °C) and below and when 80 °F (27 °C) and above, and one (1) test for each composite sample.
4. Compression Test Specimens: ASTM C31 / C31M.
  - a. Cast and laboratory cure two (2) sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure two (2) sets of two standard cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C39 / C39M; test one (1) set of two laboratory-cured specimens at 7 days and one (1) set of two specimens at 28 days.
  - a. Test one (1) set of two field-cured specimens at 7 days and one (1) set of two specimens at 28 days.
  - 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.
6. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, the contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
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 the Owner/Architect, 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 both 7-day 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 C42 / C42M or by other methods as directed by engineer.
11. Additional testing and inspecting, at the 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 ASTM E1155 / ASTM E1155M within 24 hours of finishing.

END OF SECTION

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## SECTION 131122 - SWIMMING POOL SHOTCRETE

## PART 1 - GENERAL

## 1.1 DESCRIPTION

A. Work in this section. Principal items include:

1. The work under this section shall include all labor, materials, and equipment required to complete the concrete work for the following: swimming pool walls.
2. Materials and/or methods specified in this section as "I.B.C.", "I.B.C. Standards", or similar wording refer to the International Building Code, 2018 Edition.
3. Except as otherwise specified herein, the work of this section shall be in accordance with Chapter 19 "Concrete" of the International Building Code, 2018 Edition.

## 1.2 DEFINITIONS

- A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
- B. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

## 1.3 SUBMITTALS

- A. Product Data: For manufactured materials and products including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
- B. Shotcrete Mix Design: Provide a mix design for each strength and type of shotcrete. Furnish a complete list of materials including type, brand, source, and amount of cement, pozzolan, and admixtures. Obtain approval before shotcrete placement. Any shotcrete work placed prior to approval of the shotcrete mix design is not acceptable, is rejected and shall be removed at no cost to the owner.
1. Provide alternate design mixtures when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
  2. Indicate amounts of mixing water to be withheld for later addition at project site.
- C. Steel Reinforcement Shop Drawings: Provide placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, materials, and grades; bar schedules; stirrup spacing; bent bar diagrams; bar arrangements, splices and laps; mechanical connections; tie spacing; hoop spacing; and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Provide formwork shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Material Test Reports: Provide reports from a qualified testing agency, indicating compliance with requirements for the following:
  1. Aggregates - Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- F. Material Certificates: Provide certificates for each of the following, signed by the manufacturers:
  1. Cementitious materials
  2. Admixtures
  3. Form materials and form-release agents
  4. Steel reinforcement and accessories
  5. Curing compounds
  6. Bonding agents
  7. Repair materials
- G. Provide field quality control test and inspection reports.
- H. Provide minutes of pre-installation conference.
- I. Qualification Data: For installer.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications of Shotcrete Subcontractor: Proposed subcontractor must have at least five years of experience in structural shotcrete construction and have constructed at least 20 significant structural shotcrete swimming pools which, on investigation, have been found to be completed in a satisfactory manner.
- B. Qualifications of Mechanics: Employ only certified nozzlemen, nozzleman's helpers, and rodmen having at least three years of structural shotcrete placing experience and furnish written evidence of such experience upon request. Each team, consisting of the nozzleman and the helper, shall shoot a test panel of the thickness and with typical reinforcing steel pattern using each shotcreting position before commencing any wet mix shotcreting work on the pool. The special inspector shall witness the assembly, reinforcing, shooting and disassembly of the test. The panel shall be at least 4 ft x 4 ft. After shooting, but before the shotcrete has fully set, the panel shall be disassembled to assure that the team and the equipment to be used is capable of providing sound concrete behind the reinforcing steel.
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- D. Comply with provisions of the following, unless more stringent requirements are indicated:
  1. ACI 301, "Specifications for Structural Concrete."
  2. ACI 506.2, "Specification for Shotcrete."
  3. ACI 506R
- E. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing and inspections indicated below:

1. Prior to construction, a test panel shall be shot, cured, cored or sawn, examined and tested by the testing agency. The panel thickness and reinforcement shall simulate the portion of the structure that is most congested with reinforcement and should not be smaller than 4 ft x 4 ft minimum. The panel shall be shot at the same angle, with the same nozzlemen, and with the same mix as will be used on the project. IBC 1908 shall be used as a guideline. Examination and acceptance of the cores shall be conducted in accordance with ACI 506.2.
  - a. Test each set of unreinforced specimens for compressive strength according to ASTM C42.
  - b. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.
- F. Preinstallation Conference: Conduct conference at the project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.5 PROJECT CONDITIONS

- A. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:
  1. Discontinue shotcreting when ambient temperature is 40 °F (4.4 °C) and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 °F (10 °C) and not more than 90 °F (32 °C).
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
  4. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- B. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
  1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 100 °F (38 °C) for dry mix or 90 °F (32 °C) for wet mix.
  2. Reduce temperature of reinforcing steel and receiving surfaces below 100 °F (38 °C) before shotcreting.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS

- A. Form lumber: WCLIB "Construction" grade or better, WWPA No. 1 or better, or equal.
- B. Form plywood: PS 1-83, Group I, Exterior Grade B-B Plyform or better, minimum 5-ply and 5/8 in thickness, grade marked, not mill oiled. Plywood having medium or high-density overlay is acceptable.

- C. Form ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 2 in of concrete surface.
- D. Form coating: Resin type coating free of oil, silicone, wax, and non-drying material, not grain raising.

## 2.2 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494 / C494M, Type A.
  - 2. Retarding Admixture: ASTM C494 / C494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494 / C494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017 / C1017M, Type II.

## 2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615 / A615M, Grade 40 or better for No. 3 and Grade 60 for No. 4 bars and larger, deformed.
- B. Plain-Steel Wire: ASTM A82, as drawn
- C. Supports: Bolsters, chairs, spacers, ties, and other devices for spacing, supporting, and fastening reinforcing steel in place according to CRSI's "Manual of Standard Practice" and as follows:
  - 1. For uncoated reinforcement, use all-plastic or CRSI Class 1, plastic-protected bar supports.
- D. Reinforcing Anchors: ASTM A36 / A36M, unheaded rods or ASTM A307, Grade A (ASTM F568M, Property Class 4.6), hex-head bolts; carbon steel; and carbon-steel nuts.
  - 1. Finish: Plain, uncoated.

## 2.4 SHOTCRETE MATERIALS

- A. Portland Cement: ASTM C150. Use only one brand and type of cement for project.
  - 1. Fly Ash: ASTM C618, Class C or F.
- B. Fine Aggregate: ACI 506 Gradation No. 1 or 2, ASTM C33, washed hard dense durable clean sharp sand from approved pit, free of organic matter and opaline, feldspar, or siliceous magnesium substances and containing not more than 3% by weight of deleterious substances. When tested for organic impurities by ASTM C40 method, fine aggregate color not darker than reference standard color. When tested for soundness by ASTM C88 method, loss after 5 cycles not over 10% of fine aggregate.



- C. Water: Potable, complying with ASTM C94 / C94M, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
- D. Ground Wire: High-strength steel wire, 0.8 mm to 1 mm in diameter.

## 2.5 CHEMICAL ADMIXTURES

A. General: ASTM C1141, Class A or B, but limited to the following admixture materials. Provide admixtures for shotcrete that contains not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.

1. Water-Reducing Admixture: ASTM C494 / C494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C494 / C494M, Type E.
4. High-Range, Water-Reducing Admixture: ASTM C494 / C494M, Type F.
5. Accelerating Admixture: ASTM C494 / C494M, Type C.

## 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/yd<sup>2</sup>. (305 g/m<sup>2</sup>) dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

## 2.7 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, 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 I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.8 REPAIR MATERIALS

- A. Concrete Patching Mortar: Chemical treatment for waterproofing concrete.
  1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    - a. Xypex Concentrate.

## 2.9 SHOTCRETE MIXTURES, GENERAL

- A. Prepare design mixes for each type and strength of shotcrete.
  1. Limit use of fly ash to not exceed, in combination, 15% of Portland cement by weight.
- B. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
- C. Admixtures: When included in shotcrete design mixes, use admixtures and retarding admixtures according to manufacturer's written instructions.
- D. Design-Mix Adjustments: Subject to compliance with requirements, shotcrete design-mix adjustments may be proposed when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

## 2.10 SHOTCRETE MIXTURES (Wet mix process only shall be used)

A. Proportion wet mixtures according to ACI 211.1 and ACI 301, using materials to be used on project, to provide shotcrete with the following properties:

1. Compressive Strength (28 Days): 4,500 psi.
2. Cementitious Material Content: 600 lbs/yd min.
3. Maximum Water-Cementitious Ratio: 0.45.

(Use Type II/V Cement.

4. Cement to aggregate, in dry weight, shall not be less than one to five.
5. Slump: The slump measured at the point of discharge from the mixer shall be minimum 1-1/2 in and maximum 2-1/2 in.

## 2.11 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

B. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

## 2.12 BATCHING AND MIXING

A. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C94 / C94M and furnish batch ticket information.

1. Comply with ASTM C685 / C685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before applying shotcrete, remove unsound or loose materials and contaminants on cast-in-place concrete or existing shotcrete that may inhibit shotcrete bonding. Chip or scarify areas to receive shotcrete to extent necessary to provide sound substrate. Cut edges square and 1 in (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before shotcreting.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Do not place shotcrete on or against fill unless specified on the project plans. Dampen surfaces before shotcreting, but not so wet as to overcome suction. If sloughing or caving of earth banks occurs, fill the resulting voids with shotcrete at no extra cost to owner; backfilling such voids with earth is not allowed.

C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding.

### 3.2 FORMS

- A. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.
1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
  2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the work.
- B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.
- C. Embedded Piping, Boxes, and Rough Hardware: Coordinate with trades that are to fasten or install in shotcrete piping, boxes, bolts, anchors, inserts, or other rough hardware and accurately set such items in forms of shotcrete, and be responsible for changes in the position of such items after setting.

### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.
- C. Securely embed reinforcing anchors into existing substrates, located as required.
- D. Accurately position, support, and rigidly secure reinforcement against displacement by formwork, construction, or shotcreting. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
- E. Place reinforcement to obtain minimum coverage for shotcrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during shotcreting. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.
- F. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

### 3.4 JOINTS

- A. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints, unless otherwise indicated.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
  2. Locate horizontal joints in walls at top or underside of floors and slabs.
  3. Vertical joints in walls shall be located at corners, and in concealed locations where possible.
  4. Where new shotcrete is placed against existing shotcrete or concrete, the interface should be roughened to 1/4 in amplitude and it shall be clean and free of laitance.
  5. Use epoxy-bonding adhesive at locations where fresh shotcrete is placed against hardened or partially hardened shotcrete surfaces.
  6. No construction joints shall be placed in pool walls or slabs unless noted on drawings or approved by engineer.
- B. Contraction Joints: No contraction joints shall be placed on swimming pool walls or slab.

### 3.5 ALIGNMENT CONTROL

- A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

### 3.6 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.7 APPLICATION

- A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.
- B. Moisten wood forms immediately before placing shotcrete where form coatings are not used.
- C. Apply shotcrete according to ACI 506.2.
- D. Apply wet-mix shotcrete materials within 90 minutes after batching.
- E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
1. Remove and dispose of all rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
- F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray and prevent buildup against front face during shotcreting.
- G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete
- H. Do not permit shotcrete to sag, slough, or dislodge.

- I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
- J. Do not disturb shotcrete surfaces before beginning finishing operations.
- K. Puddled Shotcrete: Use of "puddled shotcrete" in which the air pressure is reduced and the water content is increased to facilitate placing in difficult locations is not allowed. Do not place shotcrete where nozzle stream cannot impinge directly on the involved surface. Where difficult shooting conditions occur, obtain proper results by maintaining correct air pressure and water ratio and reduce supply of material.
- L. Remove ground wires or other alignment control devices after shotcrete placement.
- M. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
- N. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117R, increased by a factor of 2.

### 3.8 SURFACE FINISHES

- A. General: Finish shotcrete according to descriptions in ACI 506R for the following finishes:
- B. Flash-Coat and Final Finish: After screeding and rodding surface, apply up to 1/4 in (6 mm) coat of shotcrete using ACI 506R, Gradation No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 sieve.

### 3.9 CURING

- A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing.
- C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for at least seven days with water, continuous water-fog spray, water-saturated absorptive covers, or moisture-retaining covers. Lap and seal sides and ends of covers. Do not use curing compounds of any kind.
- D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

### 3.10 FORM REMOVAL

- A. Forms not supporting weight of shotcrete may be removed after curing at not less than 50 °F (10 °C) for 24 consecutive hours after gunning, provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.
  - 1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.

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 materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

### 3.11 FIELD QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.
- B. Shotcrete Temperature: ASTM C1064 / C1064M; One (1) test hourly when air temperature is 40 °F (4.4 °C) and below and when 80 °F (27 °F) and above, and one (1) test for each set of compressive-strength specimens.
- C. In-Place Shotcrete or Test Panel: If test panel is used, the panel should not be smaller than 24 in x 24 in by 3-1/2 in (610 mm x 610 mm x 89 mm) minimum. Take a set of three (3) unreinforced cores for each mix and for each workday or for every 50 yd<sup>3</sup> (38 m<sup>3</sup>) of shotcrete placed; whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C42. Do not cut steel reinforcement.
- D. Strength of shotcrete will be considered satisfactory when mean compressive strength of each set of three (3) 3 unreinforced cores equals or exceeds 85% of specified compressive strength, with no individual core less than 75% of specified compressive strength.
- E. If any 28 day core from the test panels shows deficient strength, additional cores shall be taken and tested at contractor's expense from the area of work in place represented by the test panel; two (2) additional cores are required for each deficient core. If any additional test core proves deficient, contractor shall remove and replace deficient shotcrete as directed and approved, at no extra cost to owner. Should deficiency be evident in 7-day cores, contractor may proceed with the Work on his responsibility and risk until the 28-day cores are tested.
- F. Defective Shotcrete: Cut out and replace defective shotcrete including rebound, sand pockets, sags, sloughing, and other defects at no extra cost to the owner.

### 3.12 REPAIRS

- A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.
  1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1 in (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces and apply new shotcrete or patching mortar.

B. Repair core holes from in-place testing according to repair provisions in ACI 301 and match adjacent finish, texture, and color.

3.13 CLEANING

A. Remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION

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## SECTION 131125 - SWIMMING POOL CEMENTITIOUS WATERPROOFING

## PART 1 - GENERAL

## 1.1 Description

## A. Work in this section. Principal Items include:

1. Application of polymer modified cement waterproofing.
2. Waterproofing swimming pool gutter.
3. Waterproofing main drain sumps.
4. Waterproofing interior of surge tank.

## B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete
2. Section 131120 - Swimming Pool Cast-In-Place Concrete
3. Section 131122 - Swimming Pool Shotcrete

## 1.2 Submittals

## A. Comply with requirements of Shop Drawings, Product Data and Samples Section.

## B. Product Data: Manufacturer's specifications, data, and installation instructions.

## C. Submit list of project references as documented in this specification under Quality Assurance Article. Include contact name and phone number of the person charged with oversight of each project.

## D. Quality Control Submittals:

1. Provide protection plan of surrounding areas and non-work surfaces.

## 1.3 Quality Assurance:

## A. Qualifications:

1. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products and systems.
2. Manufacturer Qualifications: Company shall be ISO 9001:2015 Certified.
3. Applicator Qualifications: Company with minimum of 5 years' experience in application of specified products and systems on projects of similar size and scope, and is acceptable to product manufacturer.
4. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

## B. Field Sample:

1. Install field sample at project site or other pre-selected area of building, as directed by Architect/Engineer.
2. Apply material in strict accordance with manufacturer's written application instructions.
3. Manufacturer's representative or designated representative will review technical aspects; surface preparation, application and workmanship.
4. Field sample will be standard for judging workmanship on remainder of project.
5. Maintain field sample during construction for workmanship comparison.



6. Do not alter, move or destroy field sample until work is completed and approved by Architect/Engineer.
7. Obtain Architect/Engineer written approval of field sample before start of material application, including approval of aesthetics, color, texture and appearance.
8. Installer: Trained, certified, and monitored full time for duration of installation by membrane manufacturer.

#### 1.4 Product Delivery and Storage

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Transport and store in unopened containers and keep in clean, dry condition protected from rain, dew and humidity. If dry onsite storage of bags is unavailable or if project is located in a very wet, humid climate, purchase product in manufacturer's packaged metal pails.
- D. Do not stack bags more than two pallets high.
- E. Do not allow MasterEmaco® A660 modifying admixture (formerly Acryl 60) to freeze.

#### 1.5 Job Conditions

- A. Do not apply in rain or when rain is expected within 24 hours. Do not apply above 90 degrees F or below 40 degrees F or when temperatures are expected to fall below 40 degrees F within 24 hours. For hot and cold temperature applications, store materials and water at 50 degrees F to 70 degrees F before use.

#### 1.6 Warranty

- A. Defects in material, workmanship, and installation of the pool cementitious finish against cracking and delamination for a period of three (3) years.

### PART 2 - PRODUCTS

#### 2.1 Materials

- A. Waterproof Coating: MasterSeal 581 (Thoroseal) cement based, aggregate type, heavy duty, waterproof coating for concrete or masonry, as manufactured by Master Builders Solutions, or approved equal. Color shall be grey.
  1. Bonding and Modifying Mixture: MasterEmaco A660 (formerly Acryl 60) liquid compound of acrylic polymers and modifiers, as manufactured by Thoro System Products, or approved equal.
- B. Water: Clean, fresh, from domestic potable source.

## 2.2 Proportions and Mixing

- A. Materials are specified on a volume basis and shall be measured in approved containers that will ensure that the specified proportions will be controlled and accurately maintained during progress of the work. Measuring materials with shovels ("shovel count") is NOT permitted.
- B. Mixing. Perform mixing in approved mechanical mixers of the type in which quantity of water can be controlled accurately and uniformly. Mix to manufacturer's recommendations for swimming pool applications. Discard material which has begun to set before it is used; re-tempering is not allowed. Do not use any caked or lumpy materials. Completely empty mixer and mixing boxes after each batch is mixed and keep free of old material.

## PART 3 - EXECUTION

### 3.1 Preparation of Surfaces

#### A. Surface Conditions Requirements:

1. Existing surfaces to be coated must be smooth and clean. Sandblast existing concrete (old) surface to remove projections, loose particles, foreign matter or construction debris, and make sufficiently rough to provide a strong mechanical bond to 1/16 in amplitude.
2. New concrete to be rough float finish 1/16 in amplitude chip, sandblast, or grind off all defective materials and foreign matter.

#### B. Surface Repair Requirements:

1. Repair all cracks with "Waterplug" concrete patch, or approved equal.
2. All areas of loose plaster discovered shall be completely removed down to rough concrete.

#### C. Preparation:

1. Application of waterproofing constitutes acceptance of substrate. Contractor shall be responsible for properly preparing substrate. Any defects from resulting from substrate issues shall be covered under contractor's warranty.
2. Prior to coating, thoroughly wash entire surface with 2,000 psi high-pressure water.
3. Wet cementitious base surfaces with fine fog water spray to produce a uniformly moist condition.
4. Check gutter grates and accessories for correct alignment before coating is started.
5. Do not apply coating to base surfaces containing frost.
6. Install temporary coverings as required to protect adjoining surfaces from staining or damage by waterproofing operations.

### 3.2 Application of Waterproofing

- A. General: Apply waterproof coating to the manufacturer's minimum thickness at any location. Apply finish coating by manufacturer's approved brushes (do not use a paint brush).

B. Workmanship:

1. Apply waterproof coating in two coats with second coat applied the next day or before material has become too dry or glazed for good bond.
2. Dampen surface immediately ahead of application.
3. Brush on two coats of waterproof coating, each with a minimum thickness as recommended by the manufacturer.
4. Float final brushed on coat with damp sponge 15 minutes after application to provide a smoother finish without waves, cracks, ridges, pits, projections, or other imperfections.
5. Form coating carefully around curves and angles.

C. Curing:

1. Cure waterproof coating with fine water mist spray applied to finish coat three or four times at 8-hour intervals or as drying conditions require to prevent premature drying. Do not fill with water for at least 8 days.

D. Patching and Cleaning up:

1. Upon completion, cut out and patch loose, cracked, damaged, or defective waterproof coating; patches matching existing coating in texture, color, and finish, flush with adjoining coating. Remove waterproof coating droppings or spattering from all surfaces. Leave surfaces in clean unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from site.

END OF SECTION

## SECTION 131130 - SWIMMING POOL SEALANTS AND CAULKING

## PART 1 - GENERAL

## 1.1 DESCRIPTION

A. Work in this section. Principal Items include:

1. Labor, materials, and equipment to complete sealants and caulking as indicated and specified.

## 1.2 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing Materials (ASTM):
  - a. C920-11 Elastomeric Joint Sealants

## 1.3 SUBMITTALS

A. Certificates of Conformance or Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.

B. Manufacturers' Descriptive Data: Submit complete descriptive literature for each type of material. Clearly mark data to indicate which type the Contractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and caulking shall include application instructions, shelf life, mixing instructions for multi-component sealants, and recommended cleaning solvents.

## 1.4 SAMPLE JOINTS

A. Before Sealant and Caulking Work starts, provide a sample of each type of finished joint where directed. The sample shall show the workmanship, bond, and color of sealant or caulking. The workmanship, bond, and color of work throughout the project shall match that of the approved sample joints.

## 1.5 ENVIRONMENTAL CONDITIONS

A. The ambient temperature shall be within the limits of 40 °F and 100 °F when the sealant and caulking are applied, unless noted otherwise herein.

## 1.6 DELIVERY AND STORAGE

A. Materials shall be delivered to the job site in the manufacturer's original shipping containers with brand names, date of manufacture, color, and material designation clearly marked thereon.

B. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use.

C. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 °F or less than 40 °F.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. General: Products shall conform to the reference documents listed for each use. Color of sealant shall match adjacent surface color unless specified otherwise. For ASTM C920 sealants, use a sealant that has been tested on the types of substrate to which it shall be applied.

1. Interior Sealant: ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Color of sealant shall be as selected.
2. Exterior Sealant: For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Class 25, Use T. Color of sealant shall be as selected.
3. Floor Joint Sealant: ASTM C920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be as selected.
4. Primer for Sealant: Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.
5. Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.
6. Backstops: Use glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

### 2.2 POOL DECK EXPANSION JOINT SEALANT

A. "Deck-O-Seal" gun grade 2-part joint sealant 2-part polysulfide 2-component chemically cured polysulfide rubber, color as selected by Owner's representative.

1. Approved equal:

- a. Sika Corporation "Sikaflex 2C SL" 2-component chemically cured urethane sealant, color as selected by Owner's representative.

### 2.3 POOL DECK EXPANSION JOINT BACKER ROD

A. Backer rod shall be closed cell, non-absorbent compressible material manufactured for the specific purpose of controlling sealant depth. Manufactured by Sika, Quikrete or approved equal.

B. #16 silica sand.

## PART 3 - EXECUTION

### 3.1 GENERAL SURFACE PREPARATION

A. Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2 in and grind to a minimum width of 1/4 in without damage to the adjoining Work.

### 3.2 SEALANT PREPARATION

- A. Do not modify the sealant by addition of liquids, solvents, or powders. Mix multi-component elastomeric sealants in accordance with manufacturer's printed instructions

### 3.3 GENERAL APPLICATION

- A. Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.
- B. Primer: Just prior to application of sealant, clean out loose particles from joints. Apply primer in accordance with sealant manufacturer's directions. Do not apply primer to exposed finish surfaces.
- C. Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.
- D. Sealant: Use a sealant that is compatible with the material to and against which it is applied. Do not use a sealant that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Sealant shall be uniformly smooth and free of wrinkles.
1. Interior Sealant: Provide sealant at all exposed joints and at all joints indicated to receive sealant.
  2. Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints and at all joints indicated to receive sealant.
  3. Floor Joint Sealant: Provide sealant in all control joints and in other floor joints indicated or specified.

### 3.4 POOL DECK EXPANSION JOINT SEALANT

#### A. Joint Preparation

1. The number of joints and joint width should be designed for a maximum of  $\pm 25\%$  movement. The depth of the sealant should be 1/2 the width of the joint with a maximum depth of 1/2" (12.7 mm) and a minimum of 1/4" (6.35 mm).
2. In joints of 1/4 in to 1/2 in (6.4 mm to 12.7 mm), the sealant depth at midpoint should be 1/4 in (6.4 mm). In joints of 1/2 in to 1 in (12.7 mm to 25.4 mm), the depth at midpoint should be 1.4 in to 1/2 in (6.4 mm to 12.7 mm).
3. Control the sealant depth in deep joints with closed-cell backer rod or soft backer-rod. Where the joint depth does not permit the use of backer rod, a bond breaker (polyethylene strip) must be used to prevent three-point bonding.

4. To maintain the recommended sealant depth, install backer rod by compressing and rolling it into the joint channel without stretching it lengthwise. Backer rod should be about 1/8 in larger in diameter than the width of the joint to allow for compression. Backer rod becomes an integral part of the joint. The sealant does not adhere to it, and no separation bond breaker is required. Do not prime or puncture the backer rod.

#### B. Surface Preparation

1. Remove any old joint sealing material by mechanical means. If joint surfaces have absorbed oils, sufficient concrete must be removed to ensure a clean surface.
2. Joint surfaces must be structurally sound, dry, clean, and free of all loose aggregate, laitance, oil, grease, asphalt, paint, wax, mastic compounds, waterproofing compounds, or form release materials.

#### C. Priming

1. Prime Joint surfaces with manufacturer's recommended primer for the substrate before sealing. If the surfaces are other than shotcrete or concrete, test first to determine adhesion. Seek technical assistance from manufacturer.
2. Apply primer in a thin uniform film. Avoid buildup of film.
3. Allow approximate 30 minutes drying time before applying sealant.
4. Reapply primer if not sealed the same day.
5. To minimize contamination of adjacent surfaces, apply masking tape and remove before sealant has begun to thicken and set.
6. Coverage rate of primers is approximately 35 ft<sup>2</sup> per pint.

#### D. Mixing

1. Two two-component systems must be thoroughly mixed before use. The oversize Part-A container allows for the addition and mixing of Part-B and the color pigment.
2. 1-1/3 gallon unit: (1) Transfer Part-B to Part-A container using a spatula or knife. It is imperative that the entire contents of Part-B be combined with Part-A. (2) With a slow speed drill and a slotted mixing paddle, thoroughly mix for 3 minutes. The paddle blade must be kept below the sealants surface to avoid whipping in air. (3) Transfer the contents of the pigment can into the mixed Part-A and Part-B. Use a spatula or knife, removing the entire contents to ensure consistent color. (4) Continue mixing with a slow speed drill and slotted paddle until color is uniform. During the process, the sides and bottom of the base can and the paddle itself several times.
3. 3 gallon unit: Use 2 Part-B and 2 pigment container for each Part-A container. Mix as instructed under 1-1/2 gallon unit.
4. Pot life of the sealant is dependent upon temperature./

#### E. Application

1. All caulking and sealing be should be performed when temperatures are above 40 °F (+4 °C) any moisture or frost on surfaces shall adversely affect adhesion.

2. Ideally, the temperature at the times of application should be the median of temperature extremes when the joint width opening is at its midpoint.
3. Fill joints from the bottom; avoid bridging of the joint that might form air voids.
4. For large joints, the self-leveling grade may be poured directly from the can.
5. For smaller joints and for all slope-grade applications, fill the joint by flowing the sealant from a bulk-loading gun.
6. Light tooling of the sealant is recommended to smooth out ripples. On sloped surfaces, tool from lowest point to highest.

#### F. Clean Up

1. Immediately after use and before sealant has cured clean equipment with xylene.

#### G. Curing

1. The cured sealant may be removed by cutting with a sharp-edged tool and thin films by abrading.
2. Protect joint from dirt and traffic overnight. Time for initial cure will vary with humidity and temperature.

### 3.5 BACKER ROD

#### A. Installation

1. Closed-cell backer rod must be compressed in the joint at the time of installation. For joint widths up to 3/4 in (19.1 mm), the diameter of the rod should be 1/8 in (3.18 mm) larger than the width of the joint. For 3/4 in (19.1 mm) wide joints use 1 (25.4 mm) diameter rod.
2. Closed-cell backer rod may be easily installed with a blunt probe or a plain-faced roller to force the rod to the desired depth. A template or roller gauge may be used to control the depth at which the rod is placed. Do not puncture, fold, or crease backer-rod. Follow sealant manufacturer's suggestions for joint sealant width and depth ratio.

### 3.6 PROTECTION

- A. Protection: Protect all areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.
- B. Cleaning: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Upon completion of application, remove all remaining smears and stains resulting there from and leave the Work in a clean and neat condition.

END OF SECTION



## SECTION 131140 - SWIMMING POOL PLASTER

## PART 1 - GENERAL

## 1.1 REFERENCE

- A. Requirements in Addenda, Alternates and Conditions collectively apply to this work.

## 1.2 DESCRIPTION

- A. Principal Work Items Are:

1. Swimming pool plaster finish.
2. Swimming pool start-up and maintenance.

- B. Related Work Specified Elsewhere:

1. Section 131100 - Swimming Pool Contractor General Requirements
2. Section 131109 - Swimming Pool Start-up
3. Section 131120 - Cast-In-Place Concrete
4. Section 131122 - Swimming Pool Shotcrete

## 1.3 SUBMITTALS

- A. Samples: Prepare 12 in x 12 in square panel at the site showing color and texture for pool plaster. Finished plasterwork shall match the approved sample panel.
- B. Certificates: Submit certificates attesting that the materials furnished meet the requirements specified herein.
- C. Test Report: Submit results of domestic water analysis.

## 1.4 PRODUCT DELIVERY AND STORAGE

- A. Deliver manufactured materials to site in manufacturers' original unbroken packages or containers bearing manufacturers' name and brand labels. Keep cementitious materials dry until ready to be used and stored off the ground, under cover, and away from damp surfaces.

## 1.5 JOB CONDITIONS

- A. Apply plaster in exterior swimming pool only when ambient temperature is above 40 °F and below 90 °F, and protect applied plaster from rapid drying by sun or wind until curing is completed or pool is filled with water.
- B. Do not install plaster during rain. Do not begin plastering if there is a chance of rain within 24hrs of the plastering. If it begins to rain during the plastering process, see section 1.06 "Protecting plaster in unanticipated circumstances".
- C. Do not install plaster if the wind conditions are greater than 10 MPH. Do not begin plastering if there is a chance of 10MPH or greater wind within 24hrs of the plastering. If the wind raises above 10MPH during the plastering process, see section 1.06 "Protecting plaster in unanticipated circumstances".
- D. Make every effort to apply plaster as late in the construction schedule as possible to avoid staining or damage to the finish.

E. Protect interior plaster applications from construction debris. Stains or damage occurring as a result of inadequate care may result in the rejection of the installation and require complete removal and re-installation at the contractor's expense.

#### 1.6 PROTECTING THE PLASTER DURING UNANTICIPATED WEATHER EVENTS

A. If the weather becomes a threat to the plaster during the plastering process before the plaster has cured, the following steps shall be followed

1. Plaster already placed shall be protected until cured.
2. Plastering shall continue until the plaster abuts tilework. Plastering should then stop until the weather turns favorable. All plasterwork shall be protected until cured.
  - a. There shall be no cold joints in the plaster

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I White Portland cement. Manufacturer, Federal Cement.
- B. Hydrated Lime: ASTM C206, Type S.
- C. Aggregate: Georgia Marble Pool Aggregate, Riverside Premium Pool Aggregate, or approved equal. Mix per manufacturer's recommendations for specific application. If an onsite mix is used, aggregate must be white marble dust uniformly graded within the following limits, all passing the No. 30 sieve:
- D. Color: Swimming Pool plaster shall be white in color.
- E. Water: Clean, fresh, from domestic potable source, free from injurious amounts of acid, alkali, and organics.

#### 2.2 PROPORTIONS AND MIXING

- A. Materials are specified on a volume basis and shall be measured in approved containers that will insure that the specified proportions will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels ("shovel count") is not permitted.
- B. White Marble Pool Plaster Finish Coat: Mix finish in proportion of one part by volume of White Portland cement to not more than two parts by volume of sand (specified white marble dust).
- C. Mixing: Perform mixing in approved mechanical mixers of the type in which quantity of water can be controlled accurately and uniformly. While mixer is in continuous operation, charge approximately 90% of estimated quantity of water, half of sand, all cement, and the other one-half of the sand into mixer in that sequence and mix thoroughly with remainder of water until mixture is uniform in color and consistency. Avoid excess mixing to prevent hasty solution of cement resulting in accelerated set. Discard plaster which has begun to set before it is used; re-tempering is not allowed. Do not use any caked or lumpy materials. Completely empty mixer and mixing boxes after each batch is mixed and keep free of old plaster.

## PART 3 - EXECUTION

## 3.1 PREPARATION OF SURFACES

## A. Removal of existing plaster and tile

1. All surfaces to receive new plaster shall be stripped of all existing finishes, including plaster and tile, by use of a chipping gun or by picking down to the bare concrete. Expose a clean rough surface to receive new plaster.

## B. Clean base surfaces of projections, dust, loose particles, grease, bond breakers, and foreign matter; make sufficiently rough to provide a strong mechanical bond.

1. Do not apply plaster directly to the surfaces of masonry or concrete that is coated with any membrane-forming curing compound or similar agent until compound or agent is completely removed by sandblasting.
2. Thoroughly wash entire surface with 6,000 psi high-pressure water immediately prior to plastering.
3. Wet cementitious base surfaces with a fine fog water spray to produce a uniformly moist condition and check screeds, pool equipment, and accessories for correct alignment before plastering is started.
4. Do not apply plaster to base surfaces containing frost.
5. Install temporary coverings as required to protect adjoining surfaces from staining or damage by plastering operations.

## C. External project considerations

1. The pool mechanical equipment shall be operational
2. The health department and/or other governing agencies shall have approved the pools or spas for plaster
3. All chemicals required to balance the pool are onsite and ready to be used
4. All pool related piping have been flushed
5. Decking work is complete
6. The pool is protected from any cleaning or additional construction work to be completed that may introduce debris into the pool area

## 3.2 APPLICATION OF PLASTER

A. General: Apply finish plaster to minimum 1/2 in thickness at any location. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a slump not exceeding 2-1/2 in when tested using a 2 in x 4 in x 6 in high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to following procedure:

1. Place cone on level, dry, non-absorptive base plate.
2. While holding cone firmly against base plate, fill cone with plaster taken directly from hose or nozzle of plastering machine, tamping with a metal rod during filling to release all air bubbles.
3. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

4. Place cone in a vertical position adjacent to freed plaster sample using care not to disturb base plate.
  5. Lay straightedge across top of cone being careful not to vibrate cone; measure slump in inches from bottom edge of straightedge to the top of slumped plaster sample.
- B. Workmanship:
1. Apply finish plaster in two coats by "double-back" method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good bond on bases.
  2. Work plaster to screeds at intervals of from 5 ft to 8 ft, or closer as required on curved surfaces.
  3. Finish plaster to tolerance of -0 to +1/8 inch in thickness on curved surfaces and to 1/8 in in 8 feet on straight surfaces.
  4. Apply smooth trowel finish without waves, cracks, trowel marks, ridges, pits, crazing, discoloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds.
  5. Take special care to prevent sagging and consequent drooping of applications. Produce surfaces free of visible junction marks in finish coat where one day's work adjoins another.
- C. Curing: Cure plaster with fine fog water spray applied to finish coat as frequently as required to prevent dry-out of plaster. Keep plaster damp until pool is filled. Prevent damage or staining of plaster.
- D. Patching, Pointing, and Cleaning Up:
1. Upon completion, cut out and patch loose, cracked, damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster.
  2. Perform pointing and patching of surfaces and plasterwork abutting or adjoining any other finish work in a neat and workmanlike manner. If 10% or more of the pools plaster finish is found to be defective, the plaster shall be removed and replaced completely for the entire pool.
  3. Remove plaster droppings, voids, holes or spattering from all surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

### 3.3 START-UP SPECIFICATIONS

- A. Contractor shall employ a qualified water testing agency to analyze the domestic water with which the pool will be filled within 2 weeks of the plaster date, and shall employ a swimming pool experienced, water chemistry consultant to determine types and quantities of chemicals required to ensure calcium-balanced water immediately upon the completion of water filling.
1. Have on hand quantities of the chemicals as determined above, plus 25% overage for follow-up treatment. These chemicals, typically including calcium chloride, bicarbonate of soda, and muriatic acid, are in addition to standard chlorine/chlorine products and alkalizer/pH control products required elsewhere.

- B. Care shall be taken in filling the pool to assure that the water source is clean and potable and free of contaminants that could stain the fresh plaster. Flush all water lines that have not been in continuous operation before filling the pool.
- C. The pool shall not be plastered until the filtration system and chlorination system are complete and ready for start-up.
1. Contractor shall notify the Owner in writing of start-up at least two weeks prior to the plaster date.
  2. The Owner is responsible for supplying chlorine/chlorine products and alkalizer/pH control products for maintenance of the pool by the automatic treatment systems.
  3. Should these automatic treatment systems fail or if the Contractor fails to notify the Owner as required, the Contractor shall supply all chemicals required for manual treatment of the pool water.
- D. Contractor shall maintain swimming pool for a minimum 14 consecutive days in conjunction with the mechanical system operational test.
1. This maintenance period shall be extended with the mechanical system operational test if required per specifications.
  2. During this time, brush the entire pool plaster surface daily starting immediately after filling pool for a minimum of 5 days to remove plaster dust, periodically clean grates until no further accumulation of foreign material occurs, and add chemicals as required for acceptable water quality.
  3. The pool shall be vacuumed to maintain a clean and new condition throughout the minimum 14-day period starting no sooner than 5 days after the date of plaster.
  4. In no instance, shall the pool maintenance and cleaning responsibilities cease prior to gainful occupancy of the entire facility by the Owner.
  5. After successful conclusion of the mechanical system operational testing, clean grates, vacuum pool, and leave the pool ready for use.
- E. Clean-Up
1. Before the contractor leaves the site, the site shall be cleaned of all debris created due to the work. The site shall be left in a presentable condition, as determined by the owner or owners representative.

END OF SECTION

## DIVISION 22 - PLUMBING

## SECTION 220000 - PLUMBING GENERAL REQUIREMENTS

## PART 1 - GENERAL

## 1.1 SCOPE:

## A. General:

1. The Bidding Requirements, Contract Requirements, and the General Requirements (Division 01) of these specifications shall govern all parts of the work.

## B. Work Included:

1. Install work in accordance with these specifications and the accompanying plans. Furnish all labor, material, and equipment together with all incidental items not specifically shown or specified which are required by good practice to provide the complete plumbing systems as described.

## C. Coordination and Site Visits:

1. This section of the work requires examination of and reference to all architectural, structural, utility, and electrical drawings for construction conditions that may affect the work. Inspect the building site and existing facilities for verification of existing conditions. Base all measurements from established benchmarks. Any discrepancy between actual measurements and those indicated, which prevents following good practices or the intent of the drawings and specifications, shall be reported to the Architect/Engineer, and work halted until instructions are received from the Architect/Engineer.

## 1.2 CODES, PERMITS, FEES:

- A. Install all work in accordance with applicable codes and standards. Obtain all required permits; pay all required fees including utility connections or extensions, in connection with this portion of the construction. Obtain all required certificates of inspection for the work.

## PART 2 - PRODUCTS

## 2.1 MATERIALS AND WORKMANSHIP:

## A. Materials:

1. All materials and equipment shall be of first quality, new, full size and weight, standard in every respect, and suitable for the space required. Use the same manufacturer for products of similar class or service, such as valves and pumps. Protect all materials against loss, theft, or damage before and after installation.
2. Furnish and install all necessary foundations, supports, pads, bases, and piers required for all materials and equipment furnished under this contract.

3. Provide all required firestopping at piping penetrations of fire rated walls, floors, ceilings, and roofs. Firestopping shall be Dow Corning Fire Stop Sealant 2000 or Fire Stop Foam 2001, or approved equal.
4. Provide a heat-expanding fire collar for all non-metallic piping up to 6" size at penetrations of fire rated walls, floors, and ceilings per ASTM E 814.

B. Workmanship:

1. All materials and equipment shall be installed in a neat and workmanlike manner by competent specialists for each subtrade. Work shall be installed to the satisfaction of the Architect/Engineer with unsatisfactory work removed and reinstalled to his satisfaction at no extra cost to the Owner.
2. Provide all cutting and patching necessary to install the work specified in this section. Patching shall match adjacent surfaces. No structural members shall be cut without the approval of the Architect/Engineer. Provide all sleeves and inserts required before the floors and walls are built.
3. Locate all equipment that must be serviced in fully accessible positions. Provide clearance for removal of replacement parts and components, and with necessary couplings or flanges to remove the component for maintenance.

## 2.2 SUBMITTALS AND SUBSTITUTIONS:

A. Prebid Approval:

1. Manufacturer's trade names and catalog numbers stated herein are intended to indicate the quality of equipment or materials desired. All manufacturers not specifically listed require prior approval. Submit catalog data, including specifications, of the proposed equipment to the Architect/Engineer for his approval at least 10 calendar days prior to bid opening. Notice of such approvals will be published in an addendum. Approval of listed alternate equipment manufacturers is for bidding only. Final approval is to be based on requirements of the plans and specifications.

B. Submittals:

1. Within thirty days after award of this contract, provide an electronic copy of a complete list of all materials and equipment proposed for this project. List shall contain make, type, manufacturer's name, and trade designation of all materials and equipment. Submittal shall also include manufacturer's complete specification for each item, including ratings, and dimensions as required to check space requirements. The scheduled equipment is the basis of design for physical size, etc. Alternate manufacturers shall not exceed the weight or physical size. Any changes to the Architectural, Structural and Mechanical systems due to alternate manufactures shall be the responsibility of the Contractor and Supplier. Submittals for fixtures, trim, and other plumbing related items, requiring submittals, shall be submitted in a single complete package. Individual items will not be reviewed independently unless approved by the Engineer.

2. Approval of submittals shall not relieve the contractor from responsibility for deviations from the plans or specifications, unless he has, in writing, called the Architect's /Engineer's attention to deviations at the time of submission, and obtained his written approval. Approval of submittals does not relieve the contractor from responsibility for errors in shop drawings or literature.

C. Equipment Requiring Submittals:

1. Plumbing Fixtures & Trim

### PART 3 - EXECUTION

#### 3.1 ACCESSIBILITY & SAFETY:

A. Accessibility:

1. All equipment which must be serviced or operated shall be located in fully accessible position. Minor changes from the drawings may be made to allow for better accessibility. All changes shall be approved prior to actual installation.
2. Access panels shall be provided if required for accessibility. Access panels to be steel, flanged, hinged doors by Cendrex, model AHD, or equal. Size as required for installation. Subcontractor shall furnish the required panels to the General Contractor and the required location for all access panels, unless otherwise specified in the Architectural specifications. Panels shall be installed by the General Contractor.

B. Safety:

1. No water piping shall run immediately over or within a 3-foot plan view clearance of any electrical panel or motor starter. Where piping must be located within these zones, install piping inside a conduit to prevent water access to electrical equipment.

#### 3.2 COORDINATION:

- A. Coordinate all work with the various trades involved to provide a complete and satisfactory installation. The exact details of piping and equipment are not shown. No additional compensation will be made for offsets or relocation required in coordination with other trades.
- B. Alterations required due to improper supervision by the subcontractor shall be made at no extra cost, to the satisfaction of the Architect/Engineer.

#### 3.3 EXCAVATION & BACKFILL:

- A. Excavate trenches required for underground piping to proper elevation and grade. Provide trenches with solid bottoms to allow support of piping along entire length with excavation at bells as required for jointing and inspection. Provide repairing of finished surfaces, and all required shoring, bracing, pumping, and protection for safety of persons and property. Observe all Local or State Safety Codes. Verify that elevations of existing utilities will allow for proper grading of piping connecting to existing utilities.
- B. Excavation and Backfill shall be in accordance with the requirements of Division 31, of these specifications.



### 3.4 IDENTIFICATION AND CODING:

#### A. General:

1. The Contractor shall use ASME 13 standards for all piping identifications, color coding, and compliance.

#### B. Painting:

1. All painting of equipment, accessories, and piping shall be furnished and applied under the Architectural section of these specifications. All painting shall be completed before any identification markings are applied.

#### C. Piping:

1. Identify all piping as to the service of the pipe and the direction of flow. The letters shall be 3/4 inch high on piping two inches or smaller, and 1-1/4 inches high on piping up to six inches. Flow arrows shall be at least six inches long. The letters and flow arrows shall be made by precut stencils and oil base paint, one inch high and black, or factory fabricated plastic pipe markers. Piping shall be identified at 25 foot maximum intervals, on long continuous lines; adjacent to each item of equipment; on each riser and junction, and on both sides of all wall penetrations. Underground piping shall be identified with bright colored continuously printed plastic tape of not less than 6" wide by 4 mil thick, manufactured for direct burial service. Install directly above all buried pipe, 6 to 8 inches below finished grade.

#### D. Valves:

1. Regardless of size, all valves shall be tagged with a numbered brass tag, 1-1/2 inches by 3 inches minimum in size and 0.051 inch thick. A valve chart indicating valve tag number, location, service, and normal position shall be mounted in a suitable framed and glassed cover in the main mechanical room or as directed. Valve chart shall be duplicated in the Maintenance and Operations Manual.

### 3.5 TESTING:

#### A. Piping:

1. All plumbing piping (drainage, water, gas) shall be tested in accordance with the requirements of local adopted plumbing code, latest edition. Other piping systems shall be tested hydrostatically to 1.5 times the operating pressure but not less than 100 psi, for a minimum period of two hours. If the test pressure falls more than 5 percent during the test period, the leak shall be located, repaired, and the test repeated.
2. Piping shall be tested before insulation has been installed. Delicate control mechanisms shall be removed during tests to prevent shock damage. The use of chemicals or compounds to stop leaks shall not be permitted.
3. A test report shall be submitted for each piping system test. Test report forms are part of Specifications Section 220100, or are available from the Engineer.

#### B. Systems:

1. All plumbing systems shall be tested at the completion of the building to establish that the systems operate as specified and required.

### 3.6 CLEANING AND ADJUSTING:

- A. Thoroughly clean all parts of the system at the completion of the work. Flush all water circulating systems with fresh water and then drain. Clean all strainers and refill system. Adjust all devices for proper operation and lubricate all equipment as required. Repaint any painted surface that has been damaged.
- B. All potable water systems shall be flushed and disinfected after tests are completed. Disinfection shall be in accordance with local municipal and State Plumbing Inspector's criteria. In lieu of such criteria, the following procedure shall be followed for disinfection:
  1. Completely flush system. Add alkali or acid (hydrochloric) to bring water ph level to between 7.4 and 7.6.
  2. Inject chlorine (liquid, powder, tablet, or gas) throughout the system to obtain 50 to 80 mg/L residual.
  3. Bleed water from outlets to ensure distribution, and test for residual at a minimum of 15 percent of the outlets.
  4. Maintain disinfection in system for 24 hours.
  5. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
  6. Flush disinfectant from system until residual is equal to that of incoming water, or 1.0 mg/L.
  7. Take samples no sooner than 24 hours after flushing, from 10 percent of the outlets and the incoming water.

### 3.7 PROJECT CLOSEOUT:

#### A. Operations & Maintenance Manual:

The Contractor shall provide an operations and maintenance manual at least thirty days prior to completion of work. The manual shall be of the three ring binder type, entitled "Operations and Maintenance Manual", with the job name and year of completion also included. O & M manuals shall be submitted in a single package. Individual items will not be accepted independently unless approved by the Engineer. The manual shall include, as a minimum:

1. Maintenance instructions for all equipment, including lubrication requirements.
2. Fixture suppliers names, addresses, and telephone numbers.
3. Fixture catalog cuts, ratings tables, model numbers, serial numbers, and accessories.
4. Parts numbers for all replaceable parts.
5. Valve tagging chart as hereinbefore specified.
6. Guarantee letter as specified below.
7. Any additional information required to enable the Owner to properly maintain the building plumbing system.

8. After approval of the Operations and Maintenance Manual by the Architect/Engineer, the Contractor shall furnish two copies of the manual to the Owner.
- B. As-Built-Drawings:
1. Provide two sets of red-line mechanical drawings showing the work as it was actually installed. The drawings shall indicate all departures from the contract drawings and shall locate all underground utility lines with dimensions from established building lines. Make all notations neat and legible, with red indelible pencil. At the completion of the work, these as-built drawings shall be signed and dated by the Plumbing Contractor and returned to the Architect/Engineer.
- C. Guarantee:
1. All work furnished under this section shall be guaranteed in writing to be free from defective work or materials for a period of one year after acceptance of the contract. All repairs or replacements because of defective materials or workmanship or noncompliance with code shall be provided without additional cost to the Owner. Contractor shall furnish a letter indicating above guarantee with space for date of acceptance and expiration of guarantee. Letter shall be included in O & M Manual.

END OF SECTION

## SECTION 220100 - PLUMBING

## PART 1 - GENERAL

## 1.1 SCOPE:

- A. This section covers the work necessary for the plumbing system, complete. The Plumbing General Requirements, Section 220000, are to be included as a part of this section of the specifications.

## 1.2 CODES:

- A. The plumbing system shall be installed in accordance with the requirements of local adopted plumbing code, latest edition, International Fuel Gas Code, latest edition; and all local and State Codes.

## 1.3 FIXTURES &amp; EQUIPMENT:

## A. General:

1. Plumbing fixtures and equipment shall be as listed on the drawings. In addition to those specifically listed, the following manufacturers are approved for bidding only. All other manufacturers require prior approval. Final approval for installation is based on submittal data furnished:
  - a. Flush Valve Water Closets: American Standard, Briggs, Kohler, Mansfield, Sloan & Zurn.
  - b. Urinals: American Standard, Briggs, Gerber, Kohler, Mansfield, Sloan, Toto & Zurn.
  - c. Vitreous China Sinks: American Standard, Crane, Kohler, Mansfield, Sloan, Toto, & Zurn.
  - d. Stainless Steel Sinks: Elkay, Just.
  - e. Faucets: American Standard, AMTC, Aquaspec, CHG Encore Saniguard, Chicago Faucets, Delta, Elkay, Gerber, Geberit, Kohler, Moen, T&S Brass, Symmons, Sloan & Zurn.
  - f. Sensor Faucets: Chicago Faucets, Elkay, Mac Faucets, Symmons, Sloan, & T & S Brass.
  - g. Valves and Trim: Brasscraft, Dearborn Brass, ProFlo, Sloan & T&S Brass.
  - h. Flush Valves: American Standard Selectronic, AMTC, Delta, Kohler, Moen (sensor-operated only) Sloan, & Zurn.
  - i. Carriers and Drainage Products: Jay R. Smith, MIFAB, Neenah Foundry, NDS, Sun Drainage, Wade, Watts, & Zurn.
  - j. Toilet Seats: American Standard, Beneke, Church, Kohler, Plumb Tech & Zurn.
  - k. Mixing Valves: Acorn Controls, Lawler, Leonard, Powers, Stingray, Symmons, Watts, & Wilkins.
  - l. Fiberglass/ Acrylic Fixtures: Aquatic, Aquaglass, Best Bath, Fiat, Intersan, MAXX, Mustee Praxis-Comfort Designs, & Swan.
  - m. Drinking Fountains/ Electric Water Coolers: Elkay, Halsey Taylor, Haws, Murdock Stern Williams, & Sunroc.
  - n. Safety Fixtures & Safety Mixing Valves: Acorn, Bradley, Chicago Faucets, Encon, Guardian, Haws, Lawler, Speakman, Stingray.

- o. Service Sinks: Acorn, Fiat, Mustee, Proflo, Stern Williams, & Zurn.
- p. Water Heaters (Tank): American, A.O. Smith, Bock, Bradford-White, Heat Transfer-Phoenix, Lochinvar Shield, PVI, & Rheem.
- q. System Valves: Apollo, Nebco & Red-White Valve Corp.
- r. Backflow Preventers: Conbraco/Apollo, Watts, & Wilkins.
- s. Hose Bibbs: Josam, J.R. Smith, Prier, Woodford, & Zurn.
- t. Trench Drains: ABT, ACO, Dura Trench, J.R. Smith, NDS, Strongwell Polycast, Rapid, Wade, & Zurn.

2. Plumbing Fixture Standards:

All plumbing fixtures shall meet or exceed the following standards:

- a. ANSI A112.6.1 - Supports for Off-the Floor Plumbing Fixtures for Public Use.
- b. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- c. ANSI A112.19.1 - Enameled Cast Iron Plumbing Fixtures.
- d. ANSI A112.19.2 - Vitreous China Plumbing Fixtures.
- e. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- f. ANSI A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- g. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- h. ANSI Z124.1 - Gel-Coated Glass-Fiber Reinforced Polyester Resin Bathtub Units.
- i. ANSI Z124.2 - Gel-Coated Glass-Fiber Reinforced Polyester Resin Shower Receptor and Shower Stall Units.
- j. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.
- k. ARI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- l. AWSI/ASSE 1001 - Atmospheric Vacuum Breaker
- m. ANSI/ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
- n. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
- o. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- p. ANSI/ASSE 1015 - Backflow Preventers, Double Check Principle
- q. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- r. AWSI/ASSE 1020 - Pressure Vacuum Breaker
- s. AWSI/ASSE - 1-52 - Hose Connection, Double Check
- t. ANSI A112.21.1 - Floor Drains.
- u. ANSI A112.21.2 - Roof Drains.
- v. ANSI A112.26.1 - Water Hammer Arresters.
- w. PDI WH-201 - Water Hammer Arresters.
- x. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects

## PART 2 - PRODUCTS

## 2.1 PLUMBING FIXTURES &amp; TRIM:

A. All plumbing fixtures shall be provided complete with all required trim for a complete and operational system. All piping penetrations through finished walls shall be provided with chrome escutcheons. All plumbing fixtures shall be caulked and sealed to surrounding surfaces. All sink traps shall be provided with a cleanout plug in the bottom of the trap. All interior exposed pipe, valves, and fixture trim shall be chrome plated, including kitchen compartment sinks. Braided stainless steel pipe risers are approved for concealed locations only, such as behind casework doors or lav shields. Each fixture shall be provided with stop valves and the stop valves shall be quarter-turn brass ball type. All fixtures and trim must be lead free. All floor drains and floor sinks shall be provided with trap primers (PPP, Zurn or Wade as needed for appropriate use. Provide ball valve type shut-off valve upstream of all trap primer valves).

## 2.2 PIPING AND FITTINGS:

## A. General:

1. Underground sanitary sewer and storm drain lines shall be installed at 1/4" per foot slope, unless otherwise indicated. If such slope is not possible due to existing inverts, approval shall be obtained from the Architect/Engineer and the authority having jurisdiction before any piping is installed at a lesser slope.
2. Connections between piping of dissimilar materials shall be made with dielectric waterway fittings or unions.
3. Provide standard manufactured water hammer arresters at all flush valves. Size and locate per manufacturers recommendations. Provide access panels for access to all water hammer arresters.

## B. Domestic &amp; Non-Potable Hot and Cold Water:

1. Piping inside building above slab or above grade in crawl space shall be ASTM B88, Type "L", hard drawn copper. Fittings shall be ANSI/ASME B16.22 cast brass, or ANSI/ASME B16.29 wrought copper. Joints shall be ANSI/ASTM B32 solder, Grade 95-5, lead free.
  - a. Cold Water Only Option- ANSI/ASME B16.18 cast bronze, or ANSI/ASME B16.22 wrought copper. Joints shall be copper-tube dimensioned grooved joint couplings, and Flush Seal style gasket. (Gasket shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Victaulic Style 606, Gruvlok style 6400, Grinnell Universal Tongue and Groove 672, Shurjoint C305, or equal.
  - b. Piping Option - Mechanically Formed Extruded Outlets:

- 1) Mechanically formed extruded outlets shall be perpendicular to the axis of the run tube (header). They shall be formed by drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the branch wall and shall conform to ASME B31.9 and NFPA 99. T-Drill or approved equal.
  - 2) Branch tubes shall not restrict the flow in the run tube. To ensure this by conforming the branch tube to the shape of the inner curve of the run tube, a dimple / depth stop shall be formed in the branch tube to ensure that penetration into the collar is of the correct depth. For inspection purposes, a second dimple shall be placed 0.25 inch above the first dimple. Dimples shall be aligned with the tube run.
  - 3) Branches can be formed up to the run tube size as shown in ASTM F 2014. Forming procedures shall be in accordance with the tool manufacturer's recommendations.
  - 4) Joints shall be made with the use of approved brazing alloys BCup2 thru BCup5 (0-15% silver content). Braze with a filler that has a melting point above 540 deg. Centigrade (1000 deg. F). Soft soldered joints are not allowed.
  - 5) K and L copper types allowed.
  - 6) Soft and Hard copper allowed.
  - 7) Each model used for making branch connections shall be permanently marked with manufacturer's name and appropriate model number.
  - 8) Mechanically formed extruded outlets can (but not limited to) be used on commercial and residential buildings.
  - 9) Fitter / Plumber shall be trained and certified to operate the equipment.
2. At contractor's option, piping may be PEX Piping: Potable hot and cold water distribution system, using cross-linked polyethylene Tubing and ASTM F1960 cold expansion fittings.
- a. References:
    - 1) ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
    - 2) ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
    - 3) ASTM E814 Standard Test for Fire Tests of Through-Penetrations Fire Stops.
    - 4) ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing.
    - 5) ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Hot and Cold Water Distribution Systems.

- 6) ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

b. Tubing:

- 1) Standard Grade hydrostatic design and pressure ratings from PPI.
- 2) Minimum Bend Radius (cold bending): No less than 6 times the outside diameter. Bends with a radius less than stated shall require the use of a bend support as supplied by the PEX tubing manufacturer.
- 3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876 as indicated.
  - a) 3/8 inch
  - b) 1/2 inch
  - c) 3/4 inch
  - d) 1 inch
  - e) 1 1/4 inch
  - f) 1 1/2 inch
- 4) Material: Cross-linked polyethylene (PEX) manufactured by PEX-a or Engel method.

c. Manifolds:

- 1) Type "L" copper body with brass outlet connections.
- 2) For system compatibility, use 2-inch valved copper manifolds manufactured from Type L copper material, offered by the respective PEX tubing manufacturer.
- 3) Use manifolds with an isolation valve or a combination isolation and balancing valve on each outlet.
- 4) Use manifolds that support 5/8 inch or 3/4 inch PEX tubing.
- 5) Ensure manifold end cap offers tapping for 1/8 inch FNPT and 1/2 inch FNPT for vent and drain.
- 6) Install supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

d. Accessories:

- 1) Angle stops and straight stops that are compatible with PEX tubing shall be supplied by the PEX tubing manufacturer.
- 2) Bend supports designed for maintaining tight radius bends shall be supplied by the PEX tubing manufacturer.
- 3) Clips and/or PEX rails for supporting tubing runs shall be provided by the tubing manufacturer.

e. Installation:

- 1) Install in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
- 2) Do not install PEX tubing within 6 inches of gas appliance vents or within 12 inches of any recessed light fixtures.



- 3) Do not solder within 18 inches of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
  - 4) Do not expose PEX tubing to direct sunlight for more than 30 days.
  - 5) Ensure that no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
  - 6) PEX tubing passing through metal studs shall use grommets or sleeves at the penetration.
  - 7) Protect PEX tubing with sleeves where abrasion may occur.
  - 8) Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.
  - 9) No PEX piping is allowed within 18 inches of a water heater.
  - 10) Tubing manufacturer supplied bend supports shall be used where bends are less than six times the outside pipe diameter.
  - 11) Tubing shall be supported to structural members with minimum horizontal supports not less than 32 inches between hangers, using support methods required by local plumbing codes and the installation handbook.
  - 12) Pressurize PEX piping with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi above normal working pressure of the system.
  - 13) Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Water shall not be used to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F.
  - 14) PEX piping shall be installed in concealed locations only.
- f. Through Penetration Firestop:
- 1) Ensure 1 and 2-hour rated through penetration assemblies have been tested in accordance with ASTM E814.
  - 2) List of manufacturers that list PEX tubing with their firestop systems is available from the PEX tubing manufacturer.
- g. Approved Manufacturers:
- 1) Uponor Wirsbo
  - 2) Superpex by Bow
  - 3) Vanex Ultra by Vanguard
  - 4) HeatLink
  - 5) REHAU Raupex
  - 6) or approved equal
- h. Warranty:
- 1) Manufacturer's Warranty covers the repair or replacement of any tubing or fittings proven defective.
  - 2) Warranty may transfer to subsequent owners.

- 3) Warranty Period for PEX Tubing: 30 year, non-pro-rated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor.
  - 4) Warranty Period for Manifolds and Fittings: 5-year, non-pro-rated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory trained contractor.
  - 5) Warranty Period for Controls and Electrical Components: 2-year, non-pro-rated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factor-trained contractor.
  - 6) If a factory-trained contractor does not install the system, then the most recent limited warranty published by the PEX tubing manufacture takes precedence.
3. Piping underground within 5 feet of the building line, smaller than 4 inches, shall be ASTM B88, Type "K", hard drawn copper. Piping below floor slab, smaller than 4 inches, shall be type "K", soft annealed copper. Fittings shall be ANSI/ASME B16.29 wrought copper. Joints shall be ANSI/ASTM B32 solder, Grade 95-5, lead free. No joints shall be installed beneath concrete floor slabs, unless approved by the Engineer. Underground or underslab copper piping shall be provided with a polyethylene jacket, ANSI/AWWA C105, or shall be wrapped with double layer, half-lapped, 10 mil polyethylene tape.
- a. Underground (below slab) Piping Option- ½" to 4", High Density Polyethylene (HDPE) pressure pipe. ASTM D3350, ASTM D3035 & ASTM F714. AWWA C901 & AWWAC906, NSF. Fittings shall be HDPE, solvent weld. Piping shall be rated for not less than 150 psig.
  - b. Trap Primer Piping ( below floor or concealed only ) -
    - 1) ½" Wirsbo Aquapex Tubing or equal.
    - 2) ½" type K hard drawn copper, wrapped as indicated above.
4. Piping underground beyond 5 feet from building line shall be Schedule 40 PVC, ASTM D1785 or D2241. Fittings shall be PVC, ANSI/ASTM D2466. Joints shall be solvent weld, ASTM D2855, or gasketed, ASTM F477. Piping shall be rated for not less than 150 psig pressure.

#### C. Sanitary Sewer and Vent:

1. Piping and fittings shall be Schedule 40 PVC-DWV (cellular core), per ASTM F1488 and ASTM F891, solvent welded per solvent manufacturer's instructions, or ABS Schedule 40 piping and fittings per either ASTM D2661 or ASTM F628 with solvent cement conforming to ASTM D2235. All sewer risers (2 story or more) shall be service weight cast iron, no-hub or single-hub, ASTM A74. All piping penetrations through fire rated walls, floors, or ceilings, and all piping located above ceilings used as return air plenums shall also be cast iron or galvanized steel, ASTM A53. Underground PVC-DWV piping shall be installed per ASTM D-2321.

2. Piping and fittings beyond 5 feet from the building line shall be PVC, ASTM D3033 or D3034, SDR 35. Joints shall be ASTM F477 with elastomeric gaskets. Underground piping shall be installed per ASTM D-2321.
  3. All 90 degree waste line elbows shall be formed per the latest issue of the adopted plumbing code, latest edition.
  4. All exposed vent piping located in occupied areas or rooms, is to be cast iron with cast iron fittings.
  5. All flush valve fixtures that are installed back to back shall have offset waste outlet fittings.
  6. Cleanouts shall be provided at each horizontal drainage pipe, at its upper terminal, and each run of piping which is more than 100 feet and shall be provided for each 100 feet developed length, or fraction thereof of such piping. An additional cleanout shall be provided for each aggregate horizontal change of direction exceeding one hundred and thirty-five degrees, per applicable plumbing code. This shall be provided regardless of what is shown on the drawings.
  7. All floor drains, floor sinks, and hub drains shall be installed with a trap primer.
    - a. Flush Valve Primer: Trap primer shall be Precision plumbing products model FVP-1VB with vacuum breaker.
    - b. Pressure Activated Primer: Trap primer shall be Precision Plumbing products Model CPO-500 with DU distribution unit if required.
    - c. Tail Piece Primer: Trap primer shall be Precision Plumbing Products Model LTP-1500 with ½" braided stainless steel flexible priming make up water line and chrome plated escutcheons plates.
  8. All vent's through roof (VTR'S) shall be extended at least 1 foot above the roof surface, or to the top of the closest adjacent parapet wall, whichever is greater..
- D. Natural Gas:
1. Piping shall be Schedule 40 black steel pipe, ASTM A53. Exposed fittings 2 inches and smaller shall be ANSI/ASME B16.3, screwed, black malleable iron.
  2. Fittings larger than 2 inches and all underground fittings shall be Schedule 40 steel butt-welded type. Underground piping shall be provided with a polyethylene jacket, ANSI/AWWA C105, or shall be wrapped with double layer, half-lapped, 10 mil polyethylene tape.
    - a. Contractors Option for Underground Pipe:
      - 1) Gastite Type PE flexible corrugated gas piping. NFPA-54 & 56. ASTM D2513 Category 1. ASME D-B31.8-1995.

2) Piping and fittings underground and outside the building line may be JM Eagle UAC 2000 MDPE, medium-density polyethylene yellow gas pipe or an approved equal. Piping shall be installed in accordance with JM Eagle Publication JME-12B, "Polyethylene Yellow Gas Distribution Installation Guide." JM Eagle's UAC 2000 system can be joined by butt heat fusion, socket fusion, or saddle fusion. Installing contractor shall be licensed for fusion pipe installation of polyethylene pipe. ASTM D2513.

3. All exterior piping exposed to the weather shall be coated with a rust inhibitor - Rustoleum #866 Pro-Guard Primer - yellow or gray color - or approved equal.

E. Hanger and Supports:

1. Pipe hangers shall be provided to adequately support all piping systems. Hangers shall be vertically adjustable to provide for proper pitch and drainage. Hangers shall allow for expansion and contraction of the piping system. Reference "General Regulations" of the latest edition of the adopted plumbing code, latest edition.
2. Hangers for pipe sizes 1/2 to 6 inches shall be adjustable clevis type, or unistrut saddles with all-thread hanger rod.
3. Hangers for hot pipe, sizes 6 inches and over shall be adjustable steel yoke, cast iron roll, double hanger type.
4. Vertical pipes shall be supported with steel riser clamps. Spacing interval requirements per "General Regulations" of the latest edition of the adopted plumbing code, latest edition.
5. All insulated piping shall be provided with minimum 18 gauge galvanized insulation shields, 12 inches long, and oversized hangers. Pipe sizes 2 inches and over shall also be provided with 12 inch long calcium silicate insulating blocks between the piping and the galvanized insulation shield.
  - a. Alternate: Insulated pipe support inserts may be provided at hanger, support, and guide locations on piping requiring insulation. The insert should consist of either Hydrous Calcium Silicate or Polyisocyanurate Foam insulation (Urethane) encircling the entire circumference of the pipe with a 360 deg. PVC (1.524 mm thick) or galvanized steel jacket and installed during the installation of the piping system. These insulated pipe support inserts shall be provided by the Mechanical Contractor and installed by the same during pipe support installation.

6. Hanger rod sizing and spacing for pipe shall be as follows:

	Pipe Size	Minimum Rod Diameter	Maximum Spacing
To 1-1/4 inches	3/8 inch	6.5 feet	
To 2 inches	3/8 inch	10 feet	
To 3 inches	1/2 inch	10 feet	
To 6 inches	5/8 inch	10 feet	
	a. to 12 inches	7/8 inch	12 feet
PVC & ABS (all sizes)	3/8 inch	4 feet	

Cast Iron No-Hub 5/8 inch 5 feet and  
at joints

7. Provide hangers within 12 inches of each horizontal elbow.
8. Provide hangers with minimum 1-1/2 inches vertical adjustment.

2.3 INSULATION:

A. General:

1. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
2. Fire-Test-Response Characteristics: Insulation and related materials NFPA 255, UL Classified per UL 723 or meeting ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement containers, with appropriate markings of applicable testing and inspecting agency.
  - a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Piping:

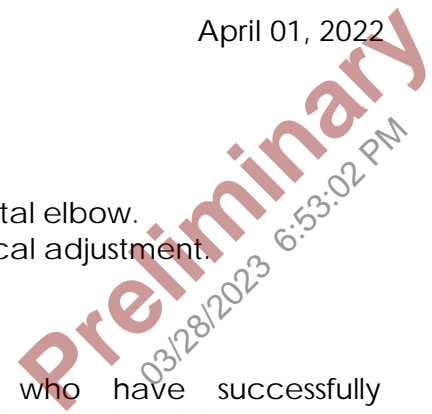
1. All domestic, potable & non-potable, hot and cold water lines and rain drains shall be insulated with preformed insulation.
  - a. Fiberglass insulation with a vapor barrier jacket. Insulation shall have a conductivity not exceeding 0.28 Btu-inch/hour-sq. ft.-degrees F. Laps and butt joints shall be sealed with pressure sensitive joint sealing tape of the same finish as the insulation jacket to provide a continuous vapor seal. Fittings and valves shall be insulated with PVC fitting covers and fiberglass insulation inserts, or with hydraulic setting insulating cement and four ounce canvass jacket with vapor barrier adhesive.
  - b. Alternate material for Cross-Linked Polyethylene Tubing (PEX): One piece preformed flexible elastomeric closed cell foam with built-in vapor barrier. Seal laps and butt joints with moisture resistant adhesive to provide a continuous vapor seal. Insulation shall have a conductivity rating not exceeding 0.27 Btu-inch/hour-sq. ft.-°F.

Insulation thicknesses shall be as follows:

System Pipe Sizes

		<u>1/2" and above</u>
Domestic Cold Water (pot. & non-pot.)	1/2"	
Domestic Hot Water & Recirc. (pot. & non-pot.)	1"	

2. Insulation shall be installed in strict accordance with manufacturer's instructions.
3. Insulation shall be continuous through penetrations.
4. All insulation shall be installed in a neat and workmanlike manner.



## 2.4 VALVES & STRAINERS:

### A. Ball Valves:

1. Valves 2-inches and smaller shall be lead free cast bronze body, chrome-plated brass ball, teflon seats, and lever handle, 600 psi CWP. Valves shall comply with MSS SP-110, NSF/ANSI 61, NSF/ANSI 372 Lead Free. Valves over 2-inches shall be cast steel body, chrome plated steel ball, teflon seats, and lever handle. Victaulic, Anvil Gruvlok, Grinnell, or Shurjoint ball valves are acceptable if grooved piping is used. Valves mounted higher than 7'-0" A.F.F. shall be provided with chain, wheel, and guides. Basis of design: Apollo #77CLF-A Series or equal.

### B. Check Valves:

1. Valves 2-inches and smaller shall be bronze body Y-pattern, ASTM B-62, swing check, bronze disc, 200 psi WOG. Valves shall comply with MSS SP-80, NSF/ANSI 61-8 F&G, NSF/ANSI 372 Lead Free. Valves, over 2-inches shall be iron body, ASTM A-126, bronze trim, swing check, renewable disc and seat. Valves shall comply with MSS SP-71. Victaulic, Anvil Gruvlok, Grinnell, or Shurlock check valves are acceptable if grooved piping is used. Basis of design: Apollo # 161T-LF/161S-LF Lead Free Bronze, Apollo # 920F-LF Lead Free Cast Iron, or equal.
2. Swing check valves with outside lever and spring (not center guided) is to be used on sewage ejector or storm-water sump pumps. Basis of design: Apollo # 910FLW-LF Lead Free Cast Iron or equal.

### C. Balance Valve:

1. Valve shall have a twin tube 316 S.S. design with blowout proof attachment to station body. Ports shall include  $\frac{3}{4}$ " port for thermometer,  $\frac{1}{4}$ " port for pressure gauge, air vent, and  $\frac{1}{2}$ " drain port.
2. The instrument station shall be 120/150-flanged construction.
3. The butterfly valve shall be lug pattern with a rating of 200 WP, 250 deg. F. The valve shall have an infinite. Position operator with memory stop (6" and smaller), worm gear with memory stop (8" and larger).

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP:

#### A. General:

1. Install all piping, fixtures, equipment, and accessories as shown, and in strict accordance with the plumbing laws, rules, and regulations of the State and/or City. All work shall be done in a neat and orderly fashion and left in a condition satisfactory to the Architect/Engineer.

#### B. Piping:

1. All piping shall be run parallel or perpendicular to established building lines. Install piping so as to allow for expansion. Waste and vent piping occurring above floor slab shall be installed true and plumb. Extend vents at least 1 foot above roof, or to the top of the closest adjacent parapet wall, whichever is greater, and provide watertight flashing sleeves. Excavation and backfill shall be in accordance with Section 220000 of these specifications.

C. Fixtures:

1. Install fixtures true and plumb with building walls. Caulk all plumbing fixtures at joints along walls, countertops, and other intersecting surfaces. Locate fixtures as shown and per manufacturer's instructions. Furnish all required trim for fixtures to provide a complete and workable installation.

3.2 TESTS:

A. General:

1. All piping, fixtures, and equipment shall be inspected and approved before concealing or covering. All work shall be tested as required by Section 220000 of these specifications and shall be leak proof before inspection is requested. All tests shall be repeated if required by those making the inspection.
2. All potable water systems shall be flushed and disinfected in accordance with Section 220000 of these specifications. Following disinfection, system shall be flushed and water sampled to show compliance with requirements of public health authority having jurisdiction. If tested water does not meet requirements, disinfecting shall be repeated until water quality meets requirements.

B. Fixtures and Equipment:

1. Fill all plumbing fixtures with water and check for leaks or retarded flow. Repair as required. Adjust each piece of plumbing equipment as required to ensure proper functioning. Leave all fixtures and equipment in first class operating condition.
2. The Plumbing Contractor is responsible for all backflow devices to be inspected by a certified backflow technician before use of the building potable water system.

C. Smoke Test:

1. A smoke test shall be performed on the entire waste and vent system before building occupancy. After all fixtures are permanently connected and traps are filled with water, fill entire drainage systems with smoke under pressure of 1.3 pKa (1 inch of water) with a smoke machine. If leaks are detected, they shall be repaired and the smoke test shall be performed again until no leaks are found.

MUSGROVE ENGINEERING

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Phone: (208) 384-0765

PIPING SYSTEM TEST REPORT

STRUCTURE/BUILDING: \_\_\_\_\_ TEST NUMBER: \_\_\_\_\_

LOCATION: \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_

DESCRIPTION OF SYSTEM/PIPING BEING TESTED: \_\_\_\_\_

Description of Test Performed	Test Pressure	Test Duration	Pass/Fail
Hydrostatic: _____	P.S.I. _____	_____	_____
Inert Gas: _____	P.S.I. _____	_____	_____
Compressed Air: _____	P.S.I. _____	_____	_____
Waste & Vent Smoke Test: _____	1" Water Column _____	_____	_____

NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TEST'S FOR CONTRACTOR:

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Signature: \_\_\_\_\_

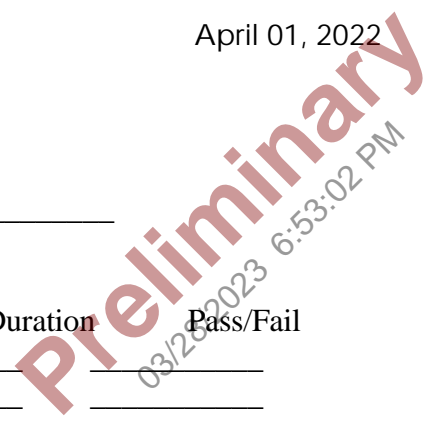
I hereby certify that the above described system has been tested as indicated above and found to be entirely satisfactory as required in the contract specifications.

Signature of Inspector: \_\_\_\_\_

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

REMARKS: \_\_\_\_\_

END OF SECTION





## DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

## SECTION 230000 - HVAC GENERAL REQUIREMENTS

## PART 1 - GENERAL

## 1.1 SCOPE:

## A. General:

1. The Bidding Requirements, Contract Requirements, and the General Requirements (Division 1) of these specifications shall govern all parts of the work.

## B. Work Included:

1. Install work in accordance with these specifications and the accompanying plans. Furnish all labor, material, and equipment together with all incidental items not specifically shown or specified which are required by good practice to provide the complete mechanical systems as described.
2. The HVAC Contractor(s) and all Sub-tier Contractors shall provide installed equipment cut sheets and purchase orders required for utility rebates.

## C. Coordination and Site Visits:

1. This section of the work requires examination of and reference to all architectural, structural, utility, and electrical drawings for construction conditions that may affect the work. Inspect the building site and existing facilities for verification of existing conditions. Base all measurements from established benchmarks. Any discrepancy between actual measurements and those indicated, which prevents following good practices or the intent of the drawings and specifications, shall be reported to the Architect/Engineer, and work halted until instructions are received from the Architect/Engineer.

## 1.2 CODES, PERMITS, FEES:

- A. Install all work in accordance with applicable codes and standards. Obtain all required permits; pay all required fees including utility connections or extensions, in connection with this portion of the construction. Obtain all required certificates of inspection for the work.

## PART 2 - PRODUCTS

## 2.1 MATERIALS AND WORKMANSHIP:

## A. Materials:

1. All materials and equipment shall be of first quality, new, full size and weight, standard in every respect, and suitable for the space required. Use the same manufacturer for products of similar class or service, such as valves, pumps, controls, and air handlers. Protect all materials against loss, theft, or damage before and after installation.

2. Furnish equipment that will operate under all conditions of load without any sound or vibration that is objectionable in the opinion of the Architect/Engineer. Vibration or noise considered objectionable will be corrected by the Subcontractor at his expense.
  3. Furnish and install all necessary foundations, supports, pads, bases, and piers required for all materials and equipment furnished under this contract.
  4. Provide all required firestopping at duct penetrations of fire rated walls, floors, ceilings, and roofs. Firestopping shall be Dow Corning Fire Stop Sealant 2000 or Fire Stop Foam 2001, or approved equal.
- B. Workmanship:
1. All materials and equipment shall be installed in a neat and workmanlike manner by competent specialists for each subtrade. Work shall be installed to the satisfaction of the Architect/Engineer with unsatisfactory work removed and reinstalled to his satisfaction at no extra cost to the Owner.
  2. Provide all cutting and patching necessary to install the work specified in this section. Patching shall match adjacent surfaces. No structural members shall be cut without the approval of the Architect/Engineer. Provide sleeves at all piping penetrations of exterior walls and floors on grade. Provide all sleeves and inserts required before new floors and walls are built.
  3. Locate all equipment that must be serviced in fully accessible positions. Provide clearance for removal of replacement parts and components, and with necessary couplings or flanges to remove the component for maintenance.
- C. Protection of Equipment During Construction:
1. At the end of each shift, all duct openings and open ends shall be covered with a plastic poly sheeting film to protect against dust and construction contamination from entering the ductwork.

## 2.2 SUBMITTALS AND SUBSTITUTIONS:

### A. Prebid Approval:

1. Manufacturer's trade names and catalog numbers stated herein are intended to indicate the quality of equipment or materials desired. All manufacturers not specifically listed require prior approval. Submit catalog data, including specifications, of the proposed equipment to the Architect/Engineer for his approval at least 10 calendar days prior to bid opening. Notice of such approvals will be published in an addendum. Approval of listed alternate equipment manufacturers is for bidding only. Final approval is to be based on requirements of the plans and specifications.

### B. Submittals:

1. Within thirty days after award of this contract, provide an electronic copy of a complete list of all materials and equipment proposed for this project. List shall contain make, type, manufacturer's name, and trade designation of all materials and equipment. Submittal shall also include manufacturer's complete specification for each item, including capacities, ratings, etc., and dimensions as required to check space requirements. The scheduled equipment is the basis of design for capacity, weights, physical size, etc. Alternate manufacturers shall not exceed the weight or physical size. Any changes to the Architectural, Structural, Mechanical, Electrical, and Control systems due to alternate manufactures shall be the responsibility of the Contractor and Supplier. Submittals for each major trade (i.e., dryside HVAC, wet side HVAC, or Plumbing) shall be submitted in a single complete package. Individual items will not be reviewed independently unless approved by the Engineer.
2. Approval of submittals shall not relieve the contractor from responsibility for deviations from the plans or specifications, unless he has, in writing, called the Architect's /Engineer's attention to deviations at the time of submission, and obtained his written approval. Approval of submittals does not relieve the contractor from responsibility for errors in shop drawings or literature.

C. Equipment Requiring Submittals:

1. Exhaust Fans
2. Electric Heaters

PART 3 - EXECUTION

3.1 ACCESSIBILITY & SAFETY:

A. Accessibility:

1. All equipment which must be serviced or operated shall be located in fully accessible position. Minor changes from the drawings may be made to allow for better accessibility. All changes shall be approved prior to actual installation.
2. Access panels shall be provided if required for accessibility. Access panels to be steel, flanged, hinged doors by Cendrex, or equal. Sized as required for installation. Subcontractor shall furnish the required panels to the General Contractor and the required location for all access panels, unless otherwise specified in the Architectural specifications. Panels shall be installed by the General Contractor.

B. Safety:

1. Subcontractor shall provide guards for all belt drives and rotating machinery.

3.2 COORDINATION:

- A. Coordinate all work with the various trades involved to provide a complete and satisfactory installation. The exact details of ductwork and equipment are not shown. No additional compensation will be made for offsets or relocation required in coordination with other trades.

- B. Alterations required due to improper supervision by the subcontractor shall be made at no extra cost, to the satisfaction of the Architect/Engineer.

### 3.3 ELECTRICAL:

- A. Electric motors required for equipment specified in this section shall be provided and installed by this Subcontractor. Motor starters, disconnects, relays, pilot lights, etc., are in general, to be furnished and installed by the Electrical Contractor. Starters, relays, controls, etc., which are factory assembled into packaged equipment shall be furnished by the Mechanical Contractor under this section of the specifications.
- B. All motors shall be provided with adequate starting and protective equipment as specified or required. Motor capacity shall be sufficient to operate driven device under all conditions of operation and load without overload. Minimum horsepower shall be as specified.

### 3.4 IDENTIFICATION AND CODING:

#### A. Painting:

1. All painting of mechanical equipment, accessories and ductwork shall be furnished and applied under the Architectural section of these specifications. All painting shall be completed before any identification markings are applied.

#### B. Equipment:

1. Identify all equipment with a black Formica label, with white reveal when engraved. Lettering to be 3/16 inch high minimum. In general, identify equipment as to area served in addition to title and code number of the equipment as taken from the plans.

### 3.5 TESTING:

#### A. Systems:

1. All systems, including heating, ventilating and air conditioning, shall be tested at the completion of the building to establish that the systems operate as specified and required. Testing shall be performed after air balancing is completed.
2. All controls shall be calibrated accurately and all equipment shall be adjusted for satisfactory operation. Excessive vibration or noise from any system shall be corrected.

### 3.6 BALANCING:

#### A. Scope:

1. Prior to final acceptance by the Owners, all air systems shall be balanced to deliver the quantities as specified or directed. The air balance shall be performed by an independent agency specializing in balancing and is certified by the National Environmental Balancing Bureau.

2. The Mechanical Contractor shall provide assistance to the Balancing Contractor by identifying all installed mechanical systems and assisting access to all installed mechanical systems. All mechanical systems shall be completely operational and functional prior to the Balancing Contractor performing their specified work.
- B. Air balancing:
1. Balancing of the air system shall consist of:
    - a. Adjust all air volumes to the quantities shown, with allowable variation of plus 10, minus 10 percent.
    - b. Record all system, zone, diffuser, grille, and register C.F.M. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Balancing Engineer shall work with the Contractor to set minimum & maximum CFM quantities for zone dampers, or zone dampers/heaters.
    - c. Test and record all system static pressures, inlet and discharge, on all packaged units, fans, and terminal units. Vary total system air quantities by adjustment of fan speeds. Provide drive changes as necessary. Vary branch air quantities by damper regulation.
    - d. Test and record motor full load amps and nameplate amps.
    - e. Test and record entering and leaving temperatures at all coils.
    - f. Adjust all automatically operated dampers, in cooperation with the Control Contractor, to the required settings. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances. Where modulating dampers or economizers are provided, take measurements at full return air, minimum outside air, and 100 percent outside air mode of operation.
    - g. Adjust diffusers and grilles for proper deflection, throw, and coverage. Eliminate drafts and excessive noise where possible.
    - h. Mark final positions of all balance dampers with a red felt pen.
    - i. Air systems shall be balanced in accordance with standard procedures and recognized practices of the Associated Air Balance Council, and the Testing Adjusting, and Balancing Bureau.
- C. Water Balancing:
1. Balancing of the water system shall consist of:
    - a. Adjust all heating and cooling water system flows to within 10 percent of the design quantities shown.
    - b. Record all system and terminal unit g.p.m.'s.
    - c. Test and record all pump, coil, boiler, heat transfer elements, and chiller entering and leaving water temperatures and pressures.
    - d. Test and record all pump full load amps and nameplate amps.
    - e. Mark all final positions of all balancing cocks, valves, and operators with a centerpunch.
- D. Quality Assurance:

1. The Balancing Contractor shall demonstrate to the Engineer of record, flow verification for at least 10% of the balanced devices as selected by the Engineer. If more than 25% of the tested devices do not meet the designed or balance report, then the entire system balance must be rebalanced.

E. Balance Reports:

1. Submit four copies of the air system balance report to the Architect/Engineer for evaluation and approval. Reports shall be on TABB/SMACNA forms that indicate information addressing each of the testing methods, readings, and adjustments.

3.7 CLEANING AND ADJUSTING:

- A. Thoroughly clean all air conditioning units, air handling units, and all associated parts of the system at the completion of the work. Install new, clean air filters in all systems. Adjust all devices for proper operation and lubricate all equipment as required. Repaint any painted surface that has been damaged.

3.8 PROJECT CLOSEOUT:

- A. Operations & Maintenance Manual:

The Contractor shall provide an operations and maintenance manual at least thirty days prior to completion of work. The manual shall be of the three-ring binder type, entitled "Operations and Maintenance Manual", with the job name and year of completion also included. O & M manuals shall be submitted in a single package. In addition, the contractor shall provide two consolidated electronic versions on two separate thumb drives. Individual items will not be accepted independently unless approved by the Engineer. The manual shall include, as a minimum:

1. Maintenance instructions for all equipment, including lubrication requirements.
2. Equipment suppliers' names, addresses, and telephone numbers.
3. Equipment catalog cuts, ratings tables, model numbers, serial numbers, and accessories.
4. Parts numbers for all replaceable parts.
5. Air and/or water systems balance report as hereinbefore specified.
6. Control diagram or drawing and operation sequence.
7. Valve tagging chart as hereinbefore specified.
8. Filter chart listing unit callout, size of filters, and quantity of filters.
9. Guarantee letter as specified below.
10. Any additional information required to enable the Owner to properly maintain the building mechanical system.
11. Mechanical Equipment Start-up forms, which are included in this specification, if they are required.

12. After approval of the Operations and Maintenance Manual by the Architect/Engineer, the Contractor shall furnish two copies of the manual to the Owner.

B. Mechanical System Training Period:

1. After the mechanical system is completely installed and operational, the mechanical contractor shall provide a minimum of 2 hours training and instruction time for the building Owner or his representative. During this period, the contractor shall instruct the Owner in the operation and maintenance of all parts of the mechanical system, using the O & M manual where applicable. The contractor shall provide a copy of the Project Owner Mechanical Systems Training Form (attached to this specification), with proper signatures, to the Engineer prior to substantial completion and ensure that a copy is inserted into the project O & M manuals.

C. As-Built-Drawings:

1. Provide two sets of red-line mechanical drawings showing the work as it was actually installed. The drawings shall indicate all departures from the contract drawings. Make all notations neat and legible, with red indelible pencil. At the completion of the work, these as-built drawings shall be signed and dated by the Mechanical Contractor, and returned to the Architect/Engineer.

D. Guarantee:

1. All work furnished under this section shall be guaranteed in writing to be free from defective work or materials for a period of one year after acceptance of the contract. All repairs or replacements because of defective materials or workmanship or noncompliance with code shall be provided without additional cost to the Owner. Contractor shall furnish a letter indicating above guarantee with space for date of acceptance and expiration of guarantee. Letter shall be included in O & M Manual.

END OF SECTION 230000

**NAME OF PROJECT:** .....

**OWNER MECHANICAL SYSTEM TRAINING FORM**

Upon completion of the equipment and systems installation and connections, the contractor shall assemble all required equipment factory representative and subcontractors together for system Owner training.

Preliminary  
03/28/2023 6:53:03 PM

These people shall assist in Owner training their system(s) and remain at the site until the total system operations is acceptable and understood by the Owner's representative(s), maintenance and/or operation personnel, on operation and maintenance of their equipment. To prove acceptance of operation and instruction by the Owner's representative(s), the contractor shall provide a copy of this form, with proper signatures, to the Engineer prior to substantial completion, and ensure that a copy is inserted into the project Operation and Maintenance manuals.

"I, the Contractor, associated factory representative and subcontractors, have started each system and the total system(s); and have proven their normal operation to the Owner's representative(s) and maintenance/operation personnel and have instructed him/them \_\_\_\_\_, hours in the operation and maintenance thereof."

\_\_\_\_\_

Owner's Representative \_\_\_\_\_

\_\_\_\_\_

Signature \_\_\_\_\_

\_\_\_\_\_

Date

Date



## SECTION 230100 - HEATING, VENTILATING, AND AIR CONDITIONING

## PART 1 - GENERAL

## 1.1 SCOPE

A. This section covers the work necessary for the heating, ventilating, and air conditioning system, complete. The HVAC General Requirements, Section 230000, is to be included as a part of this section of the specifications.

## 1.2 CODES &amp; STANDARDS

A. The heating, ventilating, and air conditioning system shall be installed in accordance with the latest edition of the following codes and standards:

1. International Mechanical Code (IMC)
2. International Building Code (IBC)
3. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
4. National Fire Protection Association (NFPA)
5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)

## PART 2 - PRODUCTS

## EXHAUST FANS

Reference plans for equipment requirements.

## AIR DISTRIBUTION

## Ductwork:

Low pressure ductwork shall be fabricated from galvanized sheet metal, unless otherwise indicated. Construction requirements shall be in accordance with SMACNA - HVAC Duct Construction Standards, metal and flexible, latest edition. All sheet metal ductwork shall be sealed with McGill United Sheet Duct Sealer or equal, in accordance with the International Energy Compliance Code, latest edition. Adjustable ( twist ) elbows are not allowed. Low pressure ductwork shall be constructed to the following SMACNA static pressure standards:

- a. Supply air ductwork = 2" W.G.
- b. Return, Exhaust, Outside Air Intake ductwork = 1" W.G.

Low pressure ductwork which is exposed or located in mechanical rooms shall be fabricated from galvanized sheet metal. Construction requirements shall be in accordance with SMACNA HVAC Duct Construction Standards, metal and flexible, latest edition.

Ductwork penetrating protective elements of fire-rated corridor walls, with no openings into corridor, shall be constructed of minimum 26 gauge galvanized steel.

Shower and locker room exhaust ductwork shall be constructed of galvanized sheet metal, in accordance with SMACNA standards.

## Duct Accessories:

Turning vanes shall be installed in all rectangular or square elbows. Vanes shall be installed in vane side rails. Vanes shall be single wall vanes, and be fabricated and installed per SMACNA standards.

Volume dampers shall be fabricated from galvanized steel in accordance with SMACNA standards. Dampers shall have a continuous galvanized steel shaft on ducts 13" diameter or

larger, with damper regulators and end bearings. Dampers located above inaccessible ceilings (hard ceilings) shall be furnished with concealed ceiling damper regulators. Dampers shall be pressure rated equal to the design duct pressure rating. Dampers shall be provided at all diffuser and supply/exhaust grille takeoffs, regardless if indicated on the plans. Dampers are not required on the return air takeoffs unless specifically indicated.

Flexible connections shall be provided at all rotating fan equipment. Connectors shall be of fire, water, and weather resistant material.

Diffusers, Registers, Louvers, Grilles, Weathercaps:

1. See Drawings for requirement.

Duct Cleanliness:

Ductwork Delivery To Site

During ductwork being delivered from the premises of the manufacturer, care must be taken to prevent damage during transportation and off-loading.

Temporary Storage

Job site duct material storage areas should be clean, dry, and located away from high dust generating processes such as masonry or tile cutters, cutoff saws, drywall sanding, mortar and plaster mixers, roof pitch kettles, portable electric generators, and main walkways that will be constantly broom swept. The general contractor should designate a suitable area for temporary storage.

To prevent ductwork material damage from standing water, storage locations should include pallets or blocking to keep fabricated metal ductwork above the floor surface. If there is a risk of water runoff from above or dusty areas cannot be avoided, coverage should be used to protect stored materials.

Installation

Before the installation of individual duct sections, they are to be inspected to ensure that they are free from all debris.

All ductwork risers must be covered to prevent the entry of debris into the duct.

Downward facing and horizontal ductwork openings will not be required to be covered.

Access covers shall be firmly fitted in position on completion of each section of the work. Open ends on completed ductwork and overnight work-in-progress shall be sealed.

The working area should be clean and dry and protected from the elements.

The internal surfaces of the uninsulated ductwork shall be wiped to remove excess dust immediately prior to installation.

#### K. VIBRATION ISOLATION

1. All rotating equipment and appurtenances connected to rotating equipment shall be vibration isolated from the supporting structure.

#### CONTROL SYSTEM

##### A. General:

1. The Mechanical Contractor shall be responsible for a complete and operable control system, including equipment, installation, and accessories required to perform the required control functions. All control conduit and wiring shall be furnished by the Electrical Contractor. Thermostats, sub-base switches, remote control devices, etc., shall be supplied by the Mechanical Contractor and installed and connected by the Mechanical Contractor. The Mechanical Contractor shall furnish the Electrical Contractor with wiring diagrams for all mechanical equipment and controls.

## PART 3 - EXECUTION

## 3.1 WORKMANSHIP

## General:

Install all materials and equipment as shown and in strict accordance with the applicable codes for the State and/or city. Plans do not attempt to show exact details of all piping and ductwork, and no extra payment will be allowed for offsets required due to obstructions by other trades. All work shall be done in a neat and orderly fashion and left in a condition satisfactory to the Architect/Engineer.

## Ductwork:

1. All sheet metal work shall be done by qualified, experienced mechanics in accordance with the requirements of ASHRAE and the latest edition of the applicable SMACNA Manual. All ductwork shall be installed in a neat and orderly manner, and shall be adequately supported to prevent vibration or sagging. All sheet metal ductwork shall be sealed with United-Sheet Metal Duct Sealer or equal.

EEND OF SECTION

## SECTION 260500 - ELECTRICAL GENERAL PROVISIONS

## PART 1 - GENERAL

## 1.1 CONDITIONS AND REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of this Section shall apply to all Sections of Division 26, 27, and 28.

## 1.2 SCOPE OF WORK

- A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation, including all accessories required for testing the system. It is the intent of the drawings and specifications that all systems be complete and ready for operation.

## 1.3 CODE COMPLIANCE

- A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to, the following:
- B. Occupational Safety and Health Act Standards (OSHA)
- C. NFPA #70 – National Electric Code (NEC)
- D. ADA Standards – Americans with Disabilities Act
- E. ANSI/IEEE C-2 – National Electrical Safety Code
- F. NECA – Standard of Installation
- G. International Building Code
- H. International Fire Code
- I. International Energy Conservation Code
- J. NFPA #72 – Fire Code
- K. NFPA #101 – Life Safety Code
- L. All other applicable Federal, State and local laws and regulations.
- M. Work to be executed and inspected in accordance with local codes and ordinances. Permits, fees or charges for inspection or other services shall be paid for by the contractor. Local codes and ordinances are to be considered as minimum requirements and must be properly executed without expense to the owner; but do not relieve the contractor from work shown that exceeds minimum requirements.

## 1.4 CONDITIONS AT SITE

- A. Visit to site is recommended of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

- B. Lines of other service that are damaged as a result of this work shall be promptly repaired at no expense to the owner to the complete satisfaction of the owner.

#### 1.5 DRAWINGS AND SPECIFICATIONS

- A. All drawings and all specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.
- B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included in the bid. Check all information and report any apparent discrepancies before submitting bid.
- C. Change to location, type, function, brand name, finish, etc., shall not be made without permission of engineer.
- D. Some equipment is specifically designated on the drawings. It is not the intent to sole source any item unless explicitly stated. Items have been specified based upon design requirements. All bidders are encouraged to submit products for approval. Prior approval must be obtained as required by these contract documents. Bids submitted with non-approved items will be considered invalid and bidders will be held to provide approved materials at no additional cost to the owner. Submittals received by the engineer after award of contract on non-approved equipment will not be reviewed nor will they be returned.
- E. Where conflicting direction is given within the specifications and drawings, the contractor shall include the most expensive option in the bid.

#### 1.6 SAFETY AND INDEMNITY

- A. Safety: The contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.
- B. No act, service, drawing review or construction review by the owner is intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction site.

#### 1.7 CONSTRUCTION OBSERVATION BY THE ENGINEER

- A. Prior to covering: any major portion of the materials installed under this section, notify the engineer so that an observation can be made. Notification shall be made at least three (3) working days in advance of the date the items will be covered.

### 1.8 INSTRUCTION OF OWNER'S PERSONNEL

- A. The contractor shall conduct an on-site instructional tour of the entire project. The personnel designated by the owner shall be instructed in: operation of all electrical systems, trouble-shooting procedures, preventative maintenance procedures, uses of Operation and Maintenance manuals, maintenance and cleaning of lighting fixtures and operation of all special systems.
- B. Contractor will include in his bid 8 hours of instruction time to be held at the project location after substantial completion for instruction of owner's personnel. Coordinate time and number of owner personnel to be present and provide schedule to engineer.

### 1.9 PROJECT COMPLETION

- A. Upon completion of all work and operational checks on all systems, the contractor shall request that a final construction observation be performed.
- B. The engineer shall compile a punch list of items to be completed or corrected. The contractor shall notify the engineer upon completion of the items.

### 1.10 GUARANTEE

- A. All work under this section shall be guaranteed in writing to be free of defective work, materials, or parts for a period of one (1) year after final acceptance of the work under this contract or the period indicated under the Division 1 specifications whichever is longer.
- B. Repair, revision or replacement of any and all defects, failure or inoperativeness shall be done by the contractor at no cost to the owner.

## PART 2 - PRODUCTS

### 2.1 MATERIAL APPROVAL

- A. The design, manufacturer and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE or ANSI standards.
- B. All materials must be new, unless noted otherwise, and UL listed. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency, which laboratory shall be acceptable to the owner and code enforcing agency.

### 2.2 SHOP DRAWINGS AND MATERIALS LIST

- A. Submit an electronic copy, unless noted otherwise under Division 1, of the Division 26, 27 and 28 shop drawings and material lists proposed for this project to the architect/engineer for review.

### 2.3 OPERATION AND MAINTENANCE MANUALS

- A. Submit an electronic copy, unless noted otherwise under Division 1, of the Operation and Maintenance Manuals for all Division 26, 27 and 28 equipment to the architect/engineer.

### 2.4 RECORD DRAWINGS

- A. Submit record drawings to owner.

## 2.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials in a manner to prevent damage.
- B. Protect equipment from weather and dampness.

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

- A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B. Provide experienced foreman with a minimum of three years experience working on this type of building placed in charge of this work at all times.

### 3.2 COORDINATION

- A. Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under trades that require electrical connections. Inform contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- B. Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without the authorization of the owner, shall be at contractor's risk and expense.

### 3.3 MANUFACTURER'S INSTRUCTIONS

- A. All installations are to be made in accordance with manufacturer's recommendations. A copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the engineer.
- B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the engineer before starting work.

### 3.4 QUALITY ASSURANCE

- A. The contractor shall insure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.
- B. Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and special systems.

### 3.5 CUTTING AND PATCHING

- A. Perform all cutting and fittings required for work of this section in rough construction of the building.
- B. All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

C. No joists, beams, girders or columns shall be cut by any contractor without obtaining written permission from the architect/engineer.

END OF SECTION

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03/28/2023 6:53:03 PM



## SECTION 260501 – FIELD TEST AND OPERATIONAL CHECK

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. 260502 - Short-Circuit-Coordination Study-Arc Flash Hazard Analysis

## 1.2 SCOPE OF WORK

- A. Ground resistance test.
- B. 600V cable insulation test.
- C. Sectionalizing switch insulating oil test.
- D. Transformer insulating liquid test.
- E. Primary voltage cable high potential test.
- F. Main and distribution switchboard and panelboard operational check and test.
- G. Generator test.

## 1.3 GENERAL SCOPE

- A. The contractor shall engage and pay for the services of a recognized independent testing laboratory for the purpose of performing inspections and tests as specified in this Section.
- B. The testing laboratory shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.
- C. These tests shall assure that all electrical equipment is operational within industry and manufacturer's tolerances, is installed in accordance with design specifications, and shall determine the suitability for energization.
- D. The contractor shall schedule the tests and give a minimum of two weeks advance notice to the owner.

## 1.4 QUALIFICATIONS OF TESTING AGENCY

- A. Testing agency shall be Current Technologies Inc. or approved equal.

## 1.5 TEST INSTRUMENT TRACEABILITY

- A. The testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.
- B. Instruments shall be calibrated at the following frequency:
- C. Field instruments: Six months maximum
- D. Laboratory instruments: 12 months
- E. Leased specialty equipment: 12 months (where accuracy is guaranteed by lessor, e.g. Doble)
- F. Dated calibration levels shall be visible on all test equipment.

## 1.6 FINAL SETTINGS

- A. The contractor shall set the protective devices in accordance with a short-circuit and protective device coordination report.

### 1.7 TEST REPORT

- A. Submit copies of the test results to the owner. Test results shall be included in the project O &M Manuals.
- B. The test report shall include a project summary, description of equipment tested, description of test, list of test equipment used and calibration date, test results, conclusions and recommendations, appendix (including appropriate test forms), and standards used.
- C. The test report shall be bound and its contents certified.

### 1.8 FAILURE TO MEET TEST

- A. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the owner.
- B. Contractor shall replace the defective material or equipment and have test repeated until test proves satisfactory without additional cost to the owner.

## PART 2 - **--PRODUCTS - Not Applicable**

## PART 3 - EXECUTION

### 3.1 GROUND RESISTANCE TEST

- A. Building grounding electrode resistance testing shall be accomplished with a ground resistance direct-reading single test meter utilizing the Fall-of-Potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the concrete-encased ground electrode to be tested and the two reference electrodes in a straight line spaced fifty (50) feet apart. Drive the two reference electrodes five (5) feet deep.
- B. Test results shall be in writing and shall show temperature, humidity and condition of the soil at the time of the tests. In the case where the ground resistance exceeds five (5) ohms, the owner will issue additional instructions.

### 3.2 600 VOLT CABLE INSULATION TEST

- A. Megger and record insulation resistances of all 600 volt insulated conductors size 4/0 AWG and larger using a 500 volt megger for one minute. Conduct tests with circuits isolated from source and load.

### 3.3 SECTIONALIZING SWITCH INSULATING OIL TEST

- A. Sample test the insulating oil in accordance with ASTM D-923 for the following:
  - B. Dielectric strength.
  - C. Acid neutralization number.
  - D. Interfacial tension.
  - E. Color.

### 3.4 PAD MOUNT TRANSFORMER INSULATING LIQUID TEST

- A. Sample test the insulating liquid of the pad mount transformer in accordance with ASDM D-923 for the following:
  - B. Dielectric strength.
  - C. Acid neutralization number.
  - D. Interfacial tension.
  - E. Color.

### 3.5 MAIN AND DISTRIBUTION SYSTEM SWITCHBOARD AND PANELBOARD OPERATIONAL CHECK AND TEST

- A. Check cleanliness of all interiors and all parts. Remove any excess packaging, shipping bolts, etc. Inspect for shipping damage.
- B. Tighten all points of connection with torque wrench to values recommended by the manufacturer.
- C. Verify proper operating condition of all equipment mechanically and electrically, including, but not limited to:
- D. Wiring for all meters and instrumentation.
- E. Verify operation of each circuit breaker trip device with an accurately metered timed instrument (by passing 300 percent rated current through each pole).
- F. Verify relay operation by introduction of accurately metered currents into both overcurrent and ground fault circuitry at values which will enable accurate determination of the tripping coordination of main and feeder breakers. Provide this test with the tie breaker when provided.
- G. Verify short time pick-up and delay, and instantaneous pick-up current. These should conform with manufacturer's published time current characteristic curves.
- H. Auxiliary protective devices such as phase failure relays shall be activated to ensure operation.
- I. Determine instantaneous pick-up current by primary injection using run-up or pulse method. Clearing time shall be within four (4) cycles.
- J. Perform insulation resistance test per NASET specification section 2.
- K. Measure the system neutral to ground resistance with neutral disconnect link removed, for ground fault protected systems.
- L. Utilizing primary current injection, verify the breaker picks up and trips within the manufacturer's recommendations.
- M. If the ground fault relay is external to the breaker or switch, ensure the operation at reduced voltage (60% for AC control and 80% for DC control).
- N. Exercise all devices and components ensuring smooth operation.
- O. Devices shall be tested upon settings defined by the breaker coordination study for this project.
- P. If any equipment is found defective during operational check, it shall be replaced by the contractor without cost to the owner and tests repeated by the contractor, without cost to the owner, until satisfactory results are obtained.

### 3.6 PRIMARY VOLTAGE CABLE HIGH POTENTIAL TEST

- A. All primary cables shall be given DC high potential tests after installation. All tests shall be performed in the presence of the owner and shall be performed to their complete satisfaction. DC high potential test of cables shall be performed after all splices and cable terminations are made but before connections to equipment are made. A DC micro-ammeter in series with the ground connection of the high voltage transformer shall be used to read the leakage current in the cable at two minute intervals during the test.

- B. A variable voltage regulator of adequate rating shall be used to permit the raising of test voltage over a minimum of ten minutes in 5kV increments from zero to final test values as recommended by cable manufacturer. Testing time shall be started when the voltage on the cable has attained final test value and shall be continued for at least ten minutes thereafter.
- C. Results of the test shall be plotted, current against voltage at each 5kV increment of rise after two minutes minimum or after value has stabilized, to a maximum test value, and current against time for 10 minutes thereafter in one minute intervals on a separate sheet for each length of cable tested. Curves shall be identified with the cable to which they apply and shall be certified. Time of day, outside temperature, and humidity at time of each test shall appear on each curve sheet.
- D. If any primary cable fails or tests, in the opinion of the owner, show unacceptable cable defects, all cables in that conduit between the nearest pulling points on each side of the failure shall be withdrawn. If, in the opinion of the owner, other cables that may have been installed in the same duct are not damaged, they may be re-installed, but the failed cable shall be replaced with new cable without additional charge.
- E. After replacement of the faulty cable, and any other damaged cables, all cables of the circuit in that conduit shall be retested. If the cable fails again, or if tests, in the opinion of the owner, show unacceptable cable defects, all cables shall be replaced without charge and this procedure shall be repeated until tests prove satisfactory.

### 3.7 GENERATOR TEST

- A. After the installation and initial start-up of the engine generator set is complete, a test shall be performed and logged in the presence of the owner. The contractor shall have the engine generator manufacturer furnish and engineer to operate the engine during the test, to check all details of the installation and to instruct the operators. The engineer will be required for a period of not less than two days for instruction and tests and all costs in connection therewith shall be included in the contractor's bid. The contractor shall furnish all fuel, lubricants, load banks and instruments necessary to conduct the tests and shall connect all devices required to obtain data required below. The resistor load bank shall be connected to the load side of the automatic transfer switch and the contractor shall make any necessary temporary connections to obtain full load for the test.
- B. On site testing shall include all items specified in NFPA-110.
- C. Field test requirements: Data shall be recorded every 15 minutes and at the beginning and end of every separate test and shall include all electrical and temperature information. Testing shall be accomplished in the following sequence:
- D. Check all engine and generator mounting bolts. Check alignment of engine generator and realign if not within manufacturer's limits.
- E. Test generator and exciter insulation resistance with a megger. Take generator readings at circuit breaker or at leads to switchboards. Record all results in the test report.

- F. Perform engine manufacturer's recommended prestarting checks. Include a check of water, fuel, and lube oil levels within the engine.
- G. Start engine and make engine manufacturer's after starting checks during a reasonable run-in or warm-up period.
- H. Operate engine generator for one hour at 50% of rated load.
- I. Operate engine generator for one hour at 75% of rated load.
- J. Operate engine generator for two hours at 100% of rated load.
- K. Measure sound level to assure that the sound spectrum does not exceed the criteria specified.
- L. Increase engine speed by manually overriding the governor. Speed shall be measured by a tachometer. Record speed at which overspeed trip operates.
- M. Demonstrate functioning of high temperatures coolant circuit by restricting airflow through the radiator. Record temperatures.
- N. Shutdown engine and observe operation of low oil pressure control. Record pressure at which trip operates. Note: If safety conditions of the safety system are not met during any of the preceding three steps, the necessary readjustments shall be made and the step repeated until satisfactory results are obtained.
- O. Ensure proper operation of the automatic exercising system by setting system for automatic operation then manually initiating and exercise period of at least 30 minutes.
- P. A battery starting test shall be performed with the charger disconnected, consisting of four (4) cranking cycles of 10 seconds "on" and 10 seconds "off." The engine fuel supply shall be shut off to prevent starting.
- Q. Checks to be made during on-site testing:
- R. Proper operation of all controls.
- S. Proper operation of all gauges and instruments throughout operation.
- T. Proper operation of all auxiliary and accessory equipment. All valves, including pilot valves and injection pump, shall be checked during the tests to ensure proper operation.
- U. Inspection: Upon completion of the on-site tests, a general inspection shall be made for:
- V. Leaks in the engine, piping systems, tank, etc.
- W. Excessive blow-by.
- X. Any other deficiency which may impair proper operation.
- Y. Change oil and oil filter and record hour readings.
- Z. Acceptance: Final acceptance shall be made when the generator set has successfully completed the on-site test and after all defects in material or operation have been corrected with maintenance manuals and training completed.

EEND OF SECTION

## SECTION 260519 - CONDUCTORS AND CABLES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

## 1.3 SUBMITTALS

- A. Submit shop drawings and product data.

## 1.4 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by the owner.

## PART 2 - PRODUCTS

## 2.1 BUILDING WIRES AND CABLES

- A. Conductors: Stranded, copper, 600 volt insulation, type THHN/THWN, THHN/THWN-2, XHHN/XHHW.
- B. Conductors:
- C. Solid or stranded for No. 10 and smaller, stranded for No. 8 and larger, copper, 600 volt insulation, type THHN/THWN. Aluminum conductors not allowed unless noted otherwise.
- D. Insulation Types: THWN-2 for underground, THWN for wet locations, THHN for dry locations; XHHN/XHHW for GFI branch circuits and feeders fed from GFCI breakers.
- E. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
  - 1. Phase A: Black.
  - 2. Phase B: Red.
  - 3. Phase C: Blue.
  - 4. Neutral: White.
  - 5. Ground: Green.
  - 6. Isolated ground: Green with yellow tracer.
- F. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
  - 1. Phase A: Brown.
  - 2. Phase B: Orange.
  - 3. Phase C: Yellow.
  - 4. Neutral: White or gray.
  - 5. Ground: Green.

- G. Wire connectors and splices: units of size, ampacity rating, material, type and class suitable for service indicated.
- H. Signal and communication circuits:
  - 1. Special cables as indicated on the drawings.
  - 2. Conductors for general use: stranded copper conductor, #16 AWG minimum, with THWN-2 insulation for underground, THWN for wet locations and THHN insulation for dry locations.

### PART 3 - EXECUTION

#### 3.1 GENERAL WIRING METHODS

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Use no wire smaller than #12 AWG for power and lighting circuits and no smaller than #18 AWG for control wiring.
- C. The contractor is responsible for upsizing conductor sizes to ensure the maximum voltage drop of any branch circuit does not exceed 3%. For reference, use No. 10 AWG conductor for 20 Amp, 120 volt branch circuits longer than 75 feet, and for 20 Amp, 277 volt branch circuits longer than 200 feet.
- D. Place an equal number of conductors for each phase of a circuit in the same raceway or conduit.
- E. Splice only in junction or outlet boxes.
- F. Neatly train or lace wiring inside boxes, equipment, and panelboards.
- G. Make conductor lengths for parallel circuits equal.
- H. Provide a separate neutral conductor for each ungrounded conductor. Ungrounded conductors may share a neutral when all of the following conditions are met:
  - I. The ungrounded conductors are connected to a multi-pole breaker or breakers that are clipped together with a UL listed means that provide a common trip.
  - J. The ungrounded conductors contained in the same conduit or raceway.
  - K. The ungrounded conductors all originate from a separate and unique phase bus in the panel.

#### 3.2 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions, and the "National Electrical Installation Standards" by NECA.
- B. Remove existing wires from raceway before pulling in new wires and cables.
- C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means; including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway.

- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables above accessible ceilings; do not rest on ceiling tiles. Do not fasten cables to ceiling support wires. Use cable ties to support cables from structure.

### 3.3 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
- G. Terminate spare conductors with electrical tape.

### 3.4 LABELING

- A. Provide Brady wire markers or equivalent on all conductors. All wire shall be labeled in each box and panel with the circuit number and panel identification.

### 3.5 FIELD QUALITY CONTROL

- A. Inspect wire and cable for physical damage.
- B. Perform continuity testing on all power and equipment branch circuit conductors. Verify proper phasing connections.

END OF SECTION

## PART 4 - GENERAL

### 4.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and Division 1 Specification Sections, apply to this Section.

### 4.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

### 4.3 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment to concrete encased electrode, metal underground water pipe, and effectively grounded metal frame of building.



- B. Ground each separately-derived system neutral to nearest effectively grounded metal structural frame of building or point of service entrance ground.
- C. Provide communications system grounding conductor to point of service entrance ground.
- D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground connectors, and plumbing systems.

#### 4.4 QUALITY ASSURANCE

- A. Testing: Refer to Section 260501 – Field Test and Operational Check.

### PART 5 - PRODUCTS

#### 5.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section 260519 - Conductors and Cables.
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow tracer. Where not available, green and yellow tape at each junction box or device enclosure.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Medium hard drawn copper conductor, stranded, sized as shown on the drawings.
- G. Hardware: Bolts, nuts and washers shall be bronze; cadmium plated steel or other non-corrosive material, approved for the purpose.
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

#### 5.2 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- D. Below grade compression fittings: Thomas & Betts, Series 52000, 53000, and 54000 or equivalent.
- E. Use connector and sealant approved for purpose on all below grade clamp or compression type connections.

#### 5.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, 5/8 inch diameter, minimum length 8 feet.

## PART 6 - EXECUTION

## 6.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

## 6.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NEC Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NEC are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways bonded to outlet or equipment, sized per Section 250 of the NEC.
- G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on grounding bar.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Provide green insulated ground conductor to exterior post light standards.
- I. Provide grounding and bonding at pad-mounted transformer in accordance with Section 261200.

### 6.3 INSTALLATION

- A. Ground Rods: Where indicated, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, unless otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC 250, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### 6.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

#### 6.5 SYSTEM NEUTRAL GROUND

- A. Ground the neutral conductor of each transformer or generator to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.
- B. Ground generators or transformers with secondary voltage 600 volt or less as follows:
  - C. 3 phase, 4 wire Wye connected: ground neutral point
  - D. For transformers 75 kVA or smaller with primary voltage 480 volt or less the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with NEC system ground conductor size.

## 6.6 EQUIPMENT GROUND

- A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways or cable trays to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a grounding conductor in each raceway system. Equipment grounding conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size grounding conductors per NEC 250 unless otherwise shown on the drawings.
- B. Install metal raceway couplings, fittings, and terminations secure and tight to ensure good grounding continuity. Provide grounding conductor sized per NEC through all raceway and conduit systems.
- C. Lighting fixtures shall be securely connected to equipment grounding conductors. Outdoor lighting standards shall have a factory installed ground lug for terminating the grounding conductor.
- D. Motors shall be connected to equipment ground conductors with a bolted solderless lug connection on the metal frame.

## 6.7 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Test ground system per Section 260501.
- C. END OF SECTION 260526

## SECTION 260529 - SUPPORTING DEVICES

## PART 7 - GENERAL

## 7.1 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.

## 7.2 WORK INCLUDED

- A. Conduit and equipment supports.
- B. Fastening hardware.

## 7.3 RELATED WORK

- A. Division 3 - Concrete Work. Concrete equipment pads.

## 7.4 COORDINATION

- A. Coordinate size, shape and location of concrete pads with Division 3.

## 7.5 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

## PART 8 - PRODUCTS

## 8.1 MATERIAL

- A. Support Channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

## PART 9 - EXECUTION

## 9.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors or beam clamps. Do not use spring steel clips and clamps.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- D. Do not use powder-actuated anchors.
- E. Do not drill structural steel members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. In wet locations install free-standing electrical equipment on concrete pads.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

- I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- J. All supports and attachments shall meet project seismic zone requirements.

END OF SECTION

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## SECTION 260533 - RACEWAYS AND BOXES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

## 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid Polyvinyl Chloride conduit.
- G. PVC: Rigid Polyvinyl Chloride conduit
- H. HDPE: High Density Polyethylene Conduit

## 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

## 1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

## PART 2 - PRODUCTS

## 2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. PVC coated Steel Conduit and Fittings: NEMA RN 1; rigid steel conduit with external 40 mil PVC coating and internal two mil urethane coating.
- D. EMT and Fittings: ANSI C80.3. Fittings: Set-screw type.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

## 2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 PVC. Fittings: NEMA TC 3; match to conduit and material.



### 2.3 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Finish: Manufacturer's standard enamel finish.

### 2.4 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

### 2.5 FLOOR BOXES

- A. Floor Boxes: Cast metal, fully adjustable, rectangular, unless otherwise specified.

### 2.6 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

### 2.7 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, 3R, or 4, with continuous hinge cover and flush latch, key operable.
- B. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- C. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

### 2.8 J-HOOKS

- A. J-hooks: Steel, rated for indoor use in non-corrosive environments. J-hooks shall be rated to support Category 5e cable.
- B. Fittings and Support Bodies: Manufacturer's recommended fittings including side mount flange clips, bottom mount flange clips, beam clamp, rod and flange clip, C & Z purlin clip, and all other components and assemblies to make the system work.
- C. Acceptable Product: Caddy CableCat Hanging System, 1-5/16" and 2" hooks, or approved equal
- D. Acceptable Manufacturer: Erico Fastening Products or approved equal.
- E. J-hook Supports: Manufacturer's recommended fastening devices.

### 2.9 INNERDUCT

- A. Innerduct: NEMA TC 5. UL Listed, corrugated, specifically designed for optical fiber cable pathways.
- B. Acceptable Manufactures: Arnco, Carlon, Dura-line, and Pyramid.
- C. Composition:

1. Non-plenum rated: Polyethylene (PE), or High Density Polyethylene (HDPE)
  2. Plenum rated: per manufacturer.
- D. Nominal Size: 1" (inside diameter), minimum.
- E. Pulling Strength: minimum of 600 pounds.
- F. Color: Orange, solid.
- G. Fittings and Innerduct Bodies: Manufacturer's recommended fittings including couplings, adapters, end caps, end bells, expansion couplings, plugs, sleeves, a full compliment of connective devices, and all other components to make the system work.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC or PVC Externally Coated Rigid Steel Conduit where required by NEC 517.13.
4. Underground, Grouped: RNC or PVC Externally Coated Rigid Steel Conduit where required by NEC 517.13.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

- B. Indoors: Use the following wiring methods:

1. Exposed: EMT or "Wiremold" metallic raceways or equal.
2. Exposed in public areas: "Wiremold" metallic raceways or equal. Use of exposed raceways in public areas must be approved by the architect prior to installation for each location. Use of exposed EMT in areas visible to the public is not allowed unless specifically approved by the architect prior to installation. Replacement of unapproved installations of exposed raceways will be at the expense of the contractor if deemed necessary by the architect or engineer.
3. Concealed: EMT or MC-Cable. Note: MC-Cable is not approved for "homeruns"
4. Concealed in Patient Care Areas: EMT or Hospital Grade MC-Cable where allowed by code. Note: Hospital Grade MC-Cable is not approved for "homeruns"
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
6. Damp or Wet Locations: Rigid steel conduit.

7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
8. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

### 3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size. 3/4-inch minimum for "homeruns".
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
  1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  2. Space raceways laterally to prevent voids in concrete.
  3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  4. Transition from nonmetallic tubing to rigid steel conduit or IMC before rising above floor.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
  1. Run parallel or banked raceways together, on common supports where practical.
  2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  2. Use insulating bushings to protect conductors.
- P. Tighten set screws of threadless fittings with suitable tools.
- Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- S. Install pull wires in empty raceways. Utilize polyester line with not less than 200-lbtensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- T. Telephone and Signal System Raceways: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
  2. Where conduit pass from the interior to the exterior of a building.
  3. Where otherwise required by NEC.
- V. Apply firestopping to cable and raceway penetrations of fire-rated floor, ceiling, and wall assemblies to achieve fire-resistance rating of the assembly. Boxes installed in fire-rated floor, ceiling, and wall assemblies shall result in no larger than a 16 square-inch penetration in the fire-rated wall surface and the quantity of penetrations shall not be greater than 100 square-inches for every 100 square feet of fire-rated wall area. Where boxes are located on both sides of a fire-rated wall, the boxes shall have a minimum of a 24" horizontal spacing, where a 24" horizontal spacing cannot be achieved, furnish and install listed fire-rated putty on the boxes as required by the IBC.
- W. Route conduit through roof openings for piping and ductwork where possible; otherwise, install roof penetrations in accordance with roofing system requirements. Coordinate with roofing installer.

- X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- Y. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- Z. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
- AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.
- BB. Conduits shall not be routed on or above the roof without prior approval from the Engineer. Instead, the branch circuits shall be routed at the structure level below the roof to feed roof-top equipment. When approval is granted to route conduits on or above the roof, the conduits shall be strapped to COOPER industries DB series support blocks at intervals not exceeding NEC requirements. The conduits shall not be rested directly on the roof. It shall be permissible to penetrate the roof adjacent mechanical or electrical equipment to power that respective equipment.

### 3.4 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers, at least every 8 feet.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards; disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit. Perform fastening according to the following unless other fastening methods are indicated:
1. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  2. New Concrete: Concrete inserts with machine screws and bolts.
  3. Existing Concrete: Expansion bolts.
  4. Steel: Spring-tension clamps on steel.
  5. Light Steel: Sheet-metal screws.
- N. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.
- O. Do not drill structural steel members.
- P. All supports and attachments shall meet project seismic zone requirements.

### 3.5 BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
- B. Locate boxes in masonry walls to require cutting of masonry unit edge only. Coordinate masonry cutting to achieve neat openings for boxes.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.
- E. Use 4" boxes with multiple-gang mudring where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in walls without damaging wall insulation.

- G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- H. Position outlets to locate lighting fixtures as shown on reflected ceiling plans:
- I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud walls, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- L. For boxes installed in metal construction, use rigid support metal bar hangers or metal bar fastened to two studs or with metal screws to metal studs.
- M. Set floor boxes level and adjust to finished floor surface.
- N. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- O. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- P. Locate pull and junction boxes above accessible ceilings or in unfinished areas. Support pull and junction boxes independent of conduit.
- Q. Minimum box size to be 4" square by 2 1/8" deep.

### 3.6 LABELING

- A. Label coverplate of all pull and junction boxes by system served. Indicate panel circuits for power and lighting boxes.

### 3.7 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

## SECTION 260543 – UNDER SLAB AND UNDERGROUND ELECTRICAL WORK

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes under slab conduits and related electrical work.

## PART 2 - PRODUCTS

## 2.1 CONDUIT

- A. All shall be provided with fittings and accessories approved for the purpose. Refer to Section 260533.

## 2.2 PRECAST CONCRETE MANHOLE

- A. Structural reinforced, size as indicated, with inserts for cable racks and pulley eyes.

## 2.3 BARE COPPER GROUND CONDUCTOR

- A. Medium hard drawn copper conductor, # 4/0 AWG stranded (unless otherwise noted).

## PART 3 - EXECUTION

## 3.1 GENERAL

- A. Electrical system layouts indicated on the drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit.

## 3.2 CONDUIT INSTALLATION

- A. Plastic conduit shall be installed on 2 inch sand base and covered by 2 inch sand back fill. Multiple runs shall maintain 3 inch minimum separation between runs. Plastic conduit shall not be installed in rock base.
- B. Underground conduit entering building shall be provided with one 10 foot section of rigid steel conduit at point of penetration of foundation, footing or basement wall, with approximately equal lengths inside and outside building line. Ream the smaller inside diameter conduit smooth to prevent conductor damage.
- C. Stagger conduit couplings by a minimum of 12 inches. All risers to grade shall be rigid steel.
- D. All rigid steel conduits shall be encased in 3 inch minimum concrete envelope.
- E. After completion of concrete encased duct bank, a 12 inch mandrel, ¼ inch less in diameter than a conduit, shall be pulled through each conduit.
- F. Install 1/8 inch diameter pull line in each underground conduit.
- G. Burial depths of conduits shall comply with the NEC (minimum).



H. Provide underground type plastic line markers: permanent, brightly colored, continuously printed plastic tape, intended for direct burial service, not less than 6 inches wide, reading "Caution Buried Electrical Line." Install continuous line markers located directly over buried line at 6 inches above top of conduit, during back filling operation.

### 3.3 CONCRETE DUCT BANK CONSTRUCTION

- A. Provide plastic spacers at maximum 5'-0" centers to maintain 3 inch spacing between conduits.
- B. Drive two reinforcing bars to anchor the conduits at 10'-0" on centers to prevent floating during concrete pour.
- C. Provide one warning tape (see 3.2.H. above) for each 12 inch width of concrete duct bank.

END OF SECTION

## SECTION 260800 – LIGHTING SYSTEMS COMMISSIONING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS:

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

## 1.2 SUMMARY:

- A. This Section includes requirements for commissioning the lighting system and its controls.
- B. The registered design professional is responsible to provide evidence of lighting systems commissioning and completion in accordance to the provisions of this section.

## 1.3 DEFINITIONS:

- A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.
- B. RDP: Registered Design Professional
- C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

## 1.4 COMMISSIONING DOCUMENTATION:

- A. Commissioning Plan: A commissioning plan will be developed by a registered design professional or approved agency and shall include the following items:
  - 1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
  - 2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
  - 3. Functions to be tested.
  - 4. Conditions under which the test will be performed.
  - 5. Measurable criteria for performance
- B. Test Checklists: RDP, with assistance of Architect/Engineer, shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist.
  - 1. Name and identification of tested item.
  - 2. Test number.
  - 3. Time and date of test.

4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Date of the test and name of parties involved as applicable.
  6. Individuals present for test.
  7. Deficiencies/Issues/Results of test.
  8. Note if re-test is necessary.
- C. Test and Inspection Reports: RDP shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. RDP shall compile test and inspection reports and tests and inspection certificates and include them in systems manual and commissioning report.
- D. Corrective Action Documents: RDP shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.
- E. Issues Log: RDP shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
1. Creating an Issues Log Entry:
    - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
    - b. Assign a descriptive title of the issue.
    - c. Identify date and time of the issue.
    - d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
    - e. Identify system, subsystem, and equipment to which the issue applies.
    - f. Identify location of system, subsystem, and equipment.
    - g. Include information that may be helpful in diagnosing or evaluating the issue.
    - h. Note recommended corrective action.
    - i. Identify commissioning team member responsible for corrective action.
    - j. Identify expected date of correction.
    - k. Identify person documenting the issue.
  2. Documenting Issue Resolution:
    - a. Log date correction is completed or the issue is resolved.
    - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
    - c. Identify changes to the Contract Documents that may require action.
    - d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
    - e. Identify person(s) who corrected or resolved the issue.
    - f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, RDP shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, RDP shall include the following information in the issues log and expand it in the narrative:
- a. Issue number and title.
  - b. Date of the identification of the issue.
  - c. Name of the commissioning team member assigned responsibility for resolution.
  - d. Expected date of correction.
- F. Commissioning Report: RDP shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Contract Documents. The commissioning report shall include, but is not limited to, the following:
1. Lists and explanations of substitutions; compromises; variances in the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
  2. Commissioning plan.
  3. Testing plans and reports.
  4. Corrective modification documentation.
  5. Issues log.
  6. Completed test checklists.
- G. Systems Manual: RDP shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:
1. Submittal Data stating equipment installed and selected options for each piece of equipment requiring maintenance.
  2. Operation and maintenance data on each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.
  3. Name and address of at least one service agency.
  4. Lighting controls system maintenance and calibration information.
  5. A narrative of how each system is intended to operate, including recommended setpoints.

PART 2 - **-PRODUCTS – Not Used**

PART 3 - EXECUTION

3.1 TESTING:

- A. Testing shall ensure that the control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturers installation instructions.
- B. Testing shall ensure that the lighting controls meet all provisions of the applicable energy code.
- C. Perform tests using design conditions whenever possible. Where occupant sensors, time switches, programmable schedule control, photosensor's or daylighting controls are installed, the following procedures shall be performed:
  - 1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
  - 2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
  - 3. Confirm that the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

END OF SECTION

## SECTION 260923 - LIGHTING CONTROL DEVICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors.
- B. Related Sections include the following:
1. Section 262726 - Wiring Devices for wall-box dimmers and manual light switches.

## 1.3 SUBMITTALS

- A. Submit shop drawings and product data, including all wiring diagrams.

## PART 2 - PRODUCTS

## 2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449.

## 2.2 TIME SWITCHES

- A. Description: Electromechanical-dial type complying with UL 917.
1. Astronomic dial.
  2. Two contacts, rated 30 A at 277-V ac, unless otherwise indicated.
  3. Eight-day program uniquely programmable for each weekday and holidays.
  4. Skip-day mode.

## 2.3 LIGHTING CONTROL SYSTEM

- A. Description of Work: Extent of lighting control system work is indicated by drawings, and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.
- B. Type of lighting control equipment and wiring specified in this section include the following: Low Voltage Lighting Control Panels.
- C. SYSTEM DESCRIPTION

1. The lighting control system shall consist of low voltage relay control panels with 32 programmable switch inputs and shall offer 32 control relays.
2. Each low voltage lighting control panel shall be microprocessor controlled with an integral 4 x 16 - 64 character display and with a programming keypad.
3. Programmable intelligence shall include Time-Of-Day control, 32 holiday dates, warn occupants of an impending off, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, and local control.

D. Soft-Linking            Group linking for rapid programming

1. Relays may be designated as either normally open or normally closed from software. Relay status shall not only disclose commanded relay status but next scheduled state to occur.
  2. Each control panel shall provide a Warn Off (flash the lights) to inform the occupants of an impending Off command. The Warn Off command shall provide an adjustable time duration of 1 second to 99 extra minutes. The occupants may exit the premises with adequate lighting or cancel the Warn Off by overriding the lighting zone. This option occurs with all Off commands except local overrides.
  3. The controller shall permit lighting to be overridden on for after hours use or cleaning. The controller shall provide optional switch timer assignments or timed overrides. The override choices for various relays shall provide special event occurrences and the controller shall return to the programmed state. Also, the controller shall provide priority and masking choices to customize the functions of switch inputs, thereby enabling switches to function differently at different times of the day to meet special facility operational requirements. These overrides shall be hard-wired inputs.
  4. Programming the controller shall be through the local integral keypad. Descriptive information shall assist the user to employ the system without a programming manual.
  5. Priorities and/or Masking shall be assigned to inputs, telephone override, and global commands to insure building integrity. Priorities enable or disable the inputs based on Time-Of-Day scheduling in the controller. Masks shall permit: On only, Off only and On & Off control for intelligent after hours utilization of the controlled facility
- E. The lighting control system may be fully programmed through PC programming software. Programming shall be permitted through a direct RS-232 or RS-485 connection, and modem.

F. HARDWARE FEATURES

1. Operator Interface: The control panel programming interface resides in firmware in the control panel. The programming interface shall consist of a circuit board mounted keypad capable of linking switch inputs to relay outputs and schedule assignments. Systems that utilize blocking diode technology for relay assignments shall not be acceptable.
2. Contact inputs: The control system shall permit 32 dry contacts (Digital/Switch Inputs) for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Maintained contacts shall be supported as 2 wire (SPST) inputs. Inputs shall be dry contacts (24 VDC @ 12 ma. internally supplied to the inputs). An input shall be software linked to any number of relays for override control.

3. Relay Type: The system shall utilize control relays which are rated to 20 amps at 277 VAC. The relays shall be magnetically held and are provided in groups of eight. Relays that are latched or mechanically held are not acceptable. The relays shall be rated for 10 million mechanical operations. A limited 10 year warranty shall be provided on the individual relays.
4. Photocell Control: The controller shall accept user adjustable ambient light sensors. The controller shall provide power for the sensor thereby eliminating any external power supply. Sensors shall provide for both outdoor and indoor applications and provide a dry contact to the controller once the threshold is reached. The sensor shall provide user adjustable dead band control.
5. Modular Design: The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick release hinge pins that shall permit an entire change out of the processor and input board in less than 1 minute.
6. Hardware Output Options
  - a. Latching Relay Card (LRC): The controller shall provide an option for remote placement of the control relays. A modular card shall connect into the relay compartment. Twisted (3) conductor cable shall power and control the remote mounted relays. Maximum distance is 500 feet employing 18 AWG conductor.
  - b. Modular Relay Card (MRC): The controller shall provide an option for modular relay control. The Modular Relay Card (MRC) shall offer the feature of controlling two pole voltages such as 208, 240, and 480VAC in a Normally Open or Normally Closed configuration. Single pole is offered for 120 and 277VAC in a Normally Open and Absolute Zero Configuration. This relay card shall also provide visual indication of relay status. Relays shall be individually exchangeable with plug in low voltage connectors. Combinations of relays shall be permitted since relay modules shall snap into and lock in location. Two pole modules require two relay locations for a maximum of four two pole relays per card. All other relay modules use 1 relay location for a maximum of eight per card. All Modular Relay Card components shall be warranted for 10 years.
  - c. Two Pole Relay Card (TPRC): The controller shall provide an option for two pole relay control. The Two Pole Relay Card TPRC shall offer the feature of controlling two pole voltages such as 208, 240, and 480 VAC lighting loads at 20 amps. The relays shall be modular in design and offer manual hand override control. This optional relay card shall also provide a visual indication of relay status. The 208, 240 VAC version shall provide 8 relays per card whereas the 480 VAC version shall provide 4 relays per card. Combinations of relays shall be permitted since relays shall snap into location.



- d. Automatic Relay Card (ARC): The system shall utilize hybrid control relays that are rated to 20 amps at 277 VAC. The hybrid relay shall combine a high speed electronic switch with a mechanical relay to create a unique switching device. The hybrid design shall look at each AC phase and shall close the electronic switch precisely at the absolute zero crossing. The mechanical relay in parallel shall follow and close after the in-rush current condition. The relay shall provide an integral switch for both manual hand operation and visual indication of relay status. The relays shall be rated for 10 million mechanical operations. A limited 2 year warranty shall be provided on the individual relays.
- e. Lighted Switch Card (LSC): The controller shall provide an option for pilot light wall switch annunciation. A modular card shall connect into the controller board and shall provide power to illuminate pilot light switches. This option shall confirm relay operation. When a relay is in the "ON" position the pilot light switch shall be illuminated.
7. Diagnostic Aids: Each control panel shall incorporate diagnostic aids for confirmation of proper operation, or in case of failure these aids shall guide the individual in rapid troubleshooting of the system.
8. Memory Back-up: The system shall utilize a memory back-up device that is system integrated and shall be non-serviceable. The data in RAM shall be protected against power interruptions lasting as long as 7 days. The power interrupt protection circuit shall be entirely maintenance-free.
9. Multi-tapped Transformer: The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltages of 120 & 277 VAC shall be available with each control panel.
10. Status Indication of Relays: The system shall provide visible status indication of all relays through the window of each control panel. The visual indication shall disclose On/Off status and relay number.
11. Service Override & Priority Override: The control panel shall provide a three position master-service override for the control unit. The service override shall not be accessible from the exterior.
12. Lockable Enclosure: Each control panel shall be enclosed in a lockable NEMA class 1 enclosure. The enclosure shall be manufactured out of 1/16" steel and shall provide pre-punched knockouts for efficient installation.
13. Panels: The low voltage controller shall exist in two sizes of relay enclosures. The enclosure maximum sizes shall be 32 relays per cabinet. The 16 size will employ two relays cards and the 32 will utilize 4 relay cards. Relays shall be provided in groups of eight relays per card.
14. High Voltage Barriers: The low voltage controller shall provide as an option the ability to provide a barrier for either voltage separation or emergency circuit separation. The 16-size enclosure shall permit one barrier and the 32-size enclosure shall permit up to three locations where the barrier(s) may be installed. The barrier shall be painted red to denote the difference.

15. Modem: The control system shall be capable of modem communications. Each control panel shall provide a serial communications port for external tele-communications. The modem shall utilize the Hayes compatibility standard and enable modem access as defined by the Bell 212A and CCITT V.22 protocol standards.
16. Telephone Overrides (TIM): The control system shall provide intelligent software for the Telephone Interface Module (TIM) option. The optional TIM unit shall allow modem communications and touch tone overrides from any touch tone phone. The control system shall be multi-tasking and permit up to one TIM for each control panel.
17. Software: System provided shall include the manufactures PC based interface software package. The PC based interface software shall provide access to lighting control system files within a Microsoft Windows environment. The software package shall allow individual panel programming to be executed locally, direct connection, Ethernet connection or remotely through a modem. The central programming software shall permit the user to modify the control panel programming or configuration in an "OFF-LINE" mode. This software package shall store all programmed data and archive for future use. Systems using third party software are not acceptable.
- a. Standard Software Features:
    - 1) Real Time Relay Status Monitoring
    - 2) Alpha-Numeric Descriptors
    - 3) Communications: Direct, Network, Ethernet and Modem
    - 4) Network Status Indication
    - 5) Global Software Modifications
    - 6) Manual Relay Commands
    - 7) Remote Pattern Commands
    - 8) Preset Options
  - b. File Maintenance
    - 1) Archive Programs
    - 2) Data Base Restoration
    - 3) Uploading and Downloading of Programs
18. PC Interface (RS-232 port): The controller shall permit PC programming through software. The controller shall provide a RJ-12 connection for RS-232 programming. Programming shall be permitted through either a local connection or remotely through a modem. PC software shall permit multiple file storage for data archival and for seasonal facility requirements. Operator commands may be issued directly from the PC keyboard.

#### G. MANUFACTURERS

H. Cooper Controls, Greengate

I. Lutron

J. Lighting Control & Design

K. Lightolier

L. PRODUCT SUPPORT AND SERVICE

M. Factory Support: Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

N. WARRANTY

O. Manufacturer shall supply a 2 year warranty on all hardware and software. A limited 10 year warranty shall be provided on the standard relay card.

#### 2.4 PHOTOELECTRIC RELAYS

A. Description: Solid state, with single-pole, double-throw dry contacts rated to operate connected relay or contactor coils or microprocessor input, and complying with UL 773A.

B. Light-Level Monitoring Range: 0 to 3500 fc, with an adjustment for turn-on/turn-off levels.

C. Time Delay: Prevents false operation.

D. Outdoor Sealed Units: Weather tight housing, resistant to high temperatures and equipped with sun-glare shield and ice preventer.

#### 2.5 OCCUPANCY SENSORS

A. Occupancy sensors indicated on the plans are to establish room controls and sensor quantities. The contractor is to verify sensor placement with the local manufacturer's representative or the manufacture to ensure proper coverage and functionality of the specific sensor(s) installed. The contractor is to return and make any adjustments necessary to the occupancy sensor settings and/or placement needed to maintain proper functionality within 30 days after the owner/tenant takes occupancy of the project.

B. Lighting control system shall include all occupancy sensors, power packs, and control wiring required to form a complete system.

C. All occupancy sensors shall be dual/multi technology, manufactured by Unenco, Wattstopper, Lightolier Controls, Sensor Switch, or pre-approved equal unless otherwise noted.

D. Ceiling and Wall Mount Units: Shall utilize dual/multi technology detection methods. Unit receives control power from a separately mounted auxiliary power and control unit, and operates power switching contacts in that unit.

E. Switch-Box-Mounting Units: Shall utilize dual/multi technology detection methods. Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts. Unit is to have integral manual controls and is to be mounted at standard switch height.

F. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.

1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 20 minutes, minimum. Time delay to be set at 20 minutes unless otherwise directed. Contractor shall verify time delay with the owner/tenant prior to final occupancy.

2. Manual Override Switch: Where indicated on drawings; turns lights off manually regardless of elapsed time delay.

3. Sensor shall be located and/or adjusted to detect occupancy within 1-foot of entry into room or area controlled by the occupancy sensor.
- G. Auxiliary Power and Control Units: As follows:
1. Relays rated for a minimum of 20-A normal ballast load.
  2. Sensor Power Supply: Rated to supply the number of connected sensors.
  3. Relays shall have an auxiliary contact(s) for integration with HVAC or other building control systems.
- H. Passive-Infrared Type: Detects occupancy by a combination of heat and movement in zone of coverage.
- I. Ultrasonic Type: Emits a beam of ultrasonic energy and detects occupancy through use of Doppler's principle in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy. Ultrasonic frequency shall be 25 Khz or greater and sensor shall be temperature and humidity resistant.
- J. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic or microphonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (ON or OFF) is selectable in the field by operating controls on unit.
- K. All sensors shall be capable of operating normally with electronic ballast and compact fluorescent systems.
- L. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- M. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering.
- N. In the event of failure, a bypass manual "override on" feature shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly. The override feature shall be designed for use by building maintenance personnel and shall not be readily accessible by building occupants.
- O. All sensors shall provide an LED indication light to verify that motion is being detected and that the unit is working.
- P. All sensors shall have no leakage current in OFF mode and shall have voltage drop protection.

## 2.6 MULTIPOLE CONTACTORS AND RELAYS

- A. Description: Electrically operated and mechanically held, and complying with UL 508 and NEMA ICS 2.
1. Current Rating for Switching: UL listing or rating consistent with type of load served.
  2. Control Coil Voltage: Match control power source.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.

### 3.2 CONTROL WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions.
- B. Wiring Method: Install all wiring in raceways.
- C. Bundle, train, and support wiring in enclosures.
- D. Ground equipment.
- E. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

### 3.3 IDENTIFICATION

- A. Provide Brady wire markers or equivalent on all conductors.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect control components for defects and physical damage.
- B. Verify settings of photoelectric devices with photometer.
- C. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
  - 1. Continuity tests of circuits.
  - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
- D. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- E. The Lighting Control Panel shall be tested and listed under the UL 906 Energy Management Equipment Standards.

### 3.5 CLEANING

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

END OF SECTION

## SECTION 262416 - PANELBOARDS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
1. Lighting and appliance branch-circuit panelboards.
  2. Distribution panelboards.
- B. Related sections:
1. Section 260501 - Field Test and Operational Check.
  2. Section 260526 - Grounding.

## 1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. UL listing for series rating of installed devices.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- D. Maintenance Data: For panelboards and components, include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

## 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. Comply with NEMA PB 1.
- C. Comply with the NEC.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

##### A. Manufacturers:

1. Panelboards, Overcurrent Protective Devices and Accessories:
  - a. Eaton Corp.; Cutler-Hammer Products.
  - b. General Electric Co.; Electrical Distribution & Control Div.
  - c. Siemens
  - d. Square D Co.; Schneider Electric Brands
  - e. Or approved equal.

#### 2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush or surface mounted cabinets (as indicated on drawings). Construct cabinets with code gauge galvanized steel. Provide minimum 20" wide cabinets and extra wiring space where incoming feed-through or parallel lines are shown. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Doors: Provide door-in-door construction, made of cold-rolled steel. Inner door shall provide access to breaker handles and outer door shall provide access to wiring space as well. Inner door shall be completely flush with no visible bolts, screw-heads or hinges and with flush catch and lock. Outer door shall have concealed hinges, flush catch and lock to match inner door, located in line with inner door catch. (Tee bar handles are not acceptable).
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity. Attach circuit breakers to bus so that circuits 1, 3, and 5; 2, 4, and 6, or any three similarly numbered circuits form one three-phase, four-wire circuit.
- G. Main and Neutral Lugs: Compression or mechanical type suitable for use with conductor material.

- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Isolated Equipment Ground Bus: Where indicated on drawings - Adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Extra-Capacity Neutral Bus: Where indicated on drawings, neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Where indicated on plans, On 120/208Y Panels fed by K factor Type Transformer.
- L. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Where indicated on plans.
- M. Gutter Barrier: Arrange to isolate individual panel sections.
- N. Feed-through Lugs: Compression or mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. For two-section panels.
- O. Panels located adjacent to each other shall have identically sized enclosures and trims.

### 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating. If not series rated: Fully rated to interrupt symmetrical short-circuit current available at terminals or the rating indicated on the plans, whichever is higher.

### 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices:
- B. 120/208Y volt branch circuit panelboards: Quick-make, quick-break, molded case plug-in type designed for 120/208Y volt, three-phase, four-wire service with minimum 10,000 amperes rms short circuit rating.
- C. 277/480Y volt branch circuit panelboards: Molded case bolt-on type designed for 277/480Y volt, three-phase, four-wire service with minimum 14,000 amperes rms short circuit rating.
- D. Provide multi-pole units with common trip elements.
- E. Breaker shall have center-tripped position in addition to the ON and OFF positions.
- F. Provide lockouts for all circuits that should not be inadvertently tripped (as indicated on the drawings).

### 2.5 DISTRIBUTION PANELBOARDS

- A. Dead-front, dead-rear, Nema 1 or 3R enclosure as indicated, designed for use on a three-phase, four-wire, 120/208Y or 277/480Y volt system. See drawings for additional details.



- B. Construction: Code gauge galvanized steel fully flanged for strength and rigidity. Door and trim shall be cold-rolled steel, code gauge. Provide concealed butt hinges and 3-point catch and lock. Provide separately hinged or bolted vertical access doors over lug and wiring spaces.
- C. Bus Bars: Panel shall be fully bussed. Shall be used throughout and shall be hard-rolled, electrolytic copper of 98% conductivity designed for a maximum 1000 amperes per square inch. Bars shall be factory pre-drilled to accept future field installation of 2 or 3 pole circuit breakers in any combination. Brace all bus bars for required short circuit rating of the panel, but in no case less than 35,000 amperes rms, Refer to Short Circuit information above for additional requirements.
- D. Main Overcurrent Protective Devices: Circuit breaker unless otherwise noted.
- E. Provide handle locking devices for all circuit breakers.
- F. Provide engraved nameplates with minimum ¼" high letters secured to panel front and for each circuit protective device in panel.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

### A. Main

#### B. Breaker (or Feeder) Assemblies rated for 1200 Amps:

1. 1. Main (or feeder) breakers rated for 1200 Amp may be Molded Case with temperature insensitive, solid state trips, current sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit breakers shall have the following features:
  - a. UL listed for 80 percent load application unless otherwise indicated on plans as 100% rated.
  - b. Adjustable [L] Long time time-delay and ampere setting.
  - c. Adjustable [S] Short time-delay and pick-up.
  - d. Adjustable [I] Instantaneous trip.
  - e. For 277/480Y systems rated 1000 Amp or higher - Adjustable [G] Ground fault pick-up and delay is required.
  - f. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
  - g. Adjustable [R] Reduced Energy Let-Through (RELT) Instantaneous trip. This feature shall be provided on breakers to provide a temporary setting for the instantaneous trip setting of the breaker. Setting shall be adjustable down to 1.5X of the rating plug and shall be enabled through a switch mounted on front of the switchboard. The switch shall be combined with an indicating light that positively indicates that the RELT is enabled or disabled.
  - h. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard.
  - i. Short circuit, overload and ground fault trip indicators.

#### C. Feeder Circuit Breaker Assemblies 400 Amps or larger:

1. Feeder Circuit breakers 400 Amps or larger shall be digital solid state true RMS sensing Molded Case Circuit Breakers with temperature insensitive, solid state trips, current sensors and solid state logic circuit integral with the frame. All circuit breakers shall be of same design for over-current and ground fault trip coordination. The Circuit Breakers shall have the following minimum features:
    - a. UL listed for 80 percent load application unless otherwise indicated on plans.
    - b. Long time pickup ( ampere setting ) determined by interchangeable rating plug .
    - c. Adjustable instantaneous with short time tracking function.
    - d. Circuit Breaker shall allow the UL listed field installation internal accessories ( Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch ) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
    - e. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position
  2. Where specifically indicated or required by NEC
    - a. Adjustable [L] Long time time-delay and ampere setting.
    - b. Adjustable [S] Short time-delay and pick-up.
    - c. Adjustable [I] Instantaneous trip.
    - d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
    - e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
    - f. Short circuit, overload and ground
    - g. d fault trip indicators.
    - h. Trip device of circuit breakers shall be of same type for tripping coordination.
- D. Feeder Circuit Breaker Assemblies 150 Amp and below:
1. Feeder Circuit breakers 150 Amp and below shall be thermal Magnetic Circuit breaker: Inverse time current element for low level overloads, and instantaneous magnetic trip element for short circuits, unless otherwise indicated or required to meet Section 2.4 C above. Minimum features below:
    - a. UL listed for 80 percent load application unless otherwise indicated on plans.
    - b. Circuit Breaker shall allow the UL listed field installation internal accessories (Auxiliary Switch, Shunt Trip, Undervoltage release, Bell Alarm Switch) without removal of cover to install. Circuit Breaker shall include Accessories as indicated on plans.
    - c. Circuit breaker handle accessories shall provide provisions for locking handle in the 'ON' or 'OFF' position
  2. Where specifically indicated or required by NEC

- a. Adjustable [L] Long time time-delay and ampere setting with Long time pickup ( ampere setting ) determined by interchangeable rating plug.
- b. Adjustable [S] Short time-delay and pick-up.
- c. Adjustable [I] Instantaneous trip.
- d. Adjustable [G] Ground fault pick-up and delay where indicated or required be NEC.
- e. Where Indicated special zone control interlocking for main breaker and future main and tie breaker of double-ended substation switchboard
- f. Short circuit, overload and ground
- g. d fault trip indicators.
- h. Trip device of circuit breakers shall be of same type for tripping coordination.

E. General Breaker Requirements:

1. Minimum interrupting capacity shall match the minimum required interrupt rating of the panel.
2. Standard frame sizes, trip ratings, and number of poles.
3. Lugs: Mechanical or compression style, suitable for number, size, trip ratings, and material of conductors.
4. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
5. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
6. Shunt Trip: 120-V trip coil energized from separate circuit.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Clearances: Minimum code required clearances around panelboards must be maintained.
- C. Mounting Heights: Top of trim 78 inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Mounting Hardware: Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column or other parts of building structure.
- F. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- G. Install filler plates in unused spaces.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

### 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components.
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label shall include panel designation, voltage and phase in minimum 1/4" high letters.

### 3.3 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Refer to Section 260501 – Field Test and Operational Check.
- B. After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, measure load balancing and make circuit changes as follows:
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.5 ADJUSTING

- A. Set field-adjustable switches and circuit breaker trip ranges.
- B. Adjust all operating mechanisms for free mechanical movement.

### 3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

## SECTION 262726 - WIRING DEVICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes receptacles, switches, and finish plates.

## 1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

## 1.4 SUBMITTALS

- A. Submit shop drawings and product data.

## 1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers:
- B. Wiring Devices:

1. Bryant; Hubbell, Inc.
2. GE Company; GE Wiring Devices.
3. Hubbell Wiring Device – Kellems
4. Leviton Manufacturing Co., Inc.
5. Pass & Seymour/Legrand; Wiring Devices Div.
6. Cooper Wiring Devices
7. Or approved equal.

- C. Wiring Devices for Hazardous (Classified) Locations:

1. Crouse-Hinds Electrical Co.; Distribution Equipment Div. or approved equal.

- D. Multi-outlet Assemblies:

1. Wiremold.
2. Hubbell, Inc.; Wiring Devices Div.
3. Or approved equal.

## 2.2 RECEPTACLES

- A. General Requirements for All Devices
- B. Each device shall have an amperage rating not less than that of the branch circuit(s) overcurrent protection device. Match existing color, unless noted otherwise.
- C. Emergency devices backed up by an emergency generator and the associated cover plates shall be Red color.

- D. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. All devices shall be Commercial Specification Grade (Construction specification grade is prohibited), unless noted otherwise.
- F. All convenience receptacles shall be Heavy-Duty 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 5362 Series or similar.
- G. Straight-Blade: All devices shall be Tamper Resistant where required by the National Electric Code and/or local amendments.
- H. Tamper Resistant—Convenience Receptacles: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL5362xxTR Series or similar.
- I. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter. Provide one device for each location, daisy-chaining devices to achieve GFCI protection is not approved for this project.
- J. Duplex GFCI Convenience Receptacles, 125 V, 20 A.
- K. Straight Blade, non-feed through type.
- L. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
- M. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- N. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; GFRST20xx Series or similar.
- O. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap, orange plastic face.
- P. General Description: Straight Blade, 125 V, 20 A, Configuration 5-20R. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.
- Q. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
- R. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- S. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL5362SA Series or similar.
- T. Devices: Listed and labeled as isolated-ground receptacles.
- U. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
- V. TVSS Receptacles: Duplex type, NEMA WD 6, with integral TVSS in line to ground, line to neutral, and neutral to ground, blue plastic face.
- W. General Description: Straight Blade, 125 V, 20 A, Configuration 5-20R. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

- X. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
- Y. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service".
- Z. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL5362SA Series or similar.
- AA. Mult-Outlet assemblies: Metal with finish matching the existing, unless noted otherwise.
- BB. Two-piece surface (painted steel, brushed aluminum) raceway, with factory-wired multi-outlet harness.
- CC. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- DD. Receptacles: 20 A, 125-V, NEMA WD 6 Configuration 5-20R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
- EE. Receptacle Spacing: [6 inches] [9 inches] [12 inches] [18 inches]
- FF. Wiring: No. 12 AWG solid, Type THHN copper, [single circuit] [two circuit, connecting alternating receptacles]

### 2.3 SWITCHES

- A. Snap Switches: General-duty, quiet type, rated 20 amperes, 120/277 volts AC. Handle: plastic with finish matching existing, unless noted otherwise.
- B. TOGGLE SWITCHES: Heavy-duty, quiet type, rated 20 amperes, 120/277 volts AC Comply with NEMA WD 1, UL 20, and FS W-S-896.
- C. Single Pole: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1221 Series or similar.
- D. Double Pole: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1222 Series or similar.
- E. Three Way: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1223 Series or similar.
- F. Four Way: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; 1224 Series or similar.
- G. Pilot-Light Switches, Single pole, with neon-lighted handle, illuminated when switch is "on", 20 A, for 120 and 277 V. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221PL Series or similar.
- H. Illuminated Switches, Single pole, with neon-lighted handle, illuminated when switch is "off." 20 A, for 120 and 277 V. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221IL Series or similar.
- I. Key-Operated Switches, 120/277 V, 20 Amp, with factory-supplied key in lieu of switch handle. Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; HBL1221L Series or similar.
- J. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters
- K. Control: Continuously adjustable slide. Single-pole or three-way switch to suit connections.

- L. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch wire connecting leads.
- M. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.

#### 2.4 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
1. Cover plate: Smooth plastic with finish matching existing, unless noted otherwise.
  2. Cover plate for surface mounted devices: Galvanized steel.
  3. Weatherproof cover plate: While in use, gasketed, cast metal, hinged device covers.
  4. Plate-Securing Screws: Metal with head color to match plate finish.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, vertically, with height as indicated or six inches above counters.
- F. Group adjacent switches under single, multigang wall plates.
- G. Protect devices and assemblies during painting.
- H. Install wall switches with off position down.
- I. Install cover plates on switch, receptacle, and blank outlets.

#### 3.2 IDENTIFICATION

- A. Switches and receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on the outside of the face plate for receptacles and on the inside of the face plate for switches; utilize durable wire markers or tags within all outlet boxes. Labels shall be Brother 1/2" TZ tape, black ink on clear, extra-strength adhesive tape, with size 18 text or engineer approved equal. Use matching label printer.

#### 3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.



D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Check each device to verify operation.
- B. Test GFCI operation according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

EEND OF SECTION

## SECTION 262813 - FUSES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, starters, and motor control centers; and spare fuse cabinets.

## 1.3 SUBMITTALS

- A. Product Data: Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with the NEC.

## 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.6 COORDINATION

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.

1. Fuses: Furnish one set of three of each type and size.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers:
  1. Cooper Industries, Inc.; Bussmann Div.
  2. Gould Shawmut.
  3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

4. Or approved equal.

## 2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

## 2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size fuse.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare fuse cabinet.

### 3.3 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

EEND OF SECTION

## SECTION 262815 - DISCONNECT SWITCHES

## 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 WORK INCLUDED

- A. Provide and install motor disconnects.
- B. Provide and install circuit disconnects.

## 1.3 REFERENCES

- A. Underwriters' Laboratory, Inc. - Annual Product Directories.
- B. NEMA - Classification of Standard Types of Nonventilated Enclosures for Electric Controllers.

## 1.4 REGULATORY REQUIREMENTS

- A. Conform to National Electrical Code and to applicable inspection authority.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

- A. Cutler-Hammer/Westinghouse, General Electric, Siemens, Square D, or approved equal.

## 2.2 COMPONENTS

- A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.
- B. Single Phase 120 Volt Disconnect Switches: Single pole toggle switch with thermal overload motor protection where indicated. A Horse Power rated switch may be used where fractional horse power motors have internal overload protection.
- C. Single or Three Phase Motor Disconnect Switches: two or three pole heavy duty or fusible where other loads are on same circuit, 250 or 600 volt as required in NEMA Type 1, 3R, or 4 enclosures designed to reject all except Class 'R' fuses.

## 2.3 ACCEPTABLE MANUFACTURERS - FUSES

- A. Cooper Bussmann, Edison, Littelfuse, Ferraz Shawmut, or approved equal.

## 2.4 FUSES

- A. As indicated on the drawings. All shall be of the same manufacturer. Provide one spare set of fuses (minimum of three) for each current rating and type used. See Section 262813.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor and circuit disconnect as indicated on Drawings and as required by Code. Where fuses are indicated, provide fuses correlated with full load current of motors provided.

END OF SECTION

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## SECTION 265100 - INTERIOR LIGHTING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces and recessed in canopies, emergency lighting units, and accessories.
- B. Related Sections include the following:
  - 1. Section 260923 Lighting Control Devices.

## 1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features and accessories.
- B. Maintenance data for lighting fixtures.
- C. Emergency lighting units including battery and charger.

## 1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with the NEC.
- C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

## 1.5 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, partition assemblies, and other construction.

## 1.6 WARRANTY

1.7 Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1.8 Warranty Period for Emergency Lighting Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years.

A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

B. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: As indicated on the drawings.

### 2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit maintenance without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

D. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

### 2.3 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Remote Test – Where indicated on the drawings: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test – Where indicated on the drawings: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

## 2.4 EMERGENCY LIGHTING UNITS

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
  1. Emergency Connection: Operate fixture continuously at an output of 1100 lumens for 90 minutes. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
  2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space. Provide integral to fixture or mounted adjacent to fixture.
  3. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  4. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  5. Battery: Sealed, maintenance-free, nickel-cadmium type.
  6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
  7. Battery: Sealed, maintenance-free, nickel-cadmium type.
  8. Charger: Fully automatic, solid-state type with sealed transfer relay.
  9. Night-Light Connection: Where night-light option is called out in the drawings, operate the fixture continuously.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering the light fixture, remote mounted from the lighting fixture. Comply with UL 924.
  1. Emergency Connection: Operate fixture continuously at an output of 1100 lumens for 90 minutes. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
  2. Battery: Sealed, maintenance-free, nickel-cadmium type.
  3. Charger: Fully automatic, solid-state, constant-current type.



4. Housing: NEMA 250, Type 1 enclosure.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

## 2.5 FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- C. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.
- F. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage

## 2.6 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
  1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  2. Metallic Finish: Corrosion resistant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.
- B. Furnish and install a protective barrier around fixtures that are not insulation-contact-rated (non-IC-rated) in locations where insulation is installed. The protective barrier shall be installed to yield a 4" air-gap from the fixture on all sides and top.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Attach supports to building structure.
  1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
  2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
  3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- D. Suspended Fixture Support: As follows:
  1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

### 3.2 CONNECTIONS

#### A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

### 3.3 FIELD QUALITY CONTROL

#### A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

#### B. Tests: As follows:

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

#### C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

#### D. Ballasts: Replace all noisy ballasts. Ballasts that can be heard shall be considered noisy. Repeat the procedure until a ballast is installed that is not noisy.

### 3.4 CLEANING AND ADJUSTING

#### A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

#### B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

## SECTION 265600 - EXTERIOR LIGHTING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes exterior lighting units with luminaires, lamps, ballasts, poles/support structures, and accessories.
- B. Related Sections include the following:
1. Section 260923 - Lighting Control Devices.
  2. Section 265100 - Interior Lighting for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.

## 1.3 DEFINITIONS

- A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.
- B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

## 1.4 SUBMITTALS

- A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories and finishes.
- B. Maintenance data for lighting units.

## 1.5 QUALITY ASSURANCE

- A. Luminaires and Accessories: Listed and labeled as defined in the NEC, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with ANSI C2.
- C. Comply with the NEC.

## 1.6 ELIVERY, STORAGE, AND HANDLING OF POLES

- A. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: As indicated on the drawings.

### 2.2 LUMINAIRES

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
- E. Exposed Hardware Material: Stainless steel.
- F. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- G. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- H. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
  - 1. Ballast Fuses: One in each ungrounded supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
  - 2. Single-Lamp Ballasts: Minimum starting temperature of minus 40 deg C.
  - 3. Open-circuit operation will not reduce average life.
  - 4. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
  - 5. Noise: Uniformly quiet operation, with a noise rating of B or better.
- I. Verify availability of space to install device at or close to ballast. Unit as specified is suitable for full 15-a branch-circuit protection. Coordinate with Drawings.
- J. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.

1. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

### 2.3 LUMINAIRE SUPPORT COMPONENTS

- A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 80 mph with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
- C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  1. Materials: Will not cause galvanic action at contact points.
  2. Mountings: Correctly position luminaire to provide indicated light distribution.
  3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
  4. Anchor-Bolt Template: Steel.
- E. Pole/Support Structure Bases: Anchor type with hold-down or anchor bolts, leveling nuts, and bolt covers.
- F. Steel Poles: Tubing complying with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in length with access handhole in pole wall.
- G. Steel Mast Arms: Fabricated from NPS 2 black steel pipe, continuously welded to pole attachment plate with span and rise as indicated.
- H. Metal Pole Brackets: Match pole metal. Provide cantilever brackets without underbrace, in sizes and styles indicated, with straight tubular end section to accommodate luminaire.
- I. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- J. Concrete for Pole Foundations: Comply with Division 3.

### 2.4 FINISHES

- A. Steel: Grind welds and polish surfaces to a smooth, even finish.
  1. Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123.
  2. Surface Preparation: Clean surfaces to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
  3. Interior: Apply one coat of bituminous paint on interior of pole, or otherwise treat to prevent corrosion.

4. Polyurethane Enamel: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
5. Color: As indicated on the drawings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Concrete Foundations: Construct according to Division 3.
- B. Install poles as follows:
  1. Use web fabric slings (not chain or cable) to raise and set poles.
  2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  3. Secure poles level, plumb, and square.
  4. Grout void between pole base and foundation. Use non-shrinking or expanding concrete grout firmly packed in entire void space.
  5. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- C. Luminaire Attachment: Fasten to indicated structural supports.
- D. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

#### 3.2 CONNECTIONS

- A. Ground equipment.
  1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
- B. Ground metal poles/support structures.

#### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.

#### 3.4 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.

END OF SECTION

## SECTION 266000 – ELECTRICAL DEMOLITION AND REPAIR

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes electrical demolition and repair. Work includes removal of obsolete wiring and electrical apparatus; relocation, reconnection or replacement of existing wiring affected by demolition or new construction; capping off concealed wiring abandoned due to demolition or new construction.

## PART 2 - PRODUCTS

## 2.1 EQUIPMENT

- A. Conductors and Cables: Refer to Section 260519 – Conductors and Cables.
- B. Raceways and Boxes: Refer to Section 260533 – Raceways and Boxes.

## PART 3 - EXECUTION

## 3.1 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety. Completely remove all exposed traces, hardware, wiring and conduit systems to the source. All knockouts and holes shall be patched or plugged.
- C. Contractor shall re-use existing straight conduit runs and factory bends for conduits 2" and larger, provided that they are not damaged in any way and are installed in accordance with Section 260533.
- D. Re-use of all other electrical apparatus and material is subject to approval by owner.
- E. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- F. Remove demolished material for recycling as directed by owner.
- G. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- H. Power outages shall be held to a minimum and coordinated with the owner. Contractor shall schedule outages during off-hours.

END OF SECTION

SECTION 271101 – TELECOM RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes telecom raceway systems.

1.3 RELATED WORK

- A. Section 260533 – Raceways and Boxes.
- B. Section 260536 – Cable Trays.

1.4 SYSTEM DESCRIPTION

- A. Conduit, cable trays and boxes to form an empty raceway system.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Conduit: Refer to Section 260533.
- B. Cable trays: Refer to Section 260536.
- C. Outlet, pull or junction boxes: Refer to Section 260533.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide pullboxes in telecom conduit runs spaced less than 100 feet apart, and on the backboard side of runs with more than two right angle bends.
- B. Place telecom label on pull and junction boxes.
- C. Provide pullwire in each telecom conduit run.

END OF SECTION



## SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - - **GENERAL**

## 1.1 SUMMARY

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases; concrete foundation for posts.
- C. Manual gates and related hardware.

## 1.2 RELATED SECTIONS

- A. Division 01 Specifications.

## 1.3 REFERENCES

- A. ASTM A 116 - Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric; 1995.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2000.
- C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2000.
- D. ASTM A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 1996.
- E. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2000.
- F. ASTM F 567 - Standard Practice for Installation of Chain-Link Fence; 2000.
- G. ASTM 900 - Standards Specifications for Industrial and Commercial Swing Gates.
- H. ASTM F 1043 - Standard Specifications for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- I. ASTM F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 1997.
- J. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.

## 1.4 SUBMITTALS

- A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- B. Shop Drawings: Spacing of components, post foundation dimensions, hardware anchorage, gate hardware and schedule of components.
- C. Manufacturer's Installation Instructions: Indicate installation requirements and recommended methods.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five (5) years of documented experience.
- B. Installer's Qualifications: Installer specializing in the installation of products and work specified in the section with not less than five (5) years of documented experience.

1.6 WARRANTY

A. Contractor shall warrant work as provided by the General and Supplementary Conditions and Division 01 Specifications.

PART 2 - - PRODUCTS

2.1 MATERIALS

A. General: Substitutions or equivalent products shall be in accordance with Division 01 Specifications.

B. 8' Fencing:

- 1. Posts, Rails, and Frames: ASTM F 1083 Schedule 40 steel pipe, 25 ksi; OR ASTM F 1043 IC SS40 steel pipe, 50 ksi. Standard Hot Dipped Galvanized.
- 2. Wire Fabric: 2-inch mesh, 9 gauge, ASTM A 392 zinc coated steel chain link fabric with 1.2 oz. per square foot.
- 3. Selvage edges: Fabric shall be knuckled at top and bottom.
- 4. Concrete: Type specified in Division 32.

C. Footings shall be sized as follows:

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## 2.1 COMPONENTS (finish to match post and fabric)

A. Gate Posts (Hinge and Latch Posts): All post dimensions are outside diameter.

1. 2.875 inch O.D. for gate leaf 6 feet and under.
2. 4 inch O.D. for gate leaf 6 feet to 9 feet.
3. 6.625 inch O.D. for gate leaf 10 feet to 20 feet.

B. Gates:

1. All gates shall be width noted on plans, height to match adjacent fencing.
2. Submit rolling gate shop drawings for approval.

C. Terminal Posts: Corner/End/Pull - All post dimensions are outside diameter.

1. 2.875 inch for 8' high.

D. Line Post: All post dimensions are outside diameter.

1. 2.875 inch for 8' height, max spacing 10' o.c.

E. Brace Rail: 1.66 inch O.D., plain end, sleeve coupled, unless otherwise indicated on the drawing. Manufacturer's longest lengths.

F. Top Rail: 0.065 tubing at all fencing locations and fencing heights.

G. Bottom Rail: 0.065 tubing at 3' and 10' tennis court fencing locations.

H. Bottom Tension Wire: zinc coated steel tension wire, 7 gauge complying with ASTM A824.

I. Tie Wire: Aluminum alloy steel wire, 9-gauge or 11-gauge, galvanized steel, to match fabric core material.

J. Post Brace Assembly: Install per manufacturer's recommendations

1. Horizontal Brace: 1.66 inch diameter, length and fittings as required.
2. Truss Rod: 0.375 inch diameter steel rod, length adjusted as required.

K. Gate Frame: 1.625 inch O.D., steel pipe for welded fabrication. Provide corner reinforcing gusset plates to prevent twist when damaged. Gate frames in leaf 10' or greater shall have vertical member truss rods and 3/8" adjustable truss rods with turn buckles.

## 2.2 ACCESSORIES (finish to match post and fabric)

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer, finish to match post.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel, finish to match post and fabric.

C. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp. Finish to match post and fabric. Hinge must allow for gate to swing as shown on the drawings.

- D. Hardware for Double Swinging Gates: Greater than 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates. Finish to match post and fabric. Gate frame shall have Vertical member truss rods and 3/8" adjustable truss rods with turn buckles.
- E. Gate Latch for Double Swinging Gates and Pipe Gates: Fulcrum Double Gate Latch, Hoover or equal.

### 2.3 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A 123/A 123M, at 2.0 oz/sq ft.
- B. Hardware: Hot-dip galvanized to weight required by ASTM A 153/A 153M.
- C. Accessories: Same finish as framing.

## PART 3 - - EXECUTION

### 3.1 INSTALLATION

- A. Verify finished grades are complete prior to installation.
- B. Install framework, fabric, accessories and gates in accordance with ASTM F 567.
- C. Place fabric on inside of posts and rails.
- D. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade or as shown on the drawings. Slope top of concrete for water runoff.
- E. Line Post Footing per Part 2 of this Specification. Submit shop drawings for review.
- F. Corner, Gate and Terminal Post Footing Depth Below Finish Grade per Part 2 of this Specification. Submit shop drawings for review.
- G. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gateposts.
- H. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- I. Install center brace rail on corner gate leaves and on backstop fencing.
- J. Do not stretch fabric until concrete foundation has cured 7 days.
- K. Stretch fabric between terminal posts or at intervals of 500 feet maximum, whichever is less
- L. Position bottom of fabric 2 inches above finished grade or 1 inch above mow strip or concrete flatwork or wall cap.
- M. Fasten fabric to top rail, line posts, braces, mid rail and bottom rail with tie wire at maximum 15 inches on center. Bend ends to minimize hazard to persons or clothing.
- N. Attach fabric to end, corner, and gateposts with tension bars and tension bar clips.
- O. Do not attach the hinged side of gate to building wall; provide gateposts.
- P. Install gate with fabric to match fence. Install hardware, finish to match fence.

- Q. Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, non-alignment, or malfunction throughout the entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding. Lubricate hardware and other moving parts.
- R. Latch, catches, returns, locking clamp, etc. shall be track welded to the pipe and painted with two coats of "galviron" at weld.
- S. Coordinate with drawings for post footings adjacent to masonry walls.

### 3.2 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

END OF SECTION

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## **ADDENDUM NUMBER 2**

### **SECTION 13 11 00 – SWIMMING POOL CONTRACTOR GENERAL REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.01 REFERENCE**

- A. Requirements in Addenda, Alternates and Conditions collectively apply to this work.

##### **1.02 SUMMARY**

###### **A. Principal Work Items Are:**

- 1. Pool Contractor Qualifications and Responsibilities.

###### **B. Related Work Specified Elsewhere:**

- 1. Section 131105 – Swimming Pool Required Testing and Inspections
- 2. Section 131109 – Swimming Pool Start-Up
- 3. Section 131110 – Swimming Pool Recirculation Equipment
- 4. Section 131111 – Swimming Pool Piping
- 5. Section 131115 – Swimming Pool Deck Equipment
- 6. Section 131116 – Swimming Pool Underwater Lights
- 7. Section 131120 – Cast-In-Place Concrete for Pool Foundations
- 8. Section 131121 – Swimming Pool Cast-In-Place Deck Concrete
- 9. Section 131125 – Swimming Pool Cementitious Waterproofing
- 10. Section 131130 – Swimming Pool Sealants and Caulking
- 11. Section 131145 – Swimming Pool Trim Tile
- 12. Section 131150 – Swimming Pool Manufacturer

##### **1.03 CONTRACTOR'S ALTERNATE PROPOSAL**

- A. Contractor shall submit his bid to the owner based on materials, equipment and methods as specified in this section. No substitutions of material will be allowed.
- B. It is the intent of the contract documents to encourage competition. The base proposal must be on providing the construction methods and equipment as specified and detailed. Any proposed system substitution must have prior written approval by the Architect.

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- C. If there is any deviation from the basis of design equipment it is the responsibility of the contractor to confirm that all engineering criteria are appropriate for the substituted equipment.
- D. All proposed substitutions of specified construction methods and equipment shall include a complete submittal as required by these specifications and drawings of appropriate scale incorporating all required changes. The Contractor shall provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.
- E. Any changes or modifications to the contract documents that are not authorized by the Owner or Architect shall be the sole responsibility of the Contractor.

#### 1.04 SUBMITTALS

- A. Refer to Division 1 for submittal requirements.

#### 1.05 POOL CONTRACTOR QUALIFICATIONS

- A. It is the intent of the Owner to award this Contract based on the specific experience and financial means required to complete the specified swimming pool system. The successful bidder must be regularly engaged in the construction of commercial pools. Each bidding Contractor shall demonstrate their specific experience and competency by complying with the following requirements.
1. The Pool Contractor must provide a written statement from an approved bonding company certifying that the Contractor can qualify for 100% Performance and Labor - Material Bonds on this Project.
  2. The Pool Contractor shall provide evidence of having a Contractor's License A or higher in the state of the project location.
  3. The Pool Contractor shall show evidence of having adequate experience in constructing commercial pools. In order to be considered for this Project the Pool Contractor must have completed within the last five years at least five (5) public use 25-Yard size pools with a perimeter overflow gutter in conjunction with a self-modulating surge and balance tank system. All these pools shall have been in operation for at least one year. Submit a list of such projects with the name, address, and current telephone number of the Owner and Architect for reference.
  4. The Pool Contractor shall have completed at least three (3) additional major commercial pool projects (no less than 25-Yards) within the last 5 years. Submit a list of such projects with the name, address, project cost, and current telephone number of the Owner and Architect for reference.
  5. The Pool Contractor shall have completed the manufacturer's annual training program referred as "Pool Academy".



## 1.06 POOL CONTRACTOR RESPONSIBILITIES

- A. It is the intent of this section to place the entire responsibility for the construction of the pool (including the construction of the pool shell and structures) under one vested Contractor. Under this section the Pool Contractor will provide but is not necessarily limited to the following:
1. Providing labor, material, management and coordination of own personnel and specialty subcontractors experienced in commercial pool building to produce a functioning Swimming Pool including structure and equipment ready for public use upon completion of the Work. Remove equipment from premises when no longer required.
  2. Provide, at a minimum, final fine excavation and maintaining the integrity of the vertical cut where utilized. If a vertical cut is not possible or where the integrity of the vertical cut is compromised, the pool contractor shall be responsible for costs associated with back fill and placement of materials.
  3. Construct the pool floor as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, main drain sumps and all embedded items (piping, anchors, etc.) for the pool. Reference Section 131120 – Cast-in-Place Concrete. Before commencing the placement of concrete, verify electrical bonding of the pools embedded items and reinforcing steel. Also, coordinate and arrange any required electrical, plumbing and or building inspections. Provide any structure drainage around the pool as shown on the drawings. Backfill and compact fill around the pool structure, piping trenches and excavations required by this work. Reference Division 31 - Earthwork.
  4. Furnish and install a manufactured pool with a slip resistant surface per Specification Section 131150 – Swimming Pool Manufacturer. Furnish and install specialty markings for the perimeter tile gutter nosing, wall targets, recessed steps, floor lane markings, depth markings and warning signs, and all other markings installation within the pool structures. Reference Section 131146 - Swimming Pool Finish Tile and Section 131150 Swimming Pool Manufacturer including the tolerance requirements for the concrete substrate.
  5. If the integrity of the pool floor is in question due to the placement of concrete, prior to pool finish installation, the pool may be tested for water tightness according to procedures stated in ACI 350.1 / AWWA 400. Owner is responsible for providing water for the initial fill. The Contractor shall be responsible for associated costs of providing water for any subsequent fillings due to failure of water tightness test. Reference Section 131105 – Swimming Pool Required Testing and Inspections.
  6. Provide Swimming Pool sealants and caulking. Reference Section 131130 – Swimming Pool Sealants and Caulking
  7. Provide Cementitious Waterproofing for pool main drain sumps and surge tank. Reference Section 131125 – Cementitious Waterproofing.
  8. Provide deck equipment, anchor inserts, gutter grating, grating support angle, corner gutter grating support angles and fasteners.

9. Provide pool filtration system and circulation system, valves, pumps, chemical feed equipment, water level control system, and all items necessary to operate the entire system properly for each pool.
10. Provide the heating system for each pool. Include all piping, heaters, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation line, heat the water and return it back to the recirculation line and interlock with pool recirculation pumps.
11. Provide Swimming Pool and related equipment Start-Up as stated in Section 131109, Article 3.03 including minimum consecutive 14-day trouble-free operation. Start, test, calibrate and adjust all mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose, maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.
12. Provide initial pool water fill and initial chemical balancing, Ryznar Stabilization, Langelier Index.
13. Provide all equipment and services required for erection and delivery onto the premises of any equipment or apparatus furnished. Remove equipment from premises when no longer required.
14. Provide all electrical conduit, wiring, junction boxes etc. to all low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)
15. Coordinate for all required bonding and grounding of the pool shell, fittings, and equipment.
16. Provide all necessary piping and valving as shown on the drawings and specified herein.
17. Provide the main drain hydrostatic relief system and/or a sight sump as shown on the drawings.
18. Assemble and install the cleaning and maintenance equipment for the pool as specified herein.
19. Provide for the storage of all pool related equipment, materials and systems. All items are the responsibility of the Contractor until accepted by owner.
20. Obtain final acceptance by jurisdictional health department(s).
21. USA Swimming Certification
- a. The Contractor shall provide the services of a registered engineer or land surveyor who shall measure and certify the elevations of the gutter lip at 10 foot centers as well as the length of each lane for each possible racing course. Course length survey must be made with the pool filled with water between 78 and 82 degrees Fahrenheit. Forms

for the lane measurements are available from USA Swimming (719-866-3522) and must be submitted to USA Swimming by the Contractor.

B. Related work specified in other sections

1. The following work related to the swimming pools shall be completed by other contractors.
  - a. Provide, erect and maintain all necessary barricades, signs, lights and flares for pool construction to protect workers and the public.
  - b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations. Reference Division 31 - Earthwork.
  - c. Provide the under-drain system beneath the pool if required by the geotechnical report.
  - d. Provide sub-surface drainage beneath the pump pit and backwash pit. Reference Division 31 – Earthwork if required by the geotechnical report.
  - e. Construct pump pit, backwash pit, and mechanical room building including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Division 3 - Concrete.
  - f. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction, and provide sub-surface drainage beneath the surge tank as needed or required in the project geotechnical report. Reference Division 31 - Earthwork.
  - g. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange any required electrical, plumbing and or building inspections to be performed on embedded items. Reference Division 26 - Electrical.
  - h. Provide sanitary sewer and storm drain connections as shown on the drawings. Reference Division 22 - Mechanical/Plumbing.
  - i. Layout and install all deck mounted anchors, sockets, and inserts for the pool(s).
  - j. Provide deck finish beyond back of the pool bond beam. Reference Section 131121 – Swimming Pool Deck Concrete.
  - k. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.
  - l. Provide chlorine resistant caulking (sealant) and backer rod on pool decks. Reference Section 131130 - Swimming Pool Sealants and Caulking.
2. Related work specified in Plumbing section. Reference Division 22 -Mechanical/Plumbing and Section 131111 – Swimming Pool Piping. Work to be completed by other contractors.
  - a. Furnish and install deck drainage system for pool deck.

- b. Furnish and install sanitary sewer piping from the filter room including floor drains, sumps, and sump pump as necessary.
- c. Furnish and install water service to all hose bibbs, flush hydrant boxes and auto-fill bypass to air gap above fill funnel. Install the slow closing solenoid valve in the bypass auto-fill piping.
3. Related work specified in Mechanical section. Reference Division 23 – Mechanical/HVAC. Work to be completed by other contractors.
- a. Provide the ventilation system including air intake and exhaust duct for the pool heating system in accordance with manufacturer recommendations. Provide natural gas utility connection to the pool heating system in accordance with manufacturer recommendations.
- b. Furnish and install air recirculation systems for pool related spaces.
4. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work to be completed by other contractors.
- a. Furnish and install motor starters, auxiliary contacts, magnetic relays and other electrical control devices necessary for the complete operation of the pool systems.
- b. Provide maintenance overhead lighting in the pool mechanical building.
- c. Ground and bond all pool structures, fittings and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.
- d. Obtain permits, inspections, and approvals of all wiring including grounding and bonding of all metal components associated with the pool in accordance with Local, State and National Electrical Codes.
- e. Confirm all electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

## PART 2 - UNUSED

## PART 3 - EXECUTION

### 3.01 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

- A. The completed structures shall be constructed level and to the dimensions, elevation, depths and thickness as shown on the plans.
- B. The elevation tolerance of the pool shell and gutter lip shall be plus or minus 1/8 inch.
- C. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface shall be plus or minus 1/4 inch from plumb measured with a 6 foot straight edge.

D. For competitive race courses, the following pool shell tolerances shall apply:

Course Tolerance	Minimum	Maximum
25 yard + 1 3/16" / -0"	75' - 3/4"	75' - 1 15/16"

- E. The above dimensions include allowances for a touchpad at each end of the course. The maximum dimension includes the construction tolerance. These above tolerances also apply to courses utilizing moveable bulkhead(s).
- F. The above dimensions apply to a vertical plane extending 1'-0" above and 3'-0" below the surface of the water at all points of both end walls.
- G. Ground wires or grade pins, if used, shall be installed in such a manner that they accurately outline the section of the pool shell as indicated on the plans. They shall be located at intervals sufficient to insure proper thickness throughout and shall be maintained tight. Grade pins or grounding wires shall not be permanently embedded in the pool shell.

### 3.02 AS-BUILT DOCUMENTS

- A. Refer to Division 1 for As-Built Documentation requirements.
- B. Contractor shall provide As-built engineering construction drawings that depict actual as-built conditions of the completed construction as a permanent record of each project feature.
- C. Contractor shall provide engineering construction drawings depicting actual routing, size and placement of all pool piping, valves, supports.
- D. Contractor shall provide engineering construction drawings depicting actual routing, sizing and placement of all pool electrical conduits and note circuitry and conductor routing.
- E. Contractor shall provide engineering construction drawings depicting actual routing, sizing, and placement of all utilities, including sanitary sewer, storm sewer, fresh water, and natural gas lines.
- F. Contractor shall provide engineering construction drawings depicting actual routing, sizing and placement of timing system conduits.

### 3.03 CLOSE OUT SUBMITTALS

- A. Refer to Division 1 for Close Out Submittal requirements.

### 3.04 CONCLUSION

- A. It is the intention of these specifications to provide a complete installation. All accessory construction and apparatus necessary in the operation or testing of the performance of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving the Contractor from furnishing and installing such parts. Any such omission or clarification shall be brought to the attention of the Architect prior to bidding as provided in this section.

END OF SECTION 131100

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## **ADDENDUM NUMBER 2**

### **SECTION 13 11 05 – SWIMMING POOL REQUIRED TESTING AND INSPECTIONS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. Work in this section. Principal work items include:
1. The work under this section shall include all labor, materials, and equipment required to complete the required testing and inspections to be performed by the Swimming Pool Contractor.
  2. Required testing and inspections to be performed by the Swimming Pool Contractor shall include:
    - a. Below Grade Hydrostatic Pipe Pressure Test;
- B. Not included in this section is testing and inspections required for construction materials not listed above. Other testing and inspections shall be required as listed in other specification sections.
- C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, the Contractor shall notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date or as required in bidding documents.

##### **1.02 SUBMITTALS**

- A. All submittals shall be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.
- B. Schedule of Testing and Inspections:
1. Contractor shall provide prior to the start of construction within the general construction schedule when tests and inspections listed in the specification shall be performed.
  2. Hydrostatic Water Tightness testing shall not be scheduled for a period when the forecast is for a difference of more than 35 degrees Fahrenheit between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall not be schedule when the weather forecast indicates the water surface could freeze before the test is completed.
- C. Product Data:
1. Provide product data for each type of product indicated. Include any technical data and installation requirements.
- D. Test Reports:

1. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. All products listed are required to perform the testing. All products that are being tested (i.e. Concrete, piping, etc.) shall conform with the respective specification section.

### 2.02 HYDROSTATIC PIPE PRESSURE TEST PRODUCTS

#### A. Domestic Water

1. Contractor shall utilize the existing domestic fresh water service to fill pipes. The Owner shall assume costs of the water for the initial tests. In the case where the installation fails the initial test and subsequent tests are required, the Contractor shall assume costs of supplying water for each subsequent test, but may still use the domestic fresh water service available.

#### B. Pressure Gauge

1. Gauges shall be bourdon tube type with a minimum 2-inch diameter dial. Gauge case shall be made of high impact polypropylene, ABS, or stainless steel with an acrylic gauge lens. Socket material shall be brass. Gauge sensor material shall be bronze. Scale shall be white with black divisions and numerals measured in psi with a black enameled balanced Micrometer pointer. Gauge range shall be 0 psi to 100 psi. Accuracy shall be +/-1.5% (3-2-3). Connection shall be either back or lower with 1/4" NPT connection.
2. Basis of Design: Gauges shall be Ashcroft 8008A Commercial Pressure Gauge or approved equal.

#### C. Pipe Caps / Plugs

1. All pipe caps and plugs shall be of similar material of the adjoining piping that is being capped. Pipe caps and plugs shall be installed in a similar manner to all pipe fittings.

#### D. Pressure Amplification Pump

1. A pressure amplification pump is only necessary if the domestic water pressure is incapable of providing and sustaining 1.25 times the pressures required within the specification for the duration required within this specification.
2. The pressure amplification pump shall be capable of providing and sustaining 1.25 times the required pressure for the duration of the test.
3. Basis of Design: Pressure Amplification Pump shall be 115V AC Booster Pump, single phase, maximum 117 psi, 3/8-inch NPT inlet size, manufactured by SHURFLO or approved equal



E. Air Relief Valve

1. Air Relief Valve shall be a brass ASME Safety Relief Valve with stainless steel spring with ¼" NPT connection.
2. Basis of Design: Air Relief Valves shall be ST25, ST Series Soft Seat Safety Valve by Control Devices, LLC or approved equal.

PART 3 - EXECUTION

3.01 HYDROSTATIC PIPE PRESSURE TEST PROCEDURE

- A. Pipe test procedure is based on AWWA C605-13. For further clarification, refer to AWWA C605-13.
- B. Hydrostatic testing described in this section shall be conducted with water or other environmentally safe, incompressible fluids, because of the inherent safety hazard potential associated with testing components and systems with compressed or other compressed gases.
- C. All pipes shall be capped and sufficiently extend beyond the swimming pool finishes to allow for cutting and installation of any fittings including return inlets, main drain sumps.
- D. Each system of piping shall be tested for its entirety that it is below grade. The return piping shall be tested from within 15 feet of the footprint of the equipment room slab or pump pit to the return inlets within the finish swimming pool surface. The suction piping shall be tested from within 15 feet of the footprint of the equipment room slab or pump pit to the main drain sumps within the finish swimming pool surface. For constructability purposes, if a surge tank is included in the design, the suction lines may be tested from the main drain sumps within the finish swimming pool surface and within the surge tank finish and then again from within the surge tank finish to within 15 feet of the footprint of the equipment room slab or pump pit.
- E. The Contractor shall provide measurement gauges and recording devices for the test, including pump, pipe, connections, and other necessary apparatus and shall conduct the test. Before testing, the Contractor shall place sufficient backfill to prevent pipe movement, typically embedding 1/3 of the pipe.
- F. When the existing domestic water supply is utilized, the domestic water supply shall be protected from backflow contamination.
- G. Pressure gauges shall be provided at the highest elevation possible and the lowest elevation possible, typically at the shallow end return lines and the main drain lines respectively.
- H. Air relief valves shall be installed at all high points within the system to be tested to allow for proper purging of entrapped air. Taps may be installed at all return inlet piping and a single air relief valve can be utilized to remove entrapped air. This is critical not only for the accuracy of the test but for the safety of the workers that may be within the vicinity of the pressurized pipes.
- I. Tests shall be performed only after the pipeline has been properly filled, flushed, and purged of air. The specified test pressure shall be applied utilizing the existing domestic fresh water

supply. If the existing domestic fresh water supply is incapable of providing sufficient pressure for the tests, a pressure amplification pump shall be installed to provide and maintain proper pressures for the duration of the tests.

- J. During tests, the system and exposed pipe, fittings, valves, and hydrants shall be carefully examined for leakage. Visible leaks shall be repaired and the test re-administered in its entirety. Defective elements shall be repaired or removed and replaced and the test repeated until the test requirements have been met.
- K. The duration of the hydrostatic test shall be 1 hour.
- L. The hydrostatic test pressure shall not be less than 80 psi at the highest elevation along the test section but shall not exceed 150 psi at any point. This pressure shall be maintained for the duration of the hydrostatic test.
- M. The testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than the following
  - 1. For pipes less than 8 inches in diameter, make up water shall not exceed  $\frac{1}{2}$  gallon per 1,000 linear feet of piping.
  - 2. For pipes 10 inches or greater, make up water shall not exceed  $\frac{3}{4}$  gallon per linear feet of piping.
  - 3. Visible leaks shall be repaired, regardless of the amount of leakage.
- N. Notice of Nonconformance
  - 1. If the installation does not meet the requirements of this standard, the installation shall be made satisfactory by the Contractor at the Contractor's expense.
- O. Affidavit of Compliance
  - 1. The Contractor shall provide a sworn statement that the installation complies with the requirements of this specification.

END OF SECTION 131105

**ADDENDUM NUMBER 2**

**SECTION 131109 – SWIMMING POOL START UP**

**PART 1 - GENERAL**

**1.01 SUMMARY**

**A. Principal work items are:**

1. Operation and Maintenance Manuals and Closeout Submittals
2. Pool Fill and Chemical Balance
3. Installation & Operation Certification
4. Owner System Training
5. Project Turnover

**B. Related work specified elsewhere:**

1. Section 131110 – Swimming Pool Recirculation Equipment
2. Section 131111 – Swimming Pool Piping
3. Section 131115 – Swimming Pool Deck Equipment
4. Section 131116 – Swimming Pool Underwater Lights

**1.02 COORDINATION AND CLARIFICATION**

**A. Coordinate with other contractors or subcontractors all work relating to this section.**

**B. The Contractor must establish with other contractors or subcontractors, having related work in this section, that all work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Owner.**

**C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, the Contractor shall notify the Architect through channels established by the specifications and request a clarification ten (10) days prior to the bid date.**

**1.03 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS**

**A. Submit to the Engineer Start-up Chemical Dosing procedure with listed chemicals and quantities.**

**B. Detailed operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment supplier and/or Contractor shall prepare an operation and maintenance manual for all equipment. Parts lists and operating and maintenance instructions shall be provided.**

**C. Each operation and maintenance manual shall include the following:**

1. Equipment function and calibration, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment and checking instructions.
3. Operating instructions for start-up, routine and normal operation, regulation and control, shut down and emergency conditions.
4. One (1) copy of all instructional videos.
5. Operating cycles shall be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram shall be provided in the pool equipment room. The diagram shall be engraved on laminated plastic with color-coded piping to match color of coding on piping, and including valves identified with number on tags. The minimum size shall be 11 inch x 17 inch.
6. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for all pool mechanical equipment.
7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures to be followed for the following:
- Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty;
  - Water level control adjustment and chemical control operation;
  - Normal surge tank operation and balancing;
  - Filter operation and backwashing; and
  - Super chlorination.
8. Lubrication and maintenance instructions.
9. Guide to "trouble-shooting".
10. Parts list and predicted life of parts subject to wear.
11. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.
12. Test data and performance curves, where applicable.
13. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during any period that the pool will be empty. Include furnishing and installing a yellow warning sign 8-1/2 in. x 11 in., to be mounted in the filter room, that reads:

WARNING  
Prior to Emptying Pool  
Consult O & M Manuals for Procedures

Another sign shall read:

Keep all Caps, Plugs and Tops Tight Fitting to Prevent Escape of Fumes.

14. One set of applicable submittals shall be included in each manual.

- D. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the Contractor.
- E. Manuals and other data shall be printed on heavy, first quality paper, 8-1/2 in x 11 in size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams shall be reduced to 8-1/2 in x 11 in or 11 in x 17 in. Where reduction is not practical, larger drawings shall be folded separately and placed in envelopes that are bound into the manuals. Each envelope shall bear suitable identification on the outside.
- F. Six (6) bound volumes of each manual shall be submitted. All parts lists and information shall be assembled in substantial manuals and permanent, three-ring or three-post binders. Material shall be assembled and bound in the same order as specified, and each volume shall have a table of contents and suitable index tabs.
- G. All material shall be marked with project identification. Non-applicable information shall be marked out or deleted.
- H. Shipment of equipment will not be considered complete until all required manuals and data have been received.

1.04 RECORD DRAWINGS

- A. Provide a complete set of record drawings of the entire pool system(s) including all sub-systems. All record drawings shall be prepared in accordance with the requirements of Section 017839 and shall be a complete, stand-alone set. The Contractor shall be permitted to obtain original documents and copy them for this purpose only. Provide the record set on compact disk (AutoCAD Release 2015 or compatible software).

1.05 POOL FILL WATER QUALITY

- A. The Owner shall bear the cost of the water required for two (2) complete fillings of the pool (the initial water tightness test and the final filling). Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the Contractor, at its own expense.
- B. The Contractor shall provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10 degree F.
- C. The Contractor shall provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.2 – 7.4
Calcium Hardness	200 – 400 PPM
Total Alkalinity (Calcium Hypochlorite)	60 – 80 PPM
Total Alkalinity (Sodium Hypochlorite)	80 – 120 PPM

Langelier Saturation Index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.06 START-UP CHEMICALS

- A. The Contractor shall maintain the chemical balance of the pool water (including the cost of all chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Architect and the Owner.
- B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation for minimum of thirty (30) days from substantial completion or the Owner begins using the pool.
- C. Chemicals to be provided to the Owner shall include those required by the chemical feed systems installed.

PART 2 - PRODUCTS (UNUSED)

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

3.02 INSTALLATION CERTIFICATION

- A. The Contractor shall obtain certification of manufacturer's approved installation on the following components or systems for each pool:
  1. Recirculation Pump
  2. Filtration System
  3. Heating System
  4. Chemical Delivery and Monitoring/Alarm Systems
  5. Competitive Deck Equipment
  6. Diving Platforms, Stands, and Boards
  7. Competitive Timing and Scoring Systems
  8. USA Swimming Facility Certification

### 3.03 START UP

- A. Provide Swimming Pool and related equipment Start-Up. Start, test, calibrate and adjust all mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems.
- B. Provide proof of minimum consecutive 14-day trouble-free operation. Lack of chemicals or other non-critical items shall not require a re-start of the trouble-free period but may result in a pause of the trouble free period.
- C. Provide certification that that entirety of pool systems operate and function correctly through all phases of operation.

### 3.04 SYSTEM TRAINING

- A. A qualified representative of the Contractor performing work under this section shall put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.
- B. The Contractor's training representative shall have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.
- C. The representative from the Contractor shall be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.
- D. Training periods shall consist of 8 hours of on-site training and scheduled as follows:
  - 1. 4 hours of initial training on the complete swimming pool system. The 4 hours of initial training is to be comprised of at least 1 hour of training on water chemistry analysis and adjustment. The water chemistry training will include in depth review of the use of the Langelier index and its computation.
  - 2. The initial 4 hours of training shall include information on the care, operation, adjustment, and maintenance of all items provided by the Contractor under the "Part 2 – Products" section of specification 131110 and related specifications
  - 3. 4 hours of training after the Owner's staff has had experience operating the system. This time may be requested any time after the pool has been placed in operation within a period of one (1) year from the time the pool was accepted by the Owner. The additional training shall contain at least 1 hour of review of water chemistry.

### 3.05 PROJECT TURNOVER

- A. Prior to leaving the job, the Swimming Pool Contractor shall obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and all necessary operating information provided. The Swimming Pool Contractor shall, in his contract, include the cost of one (1) additional days (total 4 hours) of instruction and operational check out by the qualified representative of the Swimming Pool Contractor during the first year of operation.
- B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments shall be submitted to the Owner and Architect/Engineer within one (1) week after each visit.

- C. The Contractor shall provide specific written procedures to be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

END OF SECTION 131109

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## **ADDENDUM NUMBER 2**

### **SECTION 131111 – SWIMMING POOL PIPING SYSTEMS**

#### **PART 1 - GENERAL**

##### **1.01 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver material in manufacturer's original, unopened containers and crates with all labels intact and legible.
- B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.
- C. Handle materials in a manner to prevent damage.
- D. Store all materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.
- E. Remove damaged materials from site.

##### **1.02 WARRANTIES**

- A. The Contractor warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The Contractor's warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the Contractor or improper wear and tear under normal use. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified.
- B. The Contractor shall agree to repair or replace any defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.
- C. Submit all warranties covering, but not limited to the following:
  - 1. Defects in material, workmanship, and installation of the pool piping system for a period of three (3) years.

#### **PART 2 - PRODUCTS**

##### **2.01 PIPING MATERIALS**

###### **A. General**

- 1. Provide all recirculating piping between the pool and the equipment room, fill receptor and all interconnecting piping to and from the chemical feed systems and chemical controller.

2. Provide all necessary pipe supports and support systems required to support all associated piping and valves.
3. Provide all other tubing, conduit, or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required to be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.
2. All PVC swimming pool piping shall be NSF approved and conform to the requirements of ASTM D-1785.
3. All PVC pipes shall be the product of one manufacturer. Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal.
4. Swimming pool piping above the floor or deck in the equipment room shall be Schedule 80 PVC.
5. Swimming pool piping below the equipment room floor or deck shall be NSF approved, Schedule 80 PVC.
6. All swimming pool piping under the pool floor shall be NSF approved, Schedule 80 PVC that is backfilled within a 3/4" minus fine crushed aggregate conforming to ASTM C136, and per recommendations indicated in the project geotechnical report. Fill material shall be submitted to the Architect for review and approval prior to placement of any below grade pool pipe.
7. All below grade swimming pool piping not located beneath the pool floor shall be backfilled with native granular material free of ice, clay, debris, organic matter, and rocks not larger than 4" across their greatest dimension, and per recommendations indicated in the project geotechnical report.
8. The influent and effluent lines to the heating system shall be schedule 80 CPVC. Connections between metallic piping and/or equipment and PVC shall be flanged.
9. All PVC and CPVC fittings shall be the product of one manufacturer. Molded fittings shall be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute. Fabricated fittings shall be as manufactured by Harrison Machine, Plastinetics, or acceptable substitute.
10. Vertical sight sump piping shall be NSF approved, Schedule 40 PVC. Horizontal sight sump piping shall be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and have 3/8" diameter holes located top and bottom on 4 ft centers. Horizontal sight sump piping shall extend 1 ft minimum beyond the main drain.
11. Chemical feed tubing from chemical feeders to recirculation piping shall be encased in Schedule 80 PVC piping. Piping shall be hard piped until the injection quill at the recirculation plumbing. All required valves shall be of all PVC construction.
12. All flanged plumbing connection hardware shall be stainless steel.

13. All materials shall be installed by workmen thoroughly skilled in their trades and all work shall present a neat and mechanical appearance when complete. The Contractor, at no additional expense to the Owner, shall replace or correct any work not judged acceptable by the Architect or Owner's testing agency, or their consultants.
14. All support hardware, brackets, fasteners, hangers, etc. installed in the surge tank shall be 316L stainless steel.
15. No installation shall be made that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.
16. All piping shall be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness per specification 131105. Pneumatic (air) pressure testing is not allowed.
17. The Contractor shall provide 1/4" PVC water stops for this work for watertight penetration of concrete walls. Water stops shall be round and the O.D. shall be sized to 150% of the O.D. of the pipe. The water stops shall be thermo-welded to the pipe from both sides and shall be located at the centerline of the wall being penetrated prior to placing the concrete to assure a watertight seal.
18. Contractor must adhere to all the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.
19. All mechanical equipment to be connected into the recirculation piping system shall be done so using flanged or union connections.
20. Provisions shall be made to purge all pipes in the system.
21. Concentric reducers at the recirculation pumps shall be fiberglass by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction.

C. Pipe Hangers and Supports

1. Manufacturer
  - a. Subject to compliance with these specifications, pipe hanger and support systems shall be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.
2. See Structural Drawings for Pipe Hangers and Supports
3. Hangers
  - a. Pipes 2 inches and smaller
    - 1) Adjustable steel clevis hanger, B-Line models B3100 or B3104.
    - 2) Adjustable steel swivel ring (band type) hanger, B-Line model B3170.
  - b. Pipes 2-1/2 inches and larger

- 1) Adjustable steel clevis hanger, B-Line model B3100.
- 2) Adjustable steel yoke pipe roll, B-Line model B3114.
4. Multiple or Trapeze Hangers
- a. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
- b. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe, B-Line B-2000 series.
5. Wall Supports
- a. Pipes 2-1/2 inches and smaller
- 1) Steel offset "J" hook hanger, B-Line model B3600.
- b. Pipes 3 inches and larger
- 1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series.
- 2) Welded steel bracket B-Line model B3066 or B3067 with roller chair or adjustable steel yoke pipe roll. B-Line model B3120 or B3110.
6. Floor Supports
- a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3093 and B3088T or B3090 and B8088. Pipe saddle shall be screwed or welded to appropriate base stand.
7. Vertical Supports
- a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.
8. Plastic Pipe Supports
- a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel, B-Line models B3106 and B3106V, to form a continuous support system for all plastic pipes smaller than 1 inch or flexible tubing.
- b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.
9. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

#### D. Hanger Attachments

1. Upper Attachments

a. Beam Clamps

- 1) Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
- 2) C-Clamps shall be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps shall be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturers recommendations for set screw torque. Retaining straps shall be used to maintain the clamp position on the beam where required.
- 3) Center load beam clamps shall be used where specified. Steel clamps shall be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt shall be B-Line B3291-B3297 series or approved equal as required to fit beams.

b. Concrete Inserts

- 1) Cast in place spot concrete inserts shall be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes, B-line models N2500 or B3014N series.
- 2) Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs/ft. in concrete, B-Line models B22I, 32I, or 52I or approved equal. Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods shall be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes

- a. Hangers shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish.
- b. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR shall have an electro-deposited green epoxy finish.
- c. Zinc Plated hardware is not acceptable for use in chemical rooms.

2. Outdoor Finishes

- a. Hanger and strut subject to weathered conditions shall be hot dipped galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dipped galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

- b. Hangers and strut located in corrosive areas shall be type 316L stainless steel with stainless steel hardware.

#### G. Valves

1. Valves 3 inches and larger shall be butterfly type valves, with PVC body, 150# SWP with stainless steel shaft, polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27 inch vacuum to 150 PSI. Extended neck 2 inch beyond flanges for any insulated piping shall be provided with handle for manual operation. All valve components shall be suitable for swimming pool chlorinated water service. Butterfly valves shall be Georg Fischer Type 563, Asahi/America Type SP Pool-Pro, Chemtrol Model-B, Simtech VP series, Colonial Valve 411 Series, or approved equal.
2. Valves smaller than 3 inches shall be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.
3. Check valves shall be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Install check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves shall be either by Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless steel spring; or approved equal, for installation between 150 lb flanges.
4. Modulating float valve in the surge tank(s) shall have PVC body and stainless steel wafer disc. All hardware shall be non-corrodible. The float-operated valves shall be provided horizontally on the main drain lines in the surge tank(s). Valve shall consist of all non-corrosion components including shaft, float arm, pins and floats. Valve shall be suitable for mounting on a 125E class standard PVC flange. The float arm leverage weight and pivot lengths shall be adjustable to obtain desired ratio of surge tank level change to pool gutter overflow level change. Two floats and stabilizer required. Valve shall be Model FV-D XWB (Extra Weight Ball) as manufactured by MerMade Filter, Inc. or approved equal manufactured by EPD.
5. Submerged valves up to 3 inches shall be PVC true union ball valves. Submerged valves over 3 inches shall be PVC bodied, wafer type, butterfly valves with stainless steel handle extensions as required. Valves shall be by approved manufacturers listed above. Submerged valves must be provided with all stainless steel connectors. The stem housing extensions shall be properly supported and braced.
6. All butterfly type valves 8 inches and larger shall be fitted with a watertight gear operator.
7. All valves located 7 feet or greater off the floor shall be fitted with a chain operator.
8. All submerged valves, valves buried below grade, or valves not readily accessible, shall be provided with a stainless steel reach rod and handle.

#### H. Pipe and valve identification

1. All exposed pool piping shall be equipped with color-coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. The Contractor shall verify that all pool piping identification is in accordance with all local and state health regulations.

2. All valves shall be identified with minimum 1-1/2 inch diameter brass tags stamped with minimum 1/2-inch high numbers and attached to valves with #16 brass jack chain (plastic laminate engraved tags with nylon attachment acceptable). Valves shall be described as to their function and referenced in the operating instruction manual and

### PART 3 - EXECUTION

#### 3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

#### 3.02 PIPING INSTALLATION

##### A. General

1. Provide and erect, according to the best practices of the trade, all piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings shall be considered as diagrammatic in indicating the general run and connections, and may or may not in all parts be shown in its true position. The piping may have to be off set, lowered or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. All changes in direction shall be made with fittings. All open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. All piping shall be arranged so as not to interfere with removal and maintenance of equipment, filters or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to ensure noiseless circulation. All valves and specialties shall be so placed to permit easy operation and access.

##### B. Pipe Hangers and Supports

1. All piping shall be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications. Refer to Part to for further specification of pipe hangers and supports.

2. All piping in a service tunnel, if required shall be supported by a structure of the Contractor's design. The structure shall be non-corrodible and shall be of a size and configuration to rigidly support all the piping as shown in the plans at a minimum spacing as shown below.
3. Hanger rods shall be galvanized steel unless otherwise noted on the plans. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.
4. Where piping is installed side by side, the Contractor will support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be non-metallic channel. The Contractor shall provide heavier members as required for the load to be supported for the entire span distance. Hanger rods shall be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.
5. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.
6. Attachment of piping hangers to the building structure shall be provided in a manner approved by the Architect. The Contractor shall provide concrete inserts to be installed by the General Contractor in the building construction at the time the concrete is poured and hangers shall be attached to these inserts.
7. Piping hangers shall be spaced per the below schedule and shall have hangers not more than one foot on each side of every change in direction. The piping systems shall be installed in an approved manner and shall not overload the building structural frame. The Contractor shall provide additional hangers and miscellaneous steel supports as required to distribute the piping system load over several structural members where required or directed. Maximum allowable spacing for piping shall be as follows:

PVC Piping	Maximum Spacing
3/4" thru 2"	5'-0"
2 1/2" thru 4"	6'-0"
6" thru 10"	9'-0"
12" thru 14"	12'-0"

8. Round rods supporting the pipe hangers shall be of the following dimensions:

Pipe Size	Round Rod Size
1/2" to 2"	3/8" rod
2-1/2" to 3"	1/2" rod
4" to 5"	5/8" rod



6"	3/4" rod
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9. Horizontal PVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120 degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1-1/4" and less	5	3/8"
1-1/2" to 3"	6	1/2"
4" to 6"	8	5/8"
8" to 12"	10	7/8"
Greater than 12"	12	1"

10. Horizontal CPVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140 degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1/2" and less *	4	3/8"
3/4" to 2"	6	3/8"
2-1/2" to 3"	7	1/2"
4" to 8"	8	7/8"
Greater than 12"	10	1"

11. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.
12. Install hangers to provide a minimum of 1-inch space between finished covering and adjacent work.
13. Place a hanger within 12 inches of each horizontal elbow.

14. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
15. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.05.C.3. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to the support spacing schedules.
16. Attachment of piping hangers to the building structure shall be provided in a manner approved by the Architect. The Contractor shall provide concrete inserts to be installed by the General Contractor in the building construction at the time the concrete is poured and hangers shall be attached to these inserts.
17. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.
18. Hanger rods shall be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.
19. Where piping is installed side by side, the Contractor will support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be non-metallic channel. The Contractor shall provide heavier members as required for the load to be supported for the entire span distance. Hanger rods shall be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.
20. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.

#### C. Concrete Inserts

- a. Provide inserts for placement in form work before concrete is poured.
  - b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
2. Where concrete slabs form finished ceilings, provide inserts to be flush with the slab surface.
  3. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

#### D. Piping Installation

1. Trench bottoms shall be smooth and free of rocks and debris. If the trench is dug in ledge rock, hardpan or where large boulders are not removed, place 3 inches of sand or compacted fine-grained soil below pipe. Pipe must be supported over its entire length with firm, stable material. Blocking will not be used to change pipe grade or provide intermittent support over low sections in the trench. Surround the pipe with backfill meeting the requirements of Section 312000 with a particle size of 1-1/2 inch or less and in accordance with the project geotechnical report. Compact in layers not to exceed 6 inches with vibratory method. Follow installation methods of ASTM D2774 "Underground Installation of Thermoplastic Pressure Piping".

2. Installations are to be installed in a straight run of pipe, with a minimum 10 pipe diameters upstream and minimum 5 pipe diameters downstream of any pipe fitting.

E. Flushing, Draining and Cleaning Pipe Systems

1. The Contractor shall flush out all water systems with water before placing them in operation. Other systems shall be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, all strainer screens shall be removed and thoroughly cleaned.

F. Expansion and Contraction

1. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections and anchors as required to prevent undue strain. The Contractor shall provide shop drawings for proposed method and arrangement for control of expansion and contraction of piping.

G. Swimming Pool Pipe Pressure Testing

1. Contractor is responsible for the maintenance of a sustained 30 PSI pressure on all pool related piping throughout the course of construction.
2. All pool related piping shall be hydraulically pressure tested (with water, not air) to a pressure of not less than 80 PSI for a period of no less than one (1) hour.
  - a. All piping installation and pressure testing shall be reviewed by the Owner's testing agency before commencement of backfilling and any pool concrete or shotcrete placement. A minimum notice of one (1) week is required prior to review. Results of review shall be documented.
  - b. The pressure test shall encompass all piping that will be below grade or below the pool shell. The test shall occur prior to any pool finish fittings are installed, including main drains and return inlets. Skimmers may be in place if required.
  - c. The pressure test may be separated by piping branch such as suction lines, return lines, gravity lines, etc. and may be performed at different times.
3. The Contractor shall adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

END OF SECTION 131111

## **ADDENDUM NUMBER 2**

### **SECTION 131116 – SWIMMING POOL UNDERWATER LIGHTS**

#### **PART 1 - GENERAL**

##### **1.01 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver material in manufacturer's original, unopened containers and crates with all labels intact and legible.
- B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.
- C. Handle materials in a manner to prevent damage.
- D. Store all materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.
- E. Remove damaged materials from site.

##### **1.02 WARRANTIES**

- A. The Contractor warrants to the Owner and Architect that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The Contractor's warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the Contractor or improper wear and tear under normal use. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified.
- B. The Contractor shall agree to repair or replace any defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.
- C. Submit all warranties covering, but not limited to the following:
  - 1. All lighting equipment including but not limited to light fixtures, light niches, and sealing rings shall be protected by warranty against defects in material, manufacturer and installation for a period of ten (10) year.

#### **PART 2 - PRODUCTS**

##### **2.01 UNDERWATER LIGHTS**

- A. Underwater lights shall be UL listed and in the quantities shown and as detailed in the construction drawings and as described in these specifications. Coordinate for proper installation. Refer to the drawings for quantities and locations.

- B. The Competition Pool underwater lights shall be 120VAC or 12VAC, 55 watts LED-type, and equivalent to 500 watts of incandescent light. Fixture housing shall be stainless steel construction with minimum wall thickness of 0.020 inch per UL 676 underwater pool lighting standard. The niche shall be stainless steel with powder coated stainless steel sealing ring for vinyl pool installation. Brass construction pressure grounding lug on interior and exterior services. Lens shall be 8-3/8 diameter clear tempered heat resistant glass. Gasket to be single-piece "U" shaped santoprene or silicone. Fasteners shall be stainless steel. The light fixture shall be supplied with a #16-3 STW (120V) or 12-3 SJTW (12V) submersible cord with ground wire positively grounded inside the fixture. Cord entrance shall be a watertight seal and epoxy encapsulated. Light fixture to be 500W Intellibrite White LED pool light series by Pentair or approved equal. Underwater lights shall be provided with cord length as required to allow for deck relamping of all fixtures.
- C. Junction boxes shall be provided in the quantities required and shall be located at least 8" above the pool coping and 5' from the pool edge. Refer to the Electrical drawings. Cord length shall be sufficient to run from fixture to the junction box with sufficient cable in the niche to relamp the fixture on the deck.

### PART 3 - EXECUTION

#### 3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

END OF SECTION 131115

## ADDENDUM NUMBER 2

### SECTION 13 11 20 - CAST-IN-PLACE CONCRETE FOR POOL FOUNDATIONS

#### PART 1- GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following pool foundation elements:
  - 1. Footings.
  - 2. Foundation walls / dive well.
  - 3. Slabs-on-ground / pool floors.
- B. This Section does NOT specify concrete for other concrete elements not associated with the pool foundation including decks, sidewalks, pavements, buildings, etc. See other specification sections for requirements related to non-pool foundation concrete elements.

##### C. WORK INCLUDED

- 1. Design, fabrication, erection, and stripping of formwork for cast-in-place concrete including shoring, reshoring, falsework, bracing, proprietary forming systems, prefabricated forms, void forms, permanent metal forms, bulkheads, keys, blockouts, sleeves, pockets, and accessories. Erection shall include installation in formwork of items furnished by other trades.
- 2. Furnish all labor and materials required to fabricate, deliver and install reinforcement and embedded metal assemblies for cast-in-place concrete, including steel bars, welded steel wire fabric, ties and supports.
- 3. Furnish all labor and materials required to perform the following:
  - a. Cast-in-place concrete
  - b. Concrete mix designs

##### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Design Mixtures: For each concrete mixture submit proposed mix designs in accordance with ACI 301, article 4.2.3. Each proposed mix design shall be accompanied by a record of past performance.
1. Submit mix designs on forms supplied at the end of this Section.
  2. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  3. Indicate amounts of mixing water to be withheld for later addition at Project site.
- 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. Do not reproduce the structural drawings for use as shop drawings.
- D. Construction Joint Layout: Submit a diagram of proposed construction joint locations for horizontal framing that exceed the limits of a single placement as stated in the structural notes, other than those indicated on the Drawings.
- E. Submit manufacturer's certification of maximum chloride ion content in admixtures.

#### 1.5 INFORMATION SUBMITTALS

- A. Steel Reinforcement Submittals for Information: Mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.
- B. Qualification Data: For manufacturer.
- C. Fly ash: Submit certification attesting to carbon content and compliance with ASTM C618.
- D. Minutes of preinstallation conference.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete,"
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- D. Concrete Testing Service: Owner will engage a qualified independent testing agency to perform material evaluation tests.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
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. Ready-mix concrete manufacturer.
    - c. 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, and concrete protection.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Store all proprietary materials in accordance with manufacturer's recommendations.

### PART 2 - PRODUCTS

#### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Form facing panels shall be plywood, metal, or other approved panel materials.
- 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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.



2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

## 2.2 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcing Bars: As indicated in Structural Notes.
- B. 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. For slabs on grade and slabs on void forms, provide sand plates, horizontal runners, or precast concrete blocks on bottom where base material will not support chair legs or where vapor barrier has been specified.

## 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  1. Portland Cement: ASTM C 150, Type I/II, gray.
  2. At contractor's option, supplement with fly ash meeting ASTM C 618 Class C or F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
  1. Maximum Coarse-Aggregate Size: As indicated on drawings.
- C. Water: ASTM C1602.

## 2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  1. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  2. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

## 2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: ASTM C1602.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

## 2.6 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.
  2. The required average strength above specified strength shall be based on the procedure given in the "MIX DESIGN SUBMITTAL FORM" appended to the end of this Specification.
  3. Required average strength above specified strength:
    - a. Based on a record of past performance: Determination of required average strength above specified strength shall be based on the standard deviation record of the results of at least 30 consecutive strength tests in accordance with ACI 301,
    - b. Based on laboratory trial mixtures: Proportions shall be selected on the basis of laboratory trial batches prepared in accordance with ACI 301,
      - 1) Proportions of ingredients for concrete mixes shall be determined by an independent testing laboratory or qualified concrete supplier.
      - 2) For each proposed mixture, at least three compressive test cylinders shall be made and tested for strength at the specified age. Additional cylinders may be made for testing for information at earlier ages.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as indicated in the structural notes.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Do not use admixtures which have not been incorporated and tested in accepted mixes.
  2. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

4. Use water-reducing admixture in pumped concrete, including the pool floor, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

## 2.7 CONCRETE MIXTURES FOR POOL FOUNDATION ELEMENTS

- A. Proportion normal-weight concrete mixture as indicated on drawings.

## 2.8 FABRICATING REINFORCEMENT

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

## 2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 95 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 95 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- 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 347R as abrupt or gradual, as follows:
1. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate 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.

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- 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 or paste. Locate temporary openings in forms at inconspicuous locations.
  - H. Chamfer exterior corners and edges of permanently exposed concrete.
  - 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, anchoring devices, and embedded items.
    - 1. Do not apply form release agent where concrete surfaces are scheduled to receive subsequent finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

### 3.2 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of slabs, 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 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be 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.

### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Installation tolerances shall be per ACI 117.

- E. Concrete Cover: Refer to the Structural Notes.
- F. Splices: Provide standard reinforcement splices by lapping and tying ends. Comply with ACI 318 for minimum lap of spliced bars where not specified on the documents. No. 14 and 18 bars shall not be lap spliced.
- G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.4 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 Architect.
  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 floors and slabs.
  2. Form keyed joints as indicated in the Structural Drawings.
  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. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

### 3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
  1. Water may be added to the concrete at the project site only if specifically withheld at the time of batching and specifically noted on the batch ticket.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, and only if specifically noted as withheld on the batch ticket.
  1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
  2. Water content shall not exceed the maximum specified water/cement ratio for the mix.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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 approved by the Engineer. Deposit concrete to avoid segregation.
  1. Deposit concrete in horizontal layers of depth to not 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.
  4. Do not permit concrete to drop freely any distance greater than 20'-0" for concrete containing a high range water reducing admixture (superplasticizer) or 5'-0" for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.
  5. Pump priming grout shall be discarded and not used in the structure.
- E. 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.
- F. 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.
- G. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
1. Maintain concrete temperature below 95 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.

### 3.6 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 all concrete surfaces not exposed to public view.

### 3.7 MISCELLANEOUS CONCRETE ITEMS

### 3.8 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. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. 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 the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. 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. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

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3. 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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. 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.

### 3.9 CONCRETE SURFACE REPAIRS

- A. Surface Defects in Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Owner's approval.
- B. Contractor shall submit a detailed, descriptive procedure listing proposed pre-packaged repair materials and methods for the repair of surface defects prior to the start of repair work.
- C. Patching Mortar: Mix, place and finish pre-packaged repair mortar in accordance with manufacturer's instructions.
- D. Unapproved and defective repairs shall be removed and replaced in accordance with requirements provided by the Engineer at no additional cost to the Owner.

### 3.10 STRUCTURAL REPAIRS

- A. Structurally Defective Concrete: Structural defects include spalls, honeycombs or rock pockets with exposed reinforcement, hollow-sounding concrete, cracks that penetrate to the reinforcement or completely through concrete elements, inadequate cover over reinforcement, and other conditions that affect the structural performance or durability of the concrete as determined by the Engineer.
- B. Repair structural defects in concrete in accordance with plans, specifications, details, etc. provided by the Engineer.
1. The cost of the additional services provided by the Engineer to prepare the repair documents, and to oversee the repair work shall be borne by the Contractor.
- C. Unapproved and defective repairs shall be removed and replaced in accordance with requirements provided by the Engineer at no additional cost to the Owner.

### 3.11 CLEANUP

- A. Imperfect or damaged work or any material damaged or determined to be defective before final completion and acceptance of the entire job shall be satisfactorily replaced at the Contractor's



expense, and in conformity with all of the requirements of the Drawings and Specifications. Removal and replacement of concrete work shall be done in such manner as not to impair the appearance or strength of the structure in any way.

- B. Cleaning: Upon completion of the work all forms, equipment, protective coverings, and any rubbish resulting therefrom shall be removed from the site. After sweeping floors, wash floors with clean water. Finished concrete surfaces shall be left in a clean condition, satisfactory to the Owner.

### 3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner may engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections may include:
  - 1. Steel reinforcement placement.
  - 2. Verification of use of required design mixture.
  - 3. Concrete placement, including conveying and depositing.
  - 4. Curing procedures and maintenance of curing temperature.
- C. Additional testing and inspecting, at Contractor's expense, may be required to determine compliance of apparently defective, replaced, or additional work with specified requirements.
- D. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 13 11 20

**MIX DESIGN SUBMITTAL FORM**

Preliminary  
03/28/2023 6:53:15 PM

Project: \_\_\_\_\_  
Method used to select proportions (ACI 301):  
\_\_\_\_ field experience or \_\_\_\_ trial mixture  
Person that prepared the submittal: \_\_\_\_\_  
Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Person selecting the mixture proportions: \_\_\_\_\_  
Ready-Mix Supplier Company: \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Phone Number: \_\_\_\_\_ Date: \_\_\_\_\_  
Main Plant Location: \_\_\_\_\_ Miles from Project: \_\_\_\_\_  
Secondary Plant Location: \_\_\_\_\_ Miles from Project: \_\_\_\_\_

**SELECTION OF CONCRETE MIX PROPORTIONS**

**1. CEMENTITIOUS MATERIALS**

Cement: \_(lbs)\_(cu.ft.) Type: \_ Source: \_\_\_\_\_ Manufacturer \_\_\_\_\_  
Fly Ash: \_(lbs)\_(cu.ft.) Type: \_ Source: \_\_\_\_\_ Manufacturer \_\_\_\_\_  
Other: \_(lbs)\_(cu.ft.) Type: \_ Source: \_\_\_\_\_ Manufacturer \_\_\_\_\_  
Fly ash replacement: \_\_\_\_\_%

**2. AGGREGATES**

Fine: \_\_\_\_\_(lbs) \_\_\_\_\_(cu.ft.) Size: \_\_\_\_\_ Type: \_\_\_\_\_ Source: \_\_\_\_\_  
Coarse: \_\_\_\_\_(lbs) \_\_\_\_\_(cu.ft.) Size: \_\_\_\_\_ Type: \_\_\_\_\_ Source: \_\_\_\_\_  
Total: \_\_\_\_\_(lbs) \_\_\_\_\_(cu.ft.) Size: \_\_\_\_\_ Type: \_\_\_\_\_ Source: \_\_\_\_\_

**3. WATER**

Water: \_\_\_\_\_(lbs) \_\_\_\_\_(cu.ft.) Source: \_\_\_\_\_

**4. ADMIXTURES**

HRWR \_\_\_\_\_oz. per 100# cement dosage  
range Non-Corrosive Accelerator \_\_\_\_\_oz. per 100# Cement  
W.R. \_\_\_\_\_oz. per 100# Cement  
A.E.A. \_\_\_\_\_oz. per 100# Cement  
Fibers or color pigments or other additions \_\_\_\_\_oz. per 100# Cement

**FRESHLY MIXED CONCRETE PROPERTIES**

Slump before additive = \_\_\_\_\_in. Air Content = \_\_\_\_\_%  
Final Slump after additive = \_\_\_\_\_in. Unit Dry Wt. = \_\_\_\_\_pcf  
Unit Wet Wt. = \_\_\_\_\_pcf  
Placement Method = \_\_\_\_\_

**DOCUMENTATION OF COMPRESSIVE STRENGTH AND REQUIRED STRENGTH ON THE BASIS OF FIELD EXPERIENCE**

Check one, complete blanks and attach historical data used for these calculations:

- Records attached represent 30 or more consecutive, recent tests of a concrete produced for a compressive strength within 1000 psi of the specified compressive strength, which was produced with similar materials and procedures, and under similar conditions, per ACI 301.

S= \_\_\_\_\_,  $f_c$  = \_\_\_\_\_,  $f_{cr}$ = \_\_\_\_\_,  $f_c(\text{avg})$  = \_\_\_\_\_

- Records attached represent two groups totaling 30 or more consecutive, recent tests of a concrete produced for a compressive strength within 1000 psi of the specified compressive strength, which was produced with similar materials and procedures, and under similar conditions, per ACI 301.

S(avg)= \_\_\_\_\_,  $f_c$  = \_\_\_\_\_,  $f_{cr}$ = \_\_\_\_\_,  $f_c(\text{avg})$  = \_\_\_\_\_

- Records attached represent 15-29 consecutive, recent tests of a concrete produced for a compressive strength within 1000 psi of the specified compressive strength, which was produced with similar materials and procedures, and under similar conditions per ACI 301 spanning a period of not less than 45 days.

S(mod)= \_\_\_\_\_,  $f_c$  = \_\_\_\_\_,  $f_{cr}$ = \_\_\_\_\_,  $f_c(\text{avg})$  = \_\_\_\_\_

- Records attached represent 10-15 recent tests of concrete with similar materials and conditions, per ACI 301, spanning a period of not less than 45 days.

$f_c$  = \_\_\_\_\_,  $f_{cr}$ = \_\_\_\_\_,  $f_c(\text{avg})$  = \_\_\_\_\_

**DOCUMENTATION OF COMPRESSIVE STRENGTH AND REQUIRED STRENGTH ON THE BASIS OF TRIAL MIXTURES**

Age (days)	Mix #1 (f'c. – W/C ratio)	Mix #2 (f'c. – W/C ratio)	Mix #3 (f'c – W/C ratio)
28	_____	_____	_____
28	_____	_____	_____
28	_____	_____	_____

Attach a water cement ratio vs.  $f_c$  graph.

Show W/C ratio selected based on  $f_c$  &  $f_{cr}$  from T5.3.2.2

Show mix design proportioned to achieve  $f_{cr} = f_c + 1200$  psi (1400 psi for strength higher than 5000 psi at 28 days)

**ATTACHMENTS**

- Manufacturer's certification of cement materials
- Grading chart of Aggregate
- Admixture certification
- Water cement ratio vs.  $f_c$  graph
- Past performance record submittal

END OF SECTION 13 11 20

## **ADDENDUM NUMBER 2**

### **SECTION 131121 – SWIMMING POOL CAST-IN-PLACE DECK CONCRETE**

#### **PART 1 - GENERAL**

##### **1.01 DESCRIPTION**

###### **A. Work in this section. Principal items include:**

1. The work under this section shall include all labor, materials, and equipment required to complete the concrete work for the following: pool deck(s), utility pedestal(s), and associated foundations.
2. Materials and/or methods specified in this section as "I.B.C.", "I.B.C. Standards", or similar wording refer to the International Building Code, 2018 Edition.
3. Except as otherwise specified herein, the work of this section shall be in accordance with Chapter 19 "Concrete" of the International Building Code, 2018 Edition.

##### **1.02 SUBMITTALS**

###### **A. Product Data: Provide product data for each type of product indicated. Include any technical data and installation requirements.**

###### **B. Concrete Mix Design: Provide a mix design for each strength and type of concrete. Furnish a complete list of materials including type, brand, source, and amount of cement, pozzolan, and admixtures. Obtain approval before concrete placement. Any concrete work placed prior to approval of the concrete mix design is not acceptable, is rejected and shall be removed at no cost to the owner.**

1. Provide alternate design mixtures when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
2. Indicate amounts of mixing water to be withheld for later addition at project site.

###### **C. Steel Reinforcement Shop Drawings: Provide placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, materials, and grades; bar schedules; stirrup spacing; bent bar diagrams; bar arrangements, splices and laps; mechanical connections; tie spacing; hoop spacing; and supports for concrete reinforcement.**

###### **D. Formwork Shop Drawings: Provide formwork shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.**

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

###### **E. Material Test Reports: Provide reports from a qualified testing agency, indicating compliance with requirements for the following:**

1. Aggregates - Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

- F. Material Certificates: Provide certificates for each of the following, signed by the manufacturers:
1. Cementitious materials
  2. Admixtures
  3. Form materials and form-release agents
  4. Steel reinforcement and accessories
  5. Curing compounds
  6. Bonding agents
  7. Repair materials
- G. Provide field quality control test and inspection reports.
- H. Contractor shall provide three (3) 4 FT X 4 FT deck finish test panels with light, medium and heavy broom finishes three weeks prior to placing the finished pool deck concrete. Test panels shall include sample contraction joint.
- I. Contractor shall provide joint spacing plan to Engineer for review 4 weeks prior to first concrete pour.
- J. Provide minutes of pre-installation conference.

#### 1.03 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and complies with ASTM C94 / C94M requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated and as documented according to ASTM E548.
1. Personnel conducting field tests shall be qualified as an ICC Certified Reinforced Concrete Technician according to the International Code Council or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI Certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI Certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

- E. ACI Publications: Comply with the following unless modified by requirements in the contract documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
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, forms and form removal limitations, shoring and reshoring procedures, steel reinforcement installation, concrete repair procedures, and concrete protection.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Keep waterstops covered during storage to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Products are subject to compliance with requirements. Products that may be incorporated in the work include, but are not limited to, the products specified.
  2. Available Manufacturers: Manufacturers are subject to compliance with requirements. Manufacturers offering products that may be incorporated in the work include, but are not limited to, the manufactures specified.

#### 2.02 CONCRETE MATERIALS

- A. Cementitious Materials: Use the same type, brand, and source throughout the project. The following cementitious materials are recommended:
1. Portland Cement: ASTM C150, Standard Specification for Portland Cement.
  2. Fly Ash: ASTM C618, Class C or F.
- B. Normal Weight Aggregate: ASTM C33, Class 5S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1 in (25 mm) nominal size.
  2. Fine Aggregate: Fine aggregate to be free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C94 / C94M, Clean and potable.

### 2.03 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494 / C494M, Type A.
  2. Retarding Admixture: ASTM C494 / C494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C494 / C494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494 / C494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C1017 / C1017M, Type II.

### 2.04 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.
  2. Limit use of fly ash to not exceed, in combination, 15% of portland cement by weight.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing 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 admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.45.

## 2.05 CONCRETE MIXES

### A. All concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,500 psi (20.7 MPa) at 28 days
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Minimum Cement Content: 600 lb/yd<sup>3</sup>
4. Slump Limit:
  - a. 3 in +/- 1 in (75 mm +/- 25 mm) or 8 in (200 mm) for concrete with verified slump of 2 to 4 in (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, +/- 1 in (25 mm).
5. Use Type II/V Cement.
6. Cement to aggregate, in dry weight, shall not be less than one to five.

### B. Shrinkage Tests:

1. Prior to placing any concrete for walls or horizontal surfaces, a trial batch of each mix design of structural concrete shall be prepared using the aggregates, cement and admixture (if any) proposed for the project. From each trial batch at least three (3) specimens for determining drying shrinkage shall be prepared. The drying shrinkage specimens shall be a 4 in x 4 in x 11 in prisms fabricated, cured, dried, and measured in accordance with the requirements of Tentative Method of Test for Length Change of Cement Mortar and Concrete, ASTM C157. The measurements shall be made and reported separately for 7 and 28 days of drying after 7 days of moist curing. The effective gage length of the specimens shall be 10 in, and except for the foundation concrete, the average drying shrinkage at 35 days shall not exceed .054%.
2. Previous Test: Ready-mixed concrete manufacturer may furnish certified test reports from an approved testing laboratory as proof of meeting shrinkage requirements, provided aggregate used and concrete covered by such test report conform to mix design approved for use on this project. Use an independent testing facility for preparing and reporting proposed mix designs.

### C. Ready-Mix Concrete

1. Comply with ASTM C94 / C94M.
2. Before using trucks for batching, mixing, and transporting concrete, thoroughly clean the trucks and equipment of materials capable of contaminating concrete.



3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 is required.
  4. When air temperature is between 85 °F and 90 °F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 °F, reduce mixing and delivery time to 60 minutes.
  5. Do not add water to ready-mix concrete at project site except when slump is below specified limits and total water does not exceed the design water-cement ratio; inject added water into mixer and mix thoroughly before discharging.
- D. Provide certificate signed by authorized official of supplier with each load of concrete stating following:
1. Time truck left plant.
  2. Mix of concrete, identify with code number of mix design.
  3. Amount of water and cement in mix.
  4. Amount and type of admixtures.
  5. Amount of water added at project site.
  6. Time truck is unloaded at project site.
- E. Truck mixers without batch tickets will be rejected.
- F. Retain certificates at project site. Submit to the owner/architect for review upon request.

## 2.06 FORM-FACING MATERIALS

- A. Forming Materials: Forming materials shall be new. Materials may be reused during the progress of the work provided they are completely cleaned and reconditioned, recoated for each reuse, capable of producing formwork of the required quality and are structurally sound.
- B. Smooth-Formed Finished Concrete: Form-facing panels shall be used to provide continuous, true, and smooth concrete surfaces. Furnish panels in the largest practicable sizes to minimize the number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better, mill-release agent treated and edge sealed.
- C. 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.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 in x 3/4 in (19 mm x 19 mm) minimum

- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect the concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 in (25 mm) to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 in (25 mm) in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

## 2.07 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615 / A615M, Grade 60 (Grade 420) deformed.
- B. Plain-Steel Wire: ASTM A82, as drawn.

## 2.08 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.
- B. Mechanical Splices (Optional): Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements.
1. Lenton Form Saver; Erico Corp.

## 2.09 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, 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 I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

### A. Concrete Patching Mortar: Chemical treatment for waterproofing concrete.

#### 1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.

##### a. Xypex Concentrate.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Before placing new concrete against existing shotcrete/concrete, remove unsound or loose materials and contaminants that may inhibit concrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1 in (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before placing concrete.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper concrete bonding.

B. Earth: Compact and trim to line and grade before placing concrete. Do not place concrete on frozen surfaces. Dampen surfaces before concrete placement. Expansive soils shall be maintained in a moist condition during construction.

C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken concrete bonding.

### 3.02 FORMWORK

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 347R as abrupt or gradual, as follows:

1. Class A, 1/8 in (3.2 mm) for smooth-formed finished surfaces.

2. Class C, 1/2 in (13 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate 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 recesses, pipe sleeves 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. See drawings for other required profiles.
- 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.
- M. Contract shall not use permanent markers on finished form materials.

### 3.03 EMBEDDED ITEMS

- 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.

### 3.04 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of 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 °F (10 °C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
1. Leave formwork for beam soffits, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70% of 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 will not be 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 the owner/architect.

### 3.05 STEEL REINFORCEMENT

- A. General: Fabrication and placement of reinforcing for concrete construction shall be in accordance with the requirements of Title 24, Part 2, International Building Code and as shown.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.06 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Joints may not intersect any anchors, embeds or other deck features.
- B. Construction Joints: Install construction joints so strength and appearance of concrete is not impaired at locations indicated or as approved by the owner/architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless noted otherwise on drawings. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 in (38 mm) into concrete, unless noted on drawings otherwise.
  - 3. Locate horizontal joints in walls at underside of floors and at the top of floor slabs.
  - 4. Locate vertical joints in walls at 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.
- C. Contraction Joints in Slab-on-Grade (Pool Deck): Contraction joints shall be placed as soon as possible to provide a clean joint with no raveled edges. Contraction joints must be placed within the first 6 hours.
  - 1. Contraction joints shall be placed to produce panels as square as possible. Panels shall not exceed a length to width ratio of 1.5 to 1. Contraction joints shall be spaced between 8 feet and 12 feet.
  - 2. Contraction joints shall not intercept or traverse any embeds or tile.
  - 3. Contractor shall provide joint spacing plan to engineer for review 4 weeks prior to first concrete pour.
  - 4. Contraction joints shall have a minimum depth of one quarter of the thickness of the slab.
  - 5. Contraction joints may be tooled or sawcut.

- D. Expansion Joints in Slab-on-Grade (Pool Deck): Expansion joints shall be installed in the pool deck where indicated in the project plans. Expansion joints shall be 1/2 in wide and extend through the entire slab.

### 3.07 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at project site, subject to limitations of ACI 301.
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 will be 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 to not 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 in (150 mm) 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 dobies 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.
- E. 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 low temperature is expected to fall below 40 °F (4.4 °C) 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.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 °F (32 °C) 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.

### 3.08 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, 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.

### 3.09 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

- B. Medium – Heavy Broom Finish: After applying float finish, provide a coarse finish by striating float-finished concrete surface  $\frac{1}{16}$  to  $\frac{1}{8}$  inch deep with a stiff-bristled broom, perpendicular to line of traffic and uniform in texture and appearance. Grind smooth any surface defect.
1. Coarseness of finish shall be similar to approved test finish as described in paragraph 1.02.
  2. Finish surfaces to the following tolerances, according to ASTM E1155 / ASTM E1155M, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

### 3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. 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.
1. All patches shall be watertight.
- B. Contractor shall not use permanent markings on any concrete finishes or finish facing formwork.

### 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 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching  $0.2 \text{ lb/ft}^2 \times \text{h}$  ( $1 \text{ kg/m}^2 \times \text{h}$ ) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. 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 the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. 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 in (300 mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 in (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. 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. After curing period has elapsed, remove curing compound without damaging concrete surfaces by methods recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of tile used on project.

### 3.12 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 one part Portland Cement to two and one-half parts fine aggregate passing a No. 16 (1.18 mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include 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 in (13 mm) in any dimension in solid concrete, but not less than 1 in (25 mm) in depth. 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 concealed formed surfaces that affect concrete's durability and structural performance as determined by owner/architect.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as 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 in (0.25 mm) 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. Repair defective areas, except random cracks and single holes 1 in (25 mm) 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 in (19 mm) 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.
  5. Repair random cracks and single holes 1 in (25 mm) 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.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.
  5. 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 C172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 yd<sup>3</sup> (4 m<sup>3</sup>), but less than 25 yd<sup>3</sup> (19 m<sup>3</sup>), plus one (1) set for each additional 50 yd<sup>3</sup> (38 m<sup>3</sup>) or fraction thereof.
    - a. When frequency of testing will provide fewer than five (5) 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 C143 / C143M; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Concrete Temperature: ASTM C1064 / C1064M; one (1) test hourly when air temperature is 40 °F (4.4 °C) and below and when 80 °F (27 °C) and above, and one (1) test for each composite sample.
  4. Compression Test Specimens: ASTM C31 / C31M.
    - a. Cast and laboratory cure two (2) sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two (2) sets of two standard cylinder specimens for each composite sample.
  5. Compressive-Strength Tests: ASTM C39 / C39M; test one (1) set of two laboratory-cured specimens at 7 days and one (1) set of two specimens at 28 days.
    - a. Test one (1) set of two field-cured specimens at 7 days and one (1) set of two specimens at 28 days.
    - 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.
  6. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, the contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  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 (3.4 MPa).
  8. Test results shall be reported in writing to the Owner/Architect, 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 both 7-day 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 C42 / C42M or by other methods as directed by engineer.
11. Additional testing and inspecting, at the 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 does not comply with the contract documents.
- D. Measure floor and slab flatness and levelness according to ASTM E1155 / ASTM E1155M within 24 hours of finishing.

END OF SECTION 131120

## **ADDENDUM NUMBER 2**

### **SECTION 131125 – SWIMMING POOL CEMENTITIOUS WATERPROOFING**

#### **PART 1 - GENERAL**

##### **1.01 Description**

- A. Work in this section. Principal Items include:
1. Application of polymer modified cement waterproofing.
  2. Waterproofing interior of surge tank.

##### **1.02 Submittals**

- A. Comply with requirements of Shop Drawings, Product Data and Samples Section.
- B. Product Data: Manufacturer's specifications, data, and installation instructions.
- C. Submit list of project references as documented in this specification under Quality Assurance Article. Include contact name and phone number of the person charged with oversight of each project.
- D. Quality Control Submittals:
1. Provide protection plan of surrounding areas and non-work surfaces.

##### **1.03 Quality Assurance:**

A. Qualifications:

1. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products and systems.
2. Manufacturer Qualifications: Company shall be ISO 9001:2015 Certified.
3. Applicator Qualifications: Company with minimum of 5 years' experience in application of specified products and systems on projects of similar size and scope, and is acceptable to product manufacturer.
4. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

B. Field Sample:

1. Install field sample at project site or other pre-selected area of building, as directed by Architect/Engineer.
2. Apply material in strict accordance with manufacturer's written application instructions.
3. Manufacturer's representative or designated representative will review technical aspects; surface preparation, application and workmanship.
4. Field sample will be standard for judging workmanship on remainder of project.

5. Maintain field sample during construction for workmanship comparison.
6. Do not alter, move or destroy field sample until work is completed and approved by Architect/Engineer.
7. Obtain Architect/Engineer written approval of field sample before start of material application, including approval of aesthetics, color, texture and appearance.
8. Installer: Trained, certified, and monitored full time for duration of installation by membrane manufacturer.

#### 1.04 Product Delivery and Storage

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Transport and store in unopened containers and keep in clean, dry condition protected from rain, dew and humidity. If dry onsite storage of bags is unavailable or if project is located in a very wet, humid climate, purchase product in manufacturer's packaged metal pails.
- D. Do not stack bags more than two pallets high.
- E. Do not allow MasterEmaco® A660 modifying admixture (formerly Acryl 60) to freeze.

#### 1.05 Job Conditions

- A. Do not apply in rain or when rain is expected within 24 hours. Do not apply above 90 degrees F (32 degrees C) or below 40 degrees F (4 degrees C) or when temperatures are expected to fall below 40 degrees F (4 degrees C) within 24 hours. For hot and cold temperature applications, store materials and water at 50 degrees F (10 degrees C) to 70 degrees F (21 degrees C) before use.

#### 1.06 Warranty

- A. Defects in material, workmanship, and installation of the pool cementitious finish against cracking and delamination for a period of three (3) years.

### PART 2 - PRODUCTS

#### 2.01 Materials

- A. Waterproof Coating: MasterSeal 581 (Thoroseal) cement based, aggregate type, heavy duty, waterproof coating for concrete or masonry, as manufactured by Master Builders Solutions, or approved equal. Color shall be grey.
  1. Bonding and Modifying Mixture: MasterEmaco A660 (formerly Acryl 60) liquid compound of acrylic polymers and modifiers, as manufactured by Thoro System Products, or approved equal.
- B. Water: Clean, fresh, from domestic potable source.

## 2.02 Proportions and Mixing

- A. Materials are specified on a volume basis and shall be measured in approved containers that will ensure that the specified proportions will be controlled and accurately maintained during progress of the work. Measuring materials with shovels ("shovel count") is NOT permitted.
- B. Mixing: Perform mixing in approved mechanical mixers of the type in which quantity of water can be controlled accurately and uniformly. Mix to manufacturer's recommendations for swimming pool applications. Discard material which has begun to set before it is used; re-tempering is not allowed. Do not use any caked or lumpy materials. Completely empty mixer and mixing boxes after each batch is mixed and keep free of old material.

## PART 3 - EXECUTION

### 3.01 Preparation of Surfaces

#### A. Surface Conditions Requirements:

1. Existing surfaces to be coated must be smooth and clean. Sandblast existing concrete (old) surface to remove projections, loose particles, foreign matter or construction debris, and make sufficiently rough to provide a strong mechanical bond to 1/16 in amplitude.
2. New concrete to be rough float finish 1/16 in amplitude chip, sandblast, or grind off all defective materials and foreign matter.

#### B. Surface Repair Requirements:

1. Repair all cracks with "Waterplug" concrete patch, or approved equal.
2. All areas of loose plaster discovered shall be completely removed down to rough concrete.

#### C. Preparation:

1. Application of waterproofing constitutes acceptance of substrate. Contractor shall be responsible for properly preparing substrate. Any defects from resulting from substrate issues shall be covered under contractor's warranty.
2. Prior to coating, thoroughly wash entire surface with 2,000 psi high-pressure water.
3. Wet cementitious base surfaces with fine fog water spray to produce a uniformly moist condition.
4. Check gutter grates and accessories for correct alignment before coating is started.
5. Do not apply coating to base surfaces containing frost.
6. Install temporary coverings as required to protect adjoining surfaces from staining or damage by waterproofing operations.

### 3.02 Application of Waterproofing

- A. General: Apply waterproof coating to the manufacturer's minimum thickness at any location. Apply finish coating by manufacturer's approved brushes (do not use a paint brush).

B. Workmanship:

1. Apply waterproof coating in two coats with second coat applied the next day or before material has become too dry or glazed for good bond.
2. Dampen surface immediately ahead of application.
3. Brush on two coats of waterproof coating, each with a minimum thickness as recommended by the manufacturer.
4. Float final brushed on coat with damp sponge 15 minutes after application to provide a smoother finish without waves, cracks, ridges, pits, projections, or other imperfections.
5. Form coating carefully around curves and angles.

C. Curing:

1. Cure waterproof coating with fine water mist spray applied to finish coat three or four times at 8-hour intervals or as drying conditions require to prevent premature drying. Do not fill with water for at least 8 days.

D. Patching and Cleaning up:

1. Upon completion, cut out and patch loose, cracked, damaged, or defective waterproof coating; patches matching existing coating in texture, color, and finish, flush with adjoining coating. Remove waterproof coating droppings or spattering from all surfaces. Leave surfaces in clean unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from site.

END OF SECTION 131125



## ADDENDUM NUMBER 2

### SECTION 131130 – SWIMMING POOL SEALANTS AND CAULKING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

A. Work in this section. Principal Items include:

1. Labor, materials, and equipment to complete sealants and caulking as indicated and specified.

##### 1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing Materials (ASTM):
  - a. C920-11 Elastomeric Joint Sealants

##### 1.03 SUBMITTALS

- A. Certificates of Conformance or Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.
- B. Manufacturers' Descriptive Data: Submit complete descriptive literature for each type of material. Clearly mark data to indicate which type the Contractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and caulking shall include application instructions, shelf life, mixing instructions for multi-component sealants, and recommended cleaning solvents.

##### 1.04 SAMPLE JOINTS

- A. Before Sealant and Caulking Work starts, provide a sample of each type of finished joint where directed. The sample shall show the workmanship, bond, and color of sealant or caulking. The workmanship, bond, and color of work throughout the project shall match that of the approved sample joints.

##### 1.05 ENVIRONMENTAL CONDITIONS

- A. The ambient temperature shall be within the limits of 40 °F and 100 °F when the sealant and caulking are applied, unless noted otherwise herein.

##### 1.06 DELIVERY AND STORAGE

- A. Materials shall be delivered to the job site in the manufacturer's original shipping containers with brand names, date of manufacture, color, and material designation clearly marked thereon.
- B. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use.
- C. Carefully handle and store materials to prevent inclusion of foreign materials or subsection to sustained temperatures exceeding 100 °F or less than 40 °F.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. General: Products shall conform to the reference documents listed for each use. Color of sealant shall match adjacent surface color unless specified otherwise. For ASTM C920 sealants, use a sealant that has been tested on the types of substrate to which it shall be applied.
1. Interior Sealant: ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Color of sealant shall be as selected.
  2. Exterior Sealant: For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Class 25, Use T. Color of sealant shall be as selected.
  3. Floor Joint Sealant: ASTM C920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be as selected.
  4. Primer for Sealant: Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.
  5. Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.
  6. Backstops: Use glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

### 2.02 POOL DECK EXPANSION JOINT SEALANT

- A. "Deck-O-Seal" gun grade 2-part joint sealant 2-part polysulfide 2-component chemically cured polysulfide rubber, color as selected by Owner's representative.
1. Approved equal:
    - a. Sika Corporation "Sikaflex 2C SL" 2-component chemically cured urethane sealant, color as selected by Owner's representative.

### 2.03 POOL DECK EXPANSION JOINT BACKER ROD

- A. Backer rod shall be closed cell, non-absorbent compressible material manufactured for the specific purpose of controlling sealant depth. Manufactured by Sika, Quikrete or approved equal.
- B. #16 silica sand.

## PART 3 - EXECUTION

### 3.01 GENERAL SURFACE PREPARATION

- A. Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2 in and grind to a minimum width of 1/4 in without damage to the adjoining Work.

### 3.02 SEALANT PREPARATION

- A. Do not modify the sealant by addition of liquids, solvents, or powders. Mix multi-component elastomeric sealants in accordance with manufacturer's printed instructions.

### 3.03 GENERAL APPLICATION

- A. Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.
- B. Primer: Just prior to application of sealant, clean out loose particles from joints. Apply primer in accordance with sealant manufacturer's directions. Do not apply primer to exposed finish surfaces.
- C. Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.
- D. Sealant: Use a sealant that is compatible with the material to and against which it is applied. Do not use a sealant that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Sealant shall be uniformly smooth and free of wrinkles.
1. Interior Sealant: Provide sealant at all exposed joints and at all joints indicated to receive sealant.
  2. Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints and at all joints indicated to receive sealant.
  3. Floor Joint Sealant: Provide sealant in all control joints and in other floor joints indicated or specified.

### 3.04 POOL DECK EXPANSION JOINT SEALANT

#### A. Joint Preparation

1. The number of joints and joint width should be designed for a maximum of  $\pm 25\%$  movement. The depth of the sealant should be 1/2 the width of the joint with a maximum depth of 1/2" (12.7 mm) and a minimum of 1/4" (6.35 mm).
2. In joints of 1/4 in to 1/2 in (6.4 mm to 12.7 mm), the sealant depth at midpoint should be 1/4 in (6.4 mm). In joints of 1/2 in to 1 in (12.7 mm to 25.4 mm), the depth at midpoint should be 1.4 in to 1/2 in (6.4 mm to 12.7 mm).
3. Control the sealant depth in deep joints with closed-cell backer rod or soft backer-rod. Where the joint depth does not permit the use of backer rod, a bond breaker (polyethylene strip) must be used to prevent three-point bonding.

4. To maintain the recommended sealant depth, install backer rod by compressing and rolling it into the joint channel without stretching it lengthwise. Backer rod should be about 1/8 in larger in diameter than the width of the joint to allow for compression. Backer rod becomes an integral part of the joint. The sealant does not adhere to it, and no separation bond breaker is required. Do not prime or puncture the backer rod.

#### B. Surface Preparation

1. Remove any old joint sealing material by mechanical means. If joint surfaces have absorbed oils, sufficient concrete must be removed to ensure a clean surface.
2. Joint surfaces must be structurally sound, dry, clean, and free of all loose aggregate, laitance, oil, grease, asphalt, paint, wax, mastic compounds, waterproofing compounds, or form release materials.

#### C. Priming

1. Prime Joint surfaces with manufacturer's recommended primer for the substrate before sealing. If the surfaces are other than shotcrete or concrete, test first to determine adhesion. Seek technical assistance from manufacturer.
2. Apply primer in a thin uniform film. Avoid buildup of film.
3. Allow approximate 30 minutes drying time before applying sealant.
4. Reapply primer if not sealed the same day.
5. To minimize contamination of adjacent surfaces, apply masking tape and remove before sealant has begun to thicken and set.
6. Coverage rate of primers is approximately 35 ft<sup>2</sup> per pint.

#### D. Mixing

1. Two two-component systems must be thoroughly mixed before use. The oversize Part-A container allows for the addition and mixing of Part-B and the color pigment.
2. 1-1/3 gallon (5.67 L) unit: (1) Transfer Part-B to Part-A container using a spatula or knife. It is imperative that the entire contents of Part-B be combined with Part-A. (2) With a slow speed drill and a slotted mixing paddle, thoroughly mix for 3 minutes. The paddle blade must be kept below the sealants surface to avoid whipping in air. (3) Transfer the contents of the pigment can into the mixed Part-A and Part-B. Use a spatula or knife, removing the entire contents to ensure consistent color. (4) Continue mixing with a slow speed drill and slotted paddle until color is uniform. During the process, the sides and bottom of the base can and the paddle itself several times.
3. 3 gallon (11.37 L) unit: Use 2 Part-B and 2 pigment container for each Part-A container. Mix as instructed under 1-1/2 gallon (5.69 L) unit.
4. Pot life of the sealant is dependent upon temperature./

#### E. Application

1. All caulking and sealing be should be performed when temperatures are above 40 °F (+4 °C) any moisture or frost on surfaces shall adversely affect adhesion.
2. Ideally, the temperature at the times of application should be the median of temperature extremes when the joint width opening is at its midpoint.
3. Fill joints from the bottom; avoid bridging of the joint that might form air voids.
4. For large joints, the self-leveling grade may be poured directly from the can.
5. For smaller joints and for all slope-grade applications, fill the joint by flowing the sealant from a bulk-loading gun.
6. Light tooling of the sealant is recommended to smooth out ripples. On sloped surfaces, tool from lowest point to highest.

F. Clean Up

1. Immediately after use and before sealant has cured clean equipment with xylene.

G. Curing

1. The cured sealant may be removed by cutting with a sharp-edged tool and thin films by abrading.
2. Protect joint from dirt and traffic overnight. Time for initial cure will vary with humidity and temperature.

3.05 BACKER ROD

A. Installation

1. Closed-cell backer rod must be compressed in the joint at the time of installation. For joint widths up to 3/4 in (19.1 mm), the diameter of the rod should be 1/8 in (3.18 mm) larger than the width of the joint. For 3/4 in (19.1 mm) wide joints use 1 (25.4 mm) diameter rod.
2. Closed-cell backer rod may be easily installed with a blunt probe or a plain-faced roller to force the rod to the desired depth. A template or roller gauge may be used to control the depth at which the rod is placed. Do not puncture, fold, or crease backer-rod. Follow sealant manufacturer's suggestions for joint sealant width and depth ratio.

3.06 PROTECTION

- A. Protection: Protect all areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.
- B. Cleaning: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Upon completion of application, remove all remaining smears and stains resulting there from and leave the Work in a clean and neat condition.

END OF SECTION 131130

**ADDENDUM NUMBER 2**

**SECTION 13 11 46 – SWIMMING POOL FINISH TILE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

A. Work in this Section: Principal items include:

1. Ceramic tile for swimming pool

**1.02 QUALITY ASSURANCE**

A. Reference Standards: Conform to the following standards unless otherwise required herein:

1. American Concrete Institute
  - a. ACI 302 - Guide for Concrete and Floor Slab Construction
2. American National Standards Institute (ANSI):
  - a. A108 - Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile Installed With Portland Cement Mortar.
  - b. A137.1:2012 Standard Specifications for Ceramic Tile.
3. American Society for Testing and Materials (ASTM):
  - a. C144-11 Aggregate for Masonry Mortar
  - b. C150 Portland Cement
  - c. C171-16 Sheet Materials for Curing Concrete
  - d. C206-14 Finishing Hydrated Lime
  - e. C207-06 (2011) Hydrated Lime for Masonry Purposes
  - f. D5957-98 (2013) Standard Guide for Flood Testing Horizontal Waterproofing Installations
  - g. F-1869-16a Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - h. F-2170-16b Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes
4. Tile Council of North America (TCNA): Latest Edition, Handbook for Ceramic Tile Installation.

B. Related Sections

1. 131100 – Swimming Pool Contractor General Requirements

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2. 131125 - Swimming Pool Cementitious Waterproofing
3. 131130 – Swimming Pool Sealants and Caulking
4. 131150 – Myrtha Performance Spec

#### 1.03 SUBMITTALS

- A. Refer to Division 1 for procedures.
- B. Product Data: Submit the tile manufacturer's printed data identifying each field tile unit and each trimmer and shaped unit by model or type number.
- C. Samples: Submit the following for selection and approval:
  1. Each type, shape, and trimmer of tile in each required color.
  2. Joint grout colors for each color of tile.
- D. Master Grade Certificates: Submit for each lot of tile before installing

#### 1.04 PRODUCT DELIVERY AND STORAGE

- A. Deliver tile materials to site in unopened factory containers sealed with Grade Seals bearing printed name of manufacturer and the words "Standard Grade". Keep the Grade Seals intact and containers dry until tiles are used. Keep cementitious materials dry until used.

#### 1.05 JOB CONDITIONS

- A. Inspect and verify job conditions. Report all defects in base surfaces to Architect/Engineer for correction before proceeding.
- B. Maintain a temperature range of 40 degrees Fahrenheit to 90 degrees Fahrenheit during installation of tile and grout materials. Tile installation should cure for a minimum 14 days with average and temperature of 70 degrees, while maintaining the minimum 40 degrees and maximum 90 degrees Fahrenheit, prior to filling pool with water.
- C. Vent temporary heaters to outside to avoid carbon dioxide damage to the new tile work.

#### 1.06 WARRANTIES

- A. The Contractor warrants to the Owner that materials and equipment furnished under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted and that the work will conform to the requirements of the contract documents. Work not conforming to these requirements including substitutions not properly approved and authorized, may be considered defective.
- B. The Contractor's warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation, modifications not executed by the Contractor or improper wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.
- C. All warranties shall be for a period of five years, unless otherwise specified.

- D. All setting materials shall be provided by the same manufacturer. All mixing materials and application procedures shall be done in accordance with manufacturer's recommendations and requirements. Documentation shall be provided to this effect by the contractor with verification from the manufacturer. This documentation shall be included in the operations and maintenance manual under warranties as documentation qualifying the project for a Lifetime Systems Warranty by Laticrete International, Inc. or approved equal.
- E. The Contractor shall agree to repair or replace any work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable

## PART 2 - PRODUCTS

### 2.01 BASIC MATERIALS

- A. Portland Cement: ASTM C150, Type II, low alkali
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar sand: ASTM C144, at least 4% passing No. 100 sieve.
- D. Joint sand: Same as mortar sand, except all passing the No. 30 sieve.
- E. Water: From domestic potable source
- F. Color pigments: Pure ground mineral oxides, non-fading, alkali and lime proof, factory weighed and packaged.

### 2.02 TILE MATERIALS

- A. Manufacturer
  - 1. Tile Products: Dal Tile, American Olean, Cepac, Agrob Buchtal or approved equal.
- B. Standard Grade conforming to ANSI A137.1. Additional Tile Requirements include:
  - 1. Provide trim units as indicated and specified, including special shapes as detailed or required.
  - 2. Tile patterns and colors shall be as indicated and specified, colors of approved shades.
  - 3. Mesh mounted or perforated paper backed tile is not allowed where the mesh of paper remains as a permanent part of the installation. If dot mounting is used, a minimum of 67% of the depth of the tile shall be free from any dots to ensure proper grout curing.
  - 4. All 1" x 1" tiles shall be face mounted as guaranteed suitable for pool use by the manufacturer.
  - 5. All tile shall be "frost proof" and suitable for an outdoor pool installation in a freeze/thaw climate.



C. Unglazed Ceramic Mosaic Tile

1. WATERLINE TILE – Provide GLAZED ceramic tile for waterline below the gutter lip as shown in the drawings.
  - a. Tile: Shall be porcelain type ceramic mosaic tile, with cushion or all-purpose edges. Use factory-made half-size units where required for tile numbers, or make the half-size units by precision cutting on powered tile saw. Ease all cut tile edges prior to installation.
  - b. Location, Size and Finish per Plans.
  - c. Color shall be selected or scheduled by Architect or Aquatic Designer.

D. Specialty Tile:

1. Handhold tile at pool perimeter shall have color selected by Architect and be provided by the swimming pool manufacturer.

E. Depth Marking and Warning Signs:

1. Horizontal and vertical depth markings and warning signs shall have 4" high numbers and letters.
  - a. Location and Size per Plans.
2. All horizontal depth markers shall be slip resistant.
3. Single tile abbreviations shall be used for 'FT' / 'FEET' and 'IN' / 'INCHES' by Dal Tile, approved tile manufacturer or Inlays, Inc.
4. Universal No Diving Symbol shall be set on a single 6" x 6" tile unless otherwise noted on the plans.
5. COLOR: All message tile shall contrast with the field tile. Refer to Architect for color selections.

- F. Trim Units: Provide tile trim units where indicated or necessary for complete and finished installation. Provide bullnose units for external corners and angles. Internal corners shall be squared. External corners shall be mitered. Provide trim units of material and finish identical to adjoining tile, except slip-resistant surfacing is not required for curved or vertical trim units. Provide special type slip-resistant tread nosing units as indicated.

2.03 DECK TILE SETTING BED MORTAR

- A. Manufacturer: LATICRETE International Inc., 3701 Fortified Mortar Bed, thick bed mortar. Polymer fortified blend of carefully selected polymers, Portland cement and graded aggregates. Exceeds ASTM C270 Requirements. Mix and Apply in accordance with Manufacturer's recommendations.
1. Tile Setting Products: LATICRETE International Inc., Mapei Corporation or approved equal.

2.04 DECK TILE BOND COAT

- A. Manufacturer: LATICRETE International Inc., 254 Platinum one step, polymer-fortified thin-set mortar or approved equal. Exceeds ANSI A118.4 Shear Bond Strength Requirements & ANSI A118.15 (ISO 13007 C2TES1). Mix and apply in accordance with Manufacturer's recommendations as a Bond Coat (placed under setting bed mortar screeds at 'horizontal surfaces').
- 2.05 DECK TILE THINSET
- A. Manufacturer: LATICRETE International Inc., 254 Platinum one step, polymer-fortified thin-set mortar. Exceeds ANSI A118.4 Shear Bond Strength Requirements & ANSI A118.15 (ISO 13007 C2TES1). Mix and apply in accordance with Manufacturer's recommendations.
- 2.06 DECK TILE JOINT GROUT
- A. Manufacturer: LATICRETE International Inc., Spectra Lock Pro Premium Grout Exceeds ANSI A118.3 (ISO 13007-3 RG), patented high performance grout. Mix and Apply in accordance with Manufacturer's recommendations.
- 2.07 POOL SHELL TILE SETTING MATERIAL
- A. Manufacturer: MAPIE KERALASTIC latex adhesive. Exceeds ANSI A118.4E, ANSI A118.15, ANSI A118.15E (ISO13007-3 C2ES2P2), patented high performance grout. To be used with Kerapoxy CQ.Mix and Apply in accordance with Manufacturer's recommendations.
- 2.08 POOL SHELLTILE JOINT GROUT
- A. Manufacturer: MAPIE KERAPOXY Premium Epoxy Grout and Mortar with Color Coated Quartz.. Exceeds ANSI A118.4E, ANSI A118.15, ANSI A118.15E (ISO13007-3 C2ES2P2), patented high performance grout. To be used with Keralastic..Mix and Apply in accordance with Manufacturer's recommendations.
- B. Planicrete W by Mapie may be considered as a substitute at the approval of the engineer.
- 1.01 ELASTOMERIC SEALANT
- A. Manufacturer: LATICRETE International Inc., Latasil sealant over Latasil 9118 primer to seal lighting and plumbing fixture penetrations and for all movement joints. Mix and Apply in accordance with Manufacturer's recommendations.
- 1.02 MIXING AND APPLICATION PROCEDURES
- A. All mixing and application procedures shall be done in accordance with the manufacturer's recommendations, requirements, and guidelines. A manufacturer's representative shall visit the site to verify field conditions, confirm materials and application requirements, and confirm that all materials and systems are installed per the manufacturer's recommendations, requirements, and guidelines. Documentation shall be provided to this effect for the Design Team's records.
- PART 2 - EXECUTION
- 2.01 PREPARATION
- A. Confirm pool shell, gutter, and surge tank water tightness prior to tile, setting bed and any water proofing systems prior to tile installation. Refer to specification sections 131120 -

Swimming Pool Cast-in-Place Concrete and 131122 - Swimming Pool Shotcrete for specific procedure.

- B. The pool surface shall be structurally sound and free of any foreign substances and debris that could reduce or impair adhesion. Sound and remove all loose concrete to firm substrate. Clean substrates of dust, dirt, oil, grease, and deleterious substances. Conform to applicable Reference Standards and to recommendations of manufacturers of materials used. Thoroughly wash/rinse with clean potable water.
- C. Surface defects or holes in the substrate shall be patched per manufacturer's recommendations.
- D. Substrates To Receive Mortar Setting Beds: Keep cementitious backing damp for at least 8 hours and scrub with a neat Portland cement slurry just prior to placing setting bed mortar.
- E. Tile Wetting: Dampen tile according to above Reference Standards or tile manufacturer's instructions, as required.
- F. Screeds: Accurately set temporary screeds to control the finish plane of mortar-bed set tile and remove as soon as setting bed is sufficiently hardened. Fill void spaces from screeds with same mortar.

## 2.02 TILE INSTALLATION

- A. Arrange tile according to patterns detailed, set tile flush with well-fitted joints, finish in true planes, that are plumb and square, and with joints of uniform size. Provide approved trimmers as shown or required. Cut tile without marring. Carefully grind and joint tile edges and cuts. Set tiles to avoid puddles and ponding in large fields and arrange curved field joints at radiuses that minimize joints and tapered grout joints.
- B. Mortar Bed Set Tile: Apply bond coat under dry pack screed mortars at horizontal surfaces (vertical renders / leveling mortars are mixed to a more plastic / plaster like consistency and typically do not require a bond coat). While bond coat remains wet and tacky, apply specified setting bed mortar, tamp, and screed to required planes. Spread no more mortar than can be covered with tile before initial set. Do not use re-tempered mortar. Trowel 1/32" to 1/16" thick bond coat over plastic setting bed mortar just before setting tile or apply bond coat to back of each tile placed. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and proper plane. Complete all beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. Adjust any out-of-line or out-of-level tile.
- C. Ceramic Tile Joint Grouting: Grout tile joints full after washing out and saturating with clean water. Mix grout with water to a thick creamy consistency and force into joints for entire joint depth, flush with surface. Clean off all excess and fill skips and gaps before grout sets. Use white grout throughout. Provide dampness for minimum 3-day curing and polish with clean dry cloths. Unless otherwise approved, install tile with uniform 3/32 inch joint width. A maximum 1/8" joint width may be utilized to meet specific installation requirements, if required.
- D. Expansion Joints: Install tile with uniform 1/8" joint width. Place expansion joint per applicable TCNA Method P601MB, P601TB, or P602 and conforming to Method EJ171. Provide shop drawings showing backer rod and joint dimensions. All expansion, control, construction, cold, and seismic joints in the pool structure should continue through the tile work, including such joints at vertical surfaces. Movement joints shall be placed at all changes in direction and

elevation. Refer to the structural engineer for additional required movement joints. Joint size shall be a minimum of 1/8". Joints through tile work directly over structural joints shall not be narrower than the structural joint. The Contractor shall use cement compatible coatings when using chalk lines for joint layout purposes.

#### 2.03 CLEANING AND PROTECTION

- A. Remove stains, cement, grout, and foreign matter after grouted joints are fully set as recommended by TCNA and manufacturers of proprietary materials. Do not use any acid for cleaning free of both sodium and potassium. Repair all defective joints until approved.
- B. Protect installed tile work with non-staining Kraft paper, polyethylene sheeting, or other approved heavy covering during the construction period to prevent damage.

#### 2.04 TESTING AND INSPECTION

- A. Before filling of the pool, and its subsequent provisional acceptance at substantial completion, the tile installation shall be visually inspected and sounded in the presence of the Architects and/or the Owner's representative to verify adhesion of the tile to its substrate as well as its overall compliance with the requirements of this Section. Any and all tile work found to be loose, improperly adhered, out of plane, misaligned or otherwise non-conforming shall be removed and replaced at no additional cost to the Owner.

#### 2.05 POOL FILLING AND EMPTYING

- A. Use a fill and drain rate of 2 feet per 24 hours to minimize thermal shock and structural movement. Maintain a temperature differential of 10 degrees Fahrenheit or less between the pool water and the substrate during fill and drain cycles.

#### 2.06 REPLACEMENT TILE

- A. Provide Owner with approximately 10% or 25 square feet (whichever is least) of each color and type tile used on the project for Owner's repair and replacement requirements.

END OF SECTION 13 11 45

## ADDENDUM NUMBER 2

### SECTION 13 11 24 – SWIMMING POOL MANUFACTURER

#### PART 1 GENERAL

##### 1.00 DEFINITION

- A. Myrtha Pool: A Myrtha Pool is a custom manufactured product based around the proprietary process of hot calendaring rigid PVC sheets to modular stainless steel self supporting panels.

##### 1.01 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide pool manufacturer's standard and/or custom components and assemblies integrated into a complete system that forms a pool capable of withstanding imposed structural loads, thermally imposed movement, and deterioration from pool chemicals, ultraviolet radiation, weather, site, seismic and service conditions at a minimum as specified in this Article.
- B. Structural Performance: Provide wall panels, structural supports, structural connections capable of withstanding the effects of soil (backfill) pressures, hydrostatic loads and resulting stresses within the limits of the design without leakage and under the specified conditions. Under said stresses the maximum allowable horizontal deflection will be 1/250 of the height of the structure, not to exceed 4mm.
- C. Penetration for wall and floor Systems: Provide wall and floor assemblies manufactured and installed with no water leakages through the system. PVC shall be continuous across connections between wall panels, between wall panels and floor membrane, and across joints between sections of floor membrane.
- D. Sustainable Criteria: Show proof of reduced carbon footprint by a minimum of 30% below conventional construction methodologies; as well as repeatable verification of receiving LEED Certification Gold Level or higher.
- E. Structural Performance: Components shall be structurally independent and capable of withstanding the most extreme seismic conditions prescribed in the current building code; as well as being capable of overcoming limited differential settlement due to deficient soil characteristics.

##### 1.02 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized experience in erecting and installing work similar in material, design, and extent to that indicated for this project and who is acceptable to manufacturer by having the following characteristics:
1. Has successfully completed five (5) projects similar in type.
  2. Has successfully completed the manufacturer's annual training program referred to as "Pool Academy".
    - a. Exception: In lieu of the required number of projects, installer may engage one or more manufacturer-endorsed master installers with a minimum completion of 20 successful projects similar in type.
- B. Manufacturer Qualifications: A firm experienced in manufacturing pools similar to those indicated for this Project and with a record of successful in-service performance.

1. ISO Registration: Firm shall provide ISO 9001 certificate or provide the following:
    - a. Evidence of successful-audited QA/QC program.
    - b. Test results in accordance with Section 2.04 "TOLERANCES & QUALITY CONTROL"
    - c. Design of all specific components in relation to each other shall be completed in a three dimensional integrated modeling software to ensure to system coordination with the pool and / or building components.
  2. Has successfully manufactured a minimum of 30 projects with a minimum of 50 bodies of water which have been installed within the past 5 (five) years that are similar to the proposed project.
- C. Source Limitations: Obtain all prefabricated pool systems through one source from a single manufacturer.

#### 1.03 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Deliver components and other manufactured items so as not to be damaged or deformed. Package small components together in crates or containers to prevent loss of small items. Package hazardous and/or sensitive materials together and clearly labeled to indicate use of caution or extra attention is required. Finished panels shall be covered with continuously applied adhesive-fixed protective layer to prevent damage to panel surface. Bundle and secure components to prevent scattering and damage to other materials during shipment.
- B. Storage:
1. All pool components shall be stored and staged with sufficient site safety and security to ensure damage or losses from vandalism, theft, and weather do not occur. Stack non-structural materials on platforms or pallets, covered with tarpaulins or other suitable weather tight and ventilated covering. Store underlayment and boxed items to ensure dryness. Do not store any plastic components in contact with other materials that might cause staining, denting, or other surface damage, or in direct sunlight.
  2. Store hazardous materials as follows:
    - a. Store in a climate controlled environment within temperature ranges specified by product manufacturer.
    - b. Keep out of direct sunlight.
    - c. Store away from open flame or sources of heat.
    - d. Comply with applicable safety regulations governing hazardous material storage and handling.
- C. Handling: Unload, store, and erect manufactured pool components to prevent bending, warping, twisting, and surface damage.

#### 1.04 PROJECT CONDITIONS

- Preliminary 03/28/2023 05:19 PM
- A. Weather Limitations: Proceed with installation only when weather conditions permit according to manufacturer's written instructions and warranty requirements. Various phases of installation may have differing requirements.
  - B. Field Measurements: Prior to commencement of installation, site conditions shall be approved in writing by installation contractor as specified in Part 3 "Installation". As projects may be phased, installation contractor shall only approve those portions of the project ready for pool installation.
  - C. Concrete Surfaces: Shall be within design tolerances and have at a minimum a broom finish. At all times concrete floor shall be protected from oil, paint, solvents, etc. Installation contractor and manufacturer shall be notified in writing if such items do come in contact with concrete floor. These items shall be remedied as required by manufacturer at Contractor's expense.

#### 1.05 WARRANTY

- A. Special Warranty on Prefabricated Pool System: Written warranty, executed by manufacturer agreeing to repair or replace pool system components provided by manufacturer that have failed and/or directly result in leakage of the pool. The manufacturer and / or their authorized distributors warrant that the provided materials will be free of defects when used and maintained in accordance with Seller's recommendations. Warranty is further limited to include material replacement only and does not cover water, chemicals or labor. Further requirements of the warranty are contained within the Certificate of Guarantee provided by A&T Europe SpA.
  - 1. Warranty Period: Structural integrity and Water-tightness twenty five and ten years from date of Substantial Completion, respectively. Plastic grill structural integrity one year from date of Substantial Completion, (see manufactures warranty).

### PART 2 - COMPONENTS

#### 2.00 STRUCTURAL ELEMENTS

- A. Primary components (wall panels and gutters) shall be fabricated by cold working from AISI 441 stainless steel sheet or standard shapes.
  - 1. Wall Panels: Panels fabricated from cold-worked PVC laminated steel (14ga (2mm) steel sheet minimum). Panel construction shall provide for flanged-bolted connections with compatible steel with no through-panel fasteners below tile line. Flange bolt spacing shall not exceed 6" without utilizing flange stiffening element. Wall panels will have a protective plastic film on the interior face (water side) of the panel that will be removed during the installation process, before the pool is filled with water. Wall panels will have a clear, protective coating applied to the exterior face to provide a permanent shield against oxidation from chlorinated atmosphere.
  - 2. Gutter: Channels fabricated from cold-worked PVC laminated steel (14ga (1.5mm) steel sheet minimum). Gutter construction shall provide for flanged-bolted connections with compatible steel between gutter segments. Gutter splice plates are not permitted. Gutters/gutter supports for tile finished gutters shall be constructed with permanent adjustment system to level gutter at skim line prior to installation of tile (floating of tile on gutter or adjustment of coping over 1/8" to obtain level skim is not permitted). Gutters will have a protective plastic film on the interior face (water side) of the gutter that will be removed during the installation process, before the pool is filled with water. Gutters will

have a clear, protective coating applied to the exterior face to provide a permanent shield against oxidation from chlorinated atmosphere.

- B. Secondary components (base frames, panel supports, buttresses, gutter supports, concrete anchors, and miscellaneous hardware) shall be grade AISI 470, A2 or ANSI 316 stainless steel (minimum) and may be fabricated by hot-working as required.
1. Base Frames: 'C'-shaped sections fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Frame construction shall ensure tight horizontal tolerance and allow for vertical adjustment to compensate for variations in finished concrete.
  2. Panel Supports: Panel supports fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Flanges, connection plates, and stiffening elements shall be fabricated by cold-working (no steel welding is permitted).
  3. Buttresses: Structural braces fabricated from 14ga (2mm) steel sheet minimum. In lieu of fabrication from cold-worked sheet, buttresses may be fabricated from hot or cold formed standard angle, c, zee or other standard section provided all additional flanges, connection plates, and stiffening elements are fabricated by cold-working (no steel welding is permitted).
  4. Gutter Supports: Brackets fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Gutter supports shall be fabricated integrally with panel supports or separately provided gutter support construction provides for bolted connection to panel supports.
  5. Gutter Drain Flanges: Flanges fabricated from hot or cold formed steel. Flanges may be secured to gutter or gutter drain manifold by steel welding. Flanges shall be fabricated to connect to standard PVC flanges. Gutter drains placed in accordance with the architects drawings. No flanges in the gutters is permitted; this would obstruct the free flowing of water into the drain.
  6. Structural Accessories: Anchors, Rods, Bolts, Nuts, and Washers shall be Grade AISI A2 stainless steel minimum.
  7. Raw Steel Components: Hand Rails, Grab Rails, Risers, etc. that are exposed to water directly will be ANSI 316 minimum.
  8. Chemical Anchor capsules shall be in accordance with ASTM E 1512.
- C. PVC-Coated Stainless Steel Plate shall be constructed from PVC coated stainless steel sheet (or blanks) manufactured by hot calendaring PVC to the stainless steel sheet. The bonded PVC shall withstand tensile (de-lamination) force of 27 lbs (120 N) on a sample if 1" at 180° angle de-lamination.
- D. Fabricate elements to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

## 2.01 PVC MEMBRANE

- A. Floor Membrane: PVC floor membrane shall be a fiberglass reinforced PVC geo-membrane (chemically coated fabric) with the following properties:
1. Minimum thickness of 1.5mm in accordance with ASTM D 374.



2. Water absorption by ISO 62 methodology #1 < 1% of mass.
3. Minimum resistance to deformation > 100 lb / inch (900 N / 50 mm).
4. Yield strength > 285 lb / inch (2,500 N / 50 mm)
5. Minimum resistance to tearing of > 100 lb (450 N) in accordance with ASTM D 1004.

## 2.02 ACCESSORIES

- A. Line Anchors: Shall be designed and fabricated to withstand forces specified by floating line manufacturer or by recognized swimming authority. Line anchor construction shall utilize third party bracing elements (not solely supported by wall panel) and/or utilize pool structural system to provide resistance to service forces (line anchors secured only to wall panels are not permitted).
- B. Gutter Mounted Elements: Shall be designed and fabricated to withstand forces specified by accessory manufacturer and/or recognized swimming authority in addition to those service conditions specified by governing code officials. Exposed steel shall be polished stainless steel. All components shall be designed to be flush and there shall be no protrusions of any kind that could potentially produce a tripping hazard
- C. Bottom Drains: Shall be as noted on the plans. Drains shall be equipped with a steel flange, counter flange, two gaskets, compatible fasteners designed to prevent seizing. Drains shall be designed and fabricated to facilitate monolithic concrete slab or block-out type installations and concrete bonding. All sumps shall be in conformance with ANSI/APSP-16 2011.
- D. Grab Rail Anchors: Grab rails penetrating PVC shall be anchored with PVC anchors mounted in concrete. Anchors shall be designed and fabricated to withstand required loads and facilitate simple removal and replacement of the grab rail without damage or part replacement. Grab rail and grab rail anchor sizes shall be coordinate to ensure compatibility.
- E. Gutter Grills: Grills fabricated in multiple-interchangeable segments out of polypropylene. Grills shall be fabricated with buffers or slats parallel to pool edge to limit deck splash-over. Grills shall have an anti-skid surface meeting local code requirements.
- F. Soft-Walk PVC Mesh: PVC mesh [Poly Extruded Matting] is a heat and pressure bonded, non-woven, flexible plastic material with superior tear strength (350psi: ASTM D-624-91), low brittleness in cold weather climates (ASTM D-746-79), significant tensile strength (2190psi: ASTM D-412-92), and contains admixtures to prevent microbial growth.

## 2.03 TOLERANCES QUALITY CONTROL

- A. Manufacturer shall present certificate of ISO 9001 registration or the following:
  1. Manufacturer will employ an independent testing agency chosen by Contractor to perform source quality-control testing and special inspections, and to prepare test reports.
    - a. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
    - b. Manufacturer shall allow testing agency access to places where structural/primary components are being fabricated or produced, and cooperate with testing agency and provide samples of materials as may be requested for additional testing and evaluation.

2. Manufacturer shall correct deficiencies in or remove and replace primary components that inspections and test reports indicate do not comply with requirements.
3. All manufacturing shall be done to millimetric precision with a net result of -0.000 meters +0.001 meters dimensionally
4. All recirculation components (i.e. – gutter drop-outs, inlets, etc.) shall be designed using static computational fluid dynamics models to ensure appropriate dispersion of chemicals. In addition, the model shall demonstrate no significant disturbance to the swimmers in the active lanes for competitive pools.

## PART 3 - INSTALLATION

### 3.01 PREPARATION

- A. Site Conditions: Installation contractor shall confirm in writing suitability of project site to proceed with installation.
  1. Field Measurements: Construction of the pool foundation and floor shall be coordinated and confirmed upon completion. A final survey will be conducted by installation contractor. A drawing and/or report of their findings shall be submitted for review. Deficiencies in any of the areas listed below shall be identified along with other applicable information. The installation contractor along with the manufacturer shall note in writing any possible recommendations for correction of deficient conditions and advise of possible delays and additional costs that may result as soon as possible, specifically considering the following:
    - a. World and relative placement of pool foundation
    - b. Horizontal line
    - c. Elevation
    - d. Concrete finish

### 3.02 TANK INSTALLATION

- A. Install pool system according to manufacturer's written instructions and installation drawings.
- B. All mud and dirt shall be swept or washed from concrete floor. In addition, oil paint and solvents shall be cleaned and surfaces treated to prevent contact with PVC components.
- C. Install grounding for steel components according to applicable articles and governing codes.
- D. Prior to component installation, all primary components shall be inspected for damage or defect. Do not install damaged or defective components. Notify pool manufacturer immediately of any damaged or defective components.
- E. Do not field cut, drill, or alter primary members without written approval from pool system manufacturer.
- F. Set primary and secondary components in locations and to elevations indicated and according to manufacturer's written specification. Maintain structural stability of pool during installation.
- G. Ensure all basic recommended manufacturer's torque requirements for bolted hardware and connections are followed during manufacturing process.

### 3.03 WATERPROOFING

- A. General: Install uniform-watertight PVC seals.
1. Wall panel sealing shall be performed according to manufacturer's written instructions.
  2. Mechanical (welded PVC) and chemical seals shall be applied within temperature and climatic ranges specified by manufacturer.
- B. Mechanical Seals:
1. Clean surfaces of dirt, dust, debris, and adhesive film by scrubbing with a lightly abrasive fabric or cloth and a mild detergent.
  2. Welded components to the panel will be applied in a manor to ensure good bond, free of exposed scorching, and free of substrate blisters and wrinkles.
  3. "Hot Welding" shall be performed using manufacturer's approved components and procedures.
- C. Chemical Seals:
1. Clean surfaces of dirt, dust, debris, and adhesive film by scrubbing with a lightly abrasive fabric or cloth and a mild detergent.
  2. Avoid application of harsh chemicals and primers on exposed-finished PVC.
  3. Apply liquid PVC in thin layers to prevent forming of bubbles in curing PVC. Seal layers shall be free of such bubbles.
  4. Install PVC rigid profiles at all panel joints utilizing manufacturer's approved "Cold Welding" techniques.

### 3.04 PVC MEMBRANE INSTALLATION

- A. Install membrane according to manufacturer's written instructions and installation drawings.
- B. Prior to permanent fixing or welding, PVC membrane shall be inspected for visible defects or blemishes. Do not install damaged or defective membrane. Notify pool manufacturer immediately of any damaged or defective membrane.
- C. PVC membrane shall be stretched both longitudinally and transversely to prevent wrinkles from forming. Wrinkled PVC membrane shall be removed and replaced.
- D. Seams:
1. All seams in membrane and connections between membrane and wall panels shall be heat continuously welded a minimum of 38mm (1½"). Heat welding devices explicitly designed for PVC membrane welding shall be utilized for welding. Welds shall be spot checked per manufacturer's written instruction prior to final seam sealing.
  2. PVC weld seams shall not extend into flanged accessory connections. Utilize secondary PVC section to provide uniform surface for flanged connections.

3. Exposed PVC membrane edges shall be sealed with liquid PVC or by heat sealing according to manufacturer's written instructions.

#### 3.05 ACCESSORIES INSTALLATION

- A. General: Install accessories according to accessory manufacturer and pool manufacturer's written instructions and installation drawings and install grounding for steel accessories according to applicable articles and governing codes.

#### 3.06 ERECTION AND LOCATION TOLERANCES

- A. Horizontal Line: Face of pool at pool edge shall remain within +/- 1/8" of designed dimensions.
- B. Structure Elevation: Elevation of wall system below tile or coping shall remain within +/- 1/8" of required elevation to achieve finished pool water level.
- C. Finished Skim Elevation: Finished elevation of skimming tile or coping shall remain within +/- 3/32" of specified pool water level.

END OF SECTION 131150