

## **PROJECT MANUAL**

### **PROJECT:**

DEXTER HIGH SCHOOL POOL UPGRADES and  
WYLIE ELEMENTARY SCHOOL POOL UPGRADES

### **OWNER:**

DEXTER COMMUNITY SCHOOLS  
2704 Baker Road  
Dexter, MI 48130

**TMP PROJECT NO.:** 22070A, 22072A  
**BID PACKAGE NO.** 1

**DATE:** May 25, 2023

**ISSUED FOR:** CONSTRUCTION

### **ARCHITECT**

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**POOL CONSULTANT**

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***Dexter High School and Wylie Elementary School Pool Upgrades***  
***22070A and 22072A***

*This Document has been prepared under the supervision of the Architect and/or Professional Engineer as indicated by their individual License Seals affixed hereon.*

***Professional License Seals***

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***TMP Architecture, Inc.***  
*Architect*

***Peter Basso Associates Inc***  
*Electrical Engineer*

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**SECTION 00 0115 - LIST OF DRAWINGS**

**LIST OF DRAWINGS**

**1.01 GENERAL**

- A. Drawings: Drawings consist of the Contract Drawings including drawings listed on the TITLE SHEET page of the separately bound drawing set titled Dexter High School Pool Upgrades and Wylie Elementary School Pool Upgrades, dated May 25, 2023 and any subsequent Addenda and Contract modifications which may occur.

**END OF SECTION**

**SECTION 00 8200.01 - TMP ELECTRONIC FILE RELEASE FORM****RE: AUTHORIZATION FORM FOR CAD FILE TRANSFERS****PROJECT NAME:** \_\_\_\_\_**TMP PROJECT NO. :** \_\_\_\_\_ **BID PACK NO.** \_\_\_\_\_**DEAR SIR/MADAM:**

- A. Per your request, TMP Architecture, Inc. will electronically transmit requested CAD files upon receipt of an original signed copy of this form which states the conditions of agreement and the receipt of the required compensation fee.
- B. By acceptance it is understood and agreed that the data and medium being supplied is to be used only for the project referenced.
- C. It is further understood and agreed that the undersigned will hold TMP Architecture, Inc. and its Consultants harmless and indemnify TMP Architecture, Inc. and its Consultants from all claims, liabilities, losses, and so forth, including attorney's fees arising out of the use or misuse of the transferred files.
- D. It is understood and agreed that the items transmitted are prepared from CAD files current at the time of preparation. All files are [AutoCAD version 2014 dwg files].
- E. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
- F. As a record of information to be transmitted, TMP Architecture, Inc. will prepare a duplicate electronic back-up for its record.
- G. Compensation for providing this material will be as follows:
1. Base Fee of [\$250] for 1 to 3 Drawings.
  2. Base Fee of [\$500] for 4 to 10 Drawings.
- H. For each additional Drawing after 10 the fee is [\$40] per Drawing.
- I. Example: [11 drawings = \$540].
- J. Payment must be provided along with a signed copy of this form before files will be released. Please remit to [Construction Manager] to be forwarded to the Project Manager at TMP Architecture, Inc. and allow five working days for processing.

**FEE: \$** \_\_\_\_\_**REQUESTED DRAWINGS:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_**FIRM REQUESTING FILES:**

Company: \_\_\_\_\_

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

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

Printed Name / Title: \_\_\_\_\_

Email: \_\_\_\_\_

**TO BE COMPLETED BY TMP ARCHITECTURE, INC.**

Released(signed by): \_\_\_\_\_ TMP Architecture, Inc.

TMP Architecture, Inc.

TMP22070A, 22072A

Printed Name/Title: \_\_\_\_\_ Date: \_\_\_\_\_

**END OF SECTION**

**SECTION 00 8200 - AVAILABILITY OF ELECTRONIC FILES****AVAILABILITY OF ELECTRONIC FILES****1.01 POLICY**

- A. As a service to Contractor, subcontractors, vendors, material suppliers and others needing electronic copies of Drawings, the Architect will provide CAD files electronically in accordance with the following policy:
1. By acceptance it is understood and agreed that the data and medium being supplied is to be used only for the project referenced.
  2. It is further understood and agreed that the undersigned will hold TMP Architecture, Inc. and its Consultants harmless and indemnify TMP Architecture, Inc. and its Consultants from all claims, liabilities, losses, and so forth, including attorney's fees arising out of the use or misuse of the transferred files.
  3. It is understood and agreed that the files transmitted are prepared from CAD files current at the time of preparation. All files are AutoCAD version 2014 dwg files.
  4. This information does not waive the need to verify and review current field conditions and the status of Addenda and/or Bulletin documentation.
  5. As a record of information to be transmitted, TMP Architecture, Inc. will prepare a duplicate electronic back-up for its record.
  6. Compensation Fee for providing this material will be as follows:
    - a. Base Fee of \$250 for 1 to 3 Drawings.
    - b. Base Fee of \$500 for 4 to 10 Drawings.
    - c. For each additional Drawing after 10, the fee is \$40 per Drawing.
      - 1) Example: 11 Drawings = \$540.
  7. A signed copy of the Release Form and Fee must be provided before files will be released.

**1.02 REQUEST PROCEDURE**

- A. To receive Drawing CAD files the Release Form must be completed in full and submitted to the Construction Manager to be forwarded to the Project Manager at TMP Architecture, Inc.
1. A signed copy of the Release Form must be submitted.
    - a. Faxed or emailed copies will be accepted.
  2. Upon remittance of the signed Release Form and Fee, allow five working days for processing.
  3. Transmission of Drawings will be provided electronically after the receipt of Fee.

**1.03 RELEASE FORM**

- A. Release Form is located immediately after this Section. Refer to Section 00 8200.01 Electronic Files Release Form.

**END OF SECTION**

**SECTION 01 2500.01 - TMP SUBSTITUTION REQUEST FORM**

SUBSTITUTION REQUEST NUMBER: \_\_\_\_\_ DATE SUBMITTED: \_\_\_\_\_  
TMP PROJECT NUMBER \_\_\_\_\_ PROJECT NAME: \_\_\_\_\_

**SPECIFIED ITEM**

SPECIFICATION TITLE: \_\_\_\_\_  
SPECIFICATION SECTION \_\_\_\_\_ SPECIFICATION ARTICLE/PARAGRAPH: \_\_\_\_\_  
SPECIFIED PRODUCT / DESCRIPTION: \_\_\_\_\_  
SPECIFIED MANUFACTURER: \_\_\_\_\_  
SPECIFIED PRODUCT / MODEL: \_\_\_\_\_  
REASON SPECIFIED ITEM CANNOT BE PROVIDED: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PROPOSED SUBSTITUTION**

DESCRIPTION OF PROPOSED SUBSTITUTION: \_\_\_\_\_  
\_\_\_\_\_  
PROPOSED MANUFACTURER: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
WEBSITE: \_\_\_\_\_  
PRODUCT / MODEL: \_\_\_\_\_  
YEARS PRODUCT/MODEL HAS BEEN MANUFACTURED: \_\_\_\_\_  
DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

WILL PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK? ☐ NO ☐ YES  
IF YES, EXPLAIN HOW: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

HOW WILL SUBSTITUTION BENEFIT THE OWNER: ☐ COST SAVINGS ☐ TIME SAVINGS ☐ OTHER  
PROVIDE SPECIFIC DETAILS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**THE FOLLOWING INFORMATION IS REQUIRED; CHECK TO INDICATE INFORMATION IS ATTACHED. (REQUEST WILL BE REJECTED WITHOUT REQUIRED DATA)**

**32.01**

- A. ☐ List of references where proposed product has been installed; include address, owner, architect, and date installed.
- B. ☐ Product data sheets.
- C. ☐ Applicable certificates and test reports.

- D. ☐ Comparative Data: Provide point-by-point, side-by-side comparison of specified product and proposed substitution addressing essential attributes specified.

**INDICATE WHICH OF THE FOLLOWING VOLUNTARY INFORMATION IS ATTACHED, IF ANY:**☐ **DRAWINGS.**☐ **SAMPLES.**☐ **OTHER ITEMS:** \_\_\_\_\_**SIGNATURE****THE UNDERSIGNED CERTIFIES:**

The proposed substitution meets or exceeds the quality level of the specified product, equipment, assembly, or system.

To provide the same warranty for the substitution as for the specified product.

Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.

Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.

The proposed substitution will have no adverse effects on other work.

The proposed substitution will not affect project schedule.

Waives claims for additional costs or time extension that may subsequently become apparent.

**CONTRACTOR / COMPANY:** \_\_\_\_\_**SIGNED BY:** \_\_\_\_\_ **PRINTED NAME:** \_\_\_\_\_**TITLE:** \_\_\_\_\_**ADDRESS:** \_\_\_\_\_**EMAIL:** \_\_\_\_\_ **PHONE:** \_\_\_\_\_**ARCHITECT'S RESPONSE**

- A. During bidding, Architect will approve substitution requests by issuing an Addendum. Substitutions not approved by addendum are rejected.
- B. During construction, Architect will notify Contractor in writing (see below) of decision to accept or reject request, and incorporate the substitution into the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments as provided for in the Conditions of the Contract.

☐ **SUBSTITUTION APPROVED - PROVIDE SUBMITTALS PER SECTION 01 3000 AND RESPECTIVE SECTION FOR WHICH SUBSTITUTION WAS MADE.**

☐ **SUBSTITUTION REJECTED - PROVIDE SPECIFIED MATERIALS.**

**SIGNED BY:** \_\_\_\_\_ **PRINTED NAME:** \_\_\_\_\_**ARCHITECT'S COMMENTS:** \_\_\_\_\_**END OF SECTION**

## **SECTION 01 2500 - SUBSTITUTION PROCEDURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 2500.01 - TMP Substitution Request Form.

#### **1.03 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
  - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
  - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
  - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. Forms included in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
  - 1. Submit an electronic document, combining the request form with supporting data into single document.

#### **3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Substitution Request Form: TMP Substitution Request Form must be completed and provided at the beginning of each substitution request.
  - 1. Refer to Section 01 2500.01 - TMP Substitution Request Form.
  - 2. Submittals without a completed TMP Substitution Request Form will not be acknowledged, reviewed, or returned. Use only this form; other forms of submission are unacceptable.
- B. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period.

#### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Substitution Request Form: TMP Substitution Request Form must be completed and provided at the beginning of each substitution request.
  - 1. Refer to Section 01 2500.01 - TMP Substitution Request Form.

2. Submittals without a completed TMP Substitution Request Form will not be acknowledged, reviewed, or returned. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
  1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
  2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
  3. Bear the costs engendered by proposed substitution of:
    - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
    - b. Other unanticipated project considerations.
- D. Substitutions will not be considered under one or more of the following circumstances:
  1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  2. Without a separate written request.

#### **3.04 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
  1. During construction, Architect's decision following review of proposed substitution will be noted on the submitted form.
  2. During bidding, Architect will approve substitution requests by issuing an Addendum. Substitutions not approved by addendum are rejected.

#### **3.05 ACCEPTANCE**

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

#### **3.06 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

#### **END OF SECTION**





# SUBMITTAL AND SAMPLE TRANSMITTAL FORM

01 3000.01

CONST. MANAGER / CONTRACTOR		PROJECT	TMP PROJECT NO.		DATE SUBMITTED		SUBMITTAL NO.	
Name and Address:		Title:						
							Initial Submittal <input type="checkbox"/> Resubmittal <input type="checkbox"/>	
Email:		Location:					REVIEWED BY TMP <input type="checkbox"/> Consultant <input type="checkbox"/> Reviewer:	
Phone:								
SPECIFICATION SECTION NO.	SUBCONTRACTOR / MANUFACTURER	ITEM DESCRIPTION	NO. OF SAMPLES	NO. OF SAMPLES RETURNED	ACTION CODE *	DATE REVIEWED	DATE RETURNED	
Transmittal shall be for one specification section only; do not submit items from multiple sections under the same transmittal. Multi-section submittals will be returned; stamped "X - Not Approved - Resubmit"								
<i>Submittal Stamps may be placed on subsequent blank page.</i>								
CONTRACTOR COMMENTS		ARCHITECT COMMENTS		The undersigned certifies that the above submitted items have been reviewed in detail and are correct and in strict conformance with the Contract Documents except as otherwise noted. NOTE: Approval of items submitted does not relieve Contractor from complying with all requirements of the Contract Documents.				
				CONTRACTOR NAME				
				SIGNATURE				

*This page intentionally left blank for Submittal Stamps*

## **SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Submittals for review, information, and project closeout.
- B. Number of copies of submittals.
- C. Requests for Interpretation (RFI) procedures.
- D. Submittal procedures.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 3000.01 - TMP Submittal and Sample Transmittal Form.

#### **1.03 REFERENCE STANDARDS**

- A. AIA G716 - Request for Information 2004.
- B. CSI/CSC Form 13.2A - Request for Information Current Edition.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 REQUESTS FOR INTERPRETATION (RFI)**

- A. Definition: A request seeking one of the following:
  - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
  - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
  - 1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  - 2. Prepare in a format and with content acceptable to Architect. Use one of the following:
    - a. Use AIA G716 - Request for Information .
    - b. Use CSI/CSC Form 13.2A - Request for Interpretation.
    - c. Other format acceptable to Architect.
  - 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
  - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
  - 2. Improper RFIs: Requests not prepared in conformance to requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response and may include an explanatory notation.
  - 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response and may include an explanatory notation.
    - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name and number, and any additional required identifiers established in Contract Documents.
  2. Discrete and consecutive RFI number, and descriptive subject/title.
  3. Issue date, and requested reply date.
  4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
  5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
  6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Identify and include improper or frivolous RFIs.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
  2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
  3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
  4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### **3.02 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule.
  2. Coordinate with Contractor's construction schedule and schedule of values.
  3. Format schedule to allow tracking of status of submittals throughout duration of construction.
  4. Arrange information to include scheduled date for initial submittal, specification number and title, description of item of work covered, and role and name of subcontractor.
  5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

- a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

### **3.03 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

### **3.04 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

### **3.05 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.06 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy.
- B. Samples: Submit the number specified in individual specification sections, but not less than 3; one (minimum) of which will be retained by Architect.
  - 1. After review, produce duplicates.
  - 2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.07 SUBMITTAL PROCEDURES**

- A. Transmittal Form: TMP Submittal and Sample Transmittal Form must be completed and provided at the beginning of each submittal.
  - 1. Refer to Section 01 3000.01 - TMP Submittal and Sample Transmittal Form.
  - 2. Submittals without a completed TMP Submittal and Sample Transmittal Form will not be acknowledged, reviewed, or returned.
- B. Submittals shall be submitted in electronic form.
  - 1. Exceptions: Physical samples.

- a. Physical Samples must be accompanied by an electronic copy and a hard/physical copy of the completed TMP Submittal and Sample Transmittal Form.
- C. Electronic Submittals: Comply with the following:
  - 1. Submittal process shall be through a data management system (i.e. Submittal Exchange) or other approved method agreed to by the Architect and Owner.
  - 2. File Format: Portable Document Format (PDF).
  - 3. File Naming: File naming shall be in the following format:
    - a. Specification section number, followed by a hyphen, and a consecutive number indicating sequential submittals for that section; followed by a general description of the submittal contents.
      - 1) Examples:
        - (a) Section 07 9200; first submittal:
          - (1) 07 9200-01 Joint Sealants
        - (b) Section 07 9200; second submittal:
          - (1) 07 9200-02 Joint Sealant Color
      - b. Resubmittals. For revised resubmittals use original number and a sequential combination numerical and alphabetical suffix; hyphen followed by "R" and a two-digit consecutive number indicating sequential resubmittals for that particular submittal.
        - 1) Examples:
          - (a) Section 07 9200; resubmittal of first submittal of section:
            - (1) 07 9200-01-R01 Joint Sealants.
          - (b) Section 07 9200; second resubmittal of first submittal of section:
            - (1) 07 9200-01-R02 Joint Sealants
          - (c) Section 07 9200; first resubmittal of second submittal of section:
            - (1) 07 9200-02-R01 Joint Sealant Color
    - 4. Each Submittal shall be one file, complete with all attachments.
      - a. Multi-file submittal will not be acknowledged, reviewed, or returned.
  - D. General Requirements:
    - 1. Use a single transmittal for related items.
      - a. Each transmittal shall be for one specification section only; do not submit items for multiple sections under the same transmittal.
        - 1) Multi-section submittals will be acknowledged and returned; stamped "X - Not Approved - Resubmit".
    - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
    - 3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
    - 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
      - a. For each submittal for review, allow 14 calendar days excluding delivery time to and from the Contractor.
      - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendardays.
    - 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
    - 7. When revised for resubmission, identify all changes made since previous submission.
    - 8. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
    - 9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

10. Submittals not requested will be recognized and returned; stamped "NA - No Action Taken - Not Reviewed"
- E. Product Data Procedures:
  1. Submit only information required by individual specification sections.
  2. Collect required information into a single submittal.
  3. Submit concurrently with related shop drawing submittal.
  4. Do not submit (Material) Safety Data Sheets for materials or products unless specifically called for in individual sections.
- F. Shop Drawing Procedures:
  1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  2. Do not reproduce Contract Documents to create shop drawings.
  3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
  4. Non-complying submittals will be acknowledged and returned; stamped "X - Not Approved - Resubmit".
- G. Samples Procedures:
  1. Transmit related items together as single package.
  2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
  3. Submit actual physical samples.
  4. Electronic submittals will not be accepted unless prior approval is received from the Architect. Electronic samples without prior approval will be acknowledged and returned; stamped "X - Not Approved - Resubmit."

### **3.08 SUBMITTAL REVIEW**

- A. General: Submittals that do not conform to the requirements of this section will not be acknowledged, reviewed, or returned.
- B. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- C. Submittals for Information: Architect will acknowledge and may review. See below for actions to be taken.
- D. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
  1. Where more than one action has been indicated, each shall apply to that portion of the submittal for which the action is indicated.
- E. Architect's review shall not indicate approval of dimensions, quantities or fabrication processes unless specific notations are made by the Architect regarding same.
- F. Architect's and consultants' actions on items submitted for review:
  1. Authorizing purchasing, fabrication, delivery, and installation:
    - a. "Reviewed - No Exceptions Taken", "Approved", or language with same legal meaning.
    - b. "Reviewed with Corrections Noted", "Approved as Noted, Resubmission not required", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
  2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit", "Not Approved - Resubmit", or language with the same legal meaning.
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
  3. Not Authorizing manufacturer:
    - a. Rejected - Resubmit, or language with the same legal meaning.
- G. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
  - a. "No Action Taken - Not Reviewed" or "Received" - to notify the Contractor that the submittal has been received for record only.

**END OF SECTION**



**SECTION 01 4000 - QUALITY REQUIREMENTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Mock-ups.
- H. Tolerances.
- I. Manufacturers' field services.
- J. Defect Assessment.

**1.02 REFERENCE STANDARDS**

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- B. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- C. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

**1.03 DEFINITIONS**

- A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
  - 1. Design Services Types Required:
    - a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
- B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

**1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
  - 2. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- C. Test Reports: After each test/inspection, promptly submit 1 copies of report to Architect and to Contractor.
  - 1. Include:

- a. Date issued.
  - b. Project title and number.
  - c. Name of inspector.
  - d. Date and time of sampling or inspection.
  - e. Identification of product and specifications section.
  - f. Location in the Project.
  - g. Type of test/inspection.
  - h. Date of test/inspection.
  - i. Results of test/inspection.
  - j. Compliance with Contract Documents.
  - k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

#### **1.06 QUALITY ASSURANCE**

- A. Testing Agency Qualifications:
1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time specialist and responsible officer.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

#### **1.07 REFERENCES AND STANDARDS**

- A. Obtain copies of standards where required by product specification sections.
- B. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

#### **1.08 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, and ASTM E699.
  2. Inspection agency: Comply with requirements of ASTM E329.

3. Laboratory Staff: Maintain a full time specialist on staff to review services.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

**3.02 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect 5 working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Make corrections as necessary until Architect's approval is issued.
- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

**3.03 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

**3.04 TESTING AND INSPECTION**

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
  - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

**3.05 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**3.06 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

## **SECTION 01 4100 - REGULATORY REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SUMMARY OF REFERENCE STANDARDS**

- A. Regulatory requirements applicable to this project are the following:
  - 1. Barrier Free Code: Comply with the following:
    - a. Michigan Building Code; 2015.
    - b. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
  - 2. School Fire Safety Rules: Michigan School Fire Safety Rules; 2016.
    - a. Includes NFPA 101-2012 - Life Safety Code; 2012, plus amendments.
  - 3. Building Code: Michigan Building Code; 2015.
  - 4. Plumbing Code: Michigan Plumbing Code; 2018.
  - 5. Mechanical Code: Michigan Mechanical Code; 2015.
  - 6. Electrical Code: NFPA 70 - National Electric Code; 2017.
    - a. Includes 2017 Michigan Construction Code - Part 8 Electrical Code Rules.
  - 7. Elevator Code: Comply with the following:
    - a. ASME A17.1 - Safety Code for Elevators and Escalators; 2010.
    - b. ASME A18.1- Safety Standard for Platform Lifts and Stairway Chairlifts; 2011.
    - c. Michigan Elevator Safety Board General Rules.
  - 8. Boiler Code: Michigan Boiler Code.
    - a. Includes the following:
      - 1) ASME Boiler and Pressure Vessel Codes; 2010, plus 2011 addenda.
      - 2) National Board Inspection Code; 2011.
      - 3) PA 407 Skilled Trades Regulation Act; 2016.
  - 9. Energy Code: Michigan Energy Code; 2015.
    - a. Includes ASHRAE Std 90.1 I-P-2013- Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013.
  - 10. Existing Building Code: Michigan Rehabilitation Code; 2015.
- B. Where specification sections reference more current standards or codes, comply with the more restrictive requirements unless notified in writing by Architect.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

### **END OF SECTION**

## **SECTION 01 4216 - DEFINITIONS**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

#### **1.02 DEFINITIONS**

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

### **END OF SECTION**

**SECTION 01 4219 - REFERENCE STANDARDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements relating to referenced standards.

**1.02 QUALITY ASSURANCE**

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with the reference standard of date of issue specified in this section, except where a specific date is established by applicable code.
- C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

**PART 2 PRODUCTS -- NOT USED**

**PART 3 EXECUTION -- NOT USED**

**END OF SECTION**

**SECTION 01 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Code-required special inspections.
- B. Submittals.

**1.02 ABBREVIATIONS AND ACRONYMS**

- A. AHJ: Authority having jurisdiction.
- B. NIST: National Institute of Standards and Technology.

**1.03 DEFINITIONS**

- A. Code or Building Code: Michigan Building Code; 2015, specifically Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

**1.04 REFERENCE STANDARDS**

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
  - 1. Submit agency name, address, and telephone number, names of full time specialist and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of special inspection.
    - h. Date of special inspection.
    - i. Results of special inspection.
    - j. Compliance with Contract Documents.



2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.
  1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. Identification of fabricated item and specification section.
    - f. Location in the Project.
    - g. Results of special inspection.
    - h. Verification of fabrication and quality control procedures.
    - i. Compliance with Contract Documents.
    - j. Compliance with referenced standard(s).
- E. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
  1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test or inspection.
    - h. Date of test or inspection.
    - i. Results of test or inspection.
    - j. Compliance with Contract Documents.

#### **1.06 SPECIAL INSPECTION AGENCY**

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

#### **1.07 QUALITY ASSURANCE**

- A. Special Inspection Agency Qualifications:
  1. Independent firm specializing in performing testing and inspections of the type specified in this section.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL**

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
  1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
  2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

**3.02 SPECIAL INSPECTIONS**

- A. Special inspections and testing shall be for materials, installation, fabrication, erection or placement of components and connections as indicated on Drawings, but not less than that required by the building code.

**END OF SECTION**

**SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Field offices.

**1.02 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

**1.03 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power, consisting of connection to existing facilities.
    - a. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.
    - b. Do not disrupt Owner's need for continuous service.
    - c. Exercise measures to conserve energy.
  - 2. Water supply, consisting of connection to existing facilities.
    - a. Extend branch piping with outlets located so water is available by hoses with threaded connections. Prevent piping from freezing.
    - b. Exercise measures to conserve water.
  - 3. Permanent building lighting may be utilized during construction.
- B. Provide and pay for all lighting, heating and cooling, and ventilation required for construction purposes.
  - 1. Lighting: Provide and maintain LED, compact fluorescent, or high-intensity discharge as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
  - 2. Heating: Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
    - a. Existing facilities may be used, at no cost to Contractor, if Work is located in existing building.
  - 3. Cooling: Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
    - a. Existing facilities may be used, at no cost to Contractor, if Work is located in existing building.
- C. New permanent facilities may be used.

**1.04 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  - 2. Internet Connections: Minimum of one; DSL modem or faster.

- a. Owner will provide internet connections if Work is located in existing facilities that have an existing internet connection.

3. Provide superintendent with cellular telephone.

**1.05 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
  - 1. Use of existing facilities is permitted if Work is located in existing facility.
- B. Maintain daily in clean and sanitary condition.
- C. At end of construction, return facilities to same or better condition as originally found.

**1.06 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide protection for plants designated to remain. Replace damaged plants.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.07 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
  - 1. STC rating of 45 in accordance with ASTM E90.
  - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint surfaces exposed to view from Owner-occupied areas.

**1.08 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

**1.09 VEHICULAR ACCESS AND PARKING**

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
  - 1. Use of designated areas of existing parking facilities by construction personnel is permitted.
- E. Designate 2 parking spaces for Owner and Architect use.
- F. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

**1.10 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site weekly.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

**1.11 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table. Remove at completion of Work.
  - 1. Use of space in existing facilities may be permitted if Work is located in existing facility and Owner agrees.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.
- D. Provide weekly janitorial services for offices.

**1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore new permanent facilities used during construction to specified condition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 6000 - PRODUCT REQUIREMENTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Re-use of existing products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**PART 2 PRODUCTS****2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
  - 1. Refer to Drawings and Section 02 4100 - Demolition.

**2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.

**2.03 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Available Products: Products specified by naming one or more Manufacturers as an Available Product indicates that these Manufacturers' products may be provided but other comparable products and Manufacturers not named may also be provided without submitting a request for substitution.

**2.04 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver and place in location as directed; obtain receipt prior to final payment.

**PART 3 EXECUTION****3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 2500 - Substitution Procedures.

**3.02 OWNER-SUPPLIED PRODUCTS**

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

**3.03 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- G. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

**3.04 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.

- I. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Prevent contact with material that may cause corrosion, discoloration, or staining.
- M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**



**SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

**1.02 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
  - 6. Include in request:
    - a. Identification of Project.
    - b. Location and description of affected work.
    - c. Necessity for cutting or alteration.
    - d. Description of proposed work and products to be used.
    - e. Effect on work of Owner or separate Contractor.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.
- D. Warranties: For each affected material under warranty, submit written verification, signed by manufacturer of existing materials, stating that the Owner's full warranty will remain in effect after cutting and patching operations have been completed

**1.04 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

**1.05 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.

- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
  - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
  - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
  - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
  - 2. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.
- I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

#### **1.06 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

#### **1.07 WARRANTIES**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

### **PART 2 PRODUCTS**

#### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

#### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

#### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect 5 calendar days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with 1 copies to Architect, Owner, participants, and those affected by decisions made.

#### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.
4. Controlling lines and levels required for mechanical and electrical trades.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation only.
  1. Verify that construction and utility arrangements are as indicated.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
  1. Provide, erect, and maintain temporary dustproof partitions.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
  2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
  1. Remove items indicated on drawings.
  2. Relocate items indicated on drawings.
  3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
  1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

- a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
- b. Provide temporary connections as required to maintain existing systems in service.
- 4. Verify that abandoned services serve only abandoned facilities.
- 5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
  - 1. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
  - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

### **3.07 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- J. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    - a. This includes painted surfaces.
    - b. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.08 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.09 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.10 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner 7 calendar days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.11 DEMONSTRATION AND INSTRUCTION**

- A. See Section 01 7900 - Demonstration and Training.
- B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
- D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

### **3.12 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.13 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.14 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Contractor on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

**3.15 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**



**SECTION 01 7329 - CUTTING AND PATCHING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Cutting and patching.

**1.02 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
  - 6. Include in request:
    - a. Location and description of affected work.
    - b. Necessity for cutting or alteration.
    - c. Description of proposed work and products to be used.
    - d. Effect on work of Owner or separate Contractor.
- C. Warranties: For each affected material under warranty, submit written verification, signed by manufacturer of existing materials, stating that the Owner's full warranty will remain in effect after cutting and patching operations have been completed.

**1.04 WARRANTIES**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

**PART 2 PRODUCTS****2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- B. Prior to Patching: Before patching, verify compatibility and suitability of substrates, including compatibility with existing finishes or primers. Beginning of patching means acceptance of existing conditions.

**3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.

- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.
- D. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
- E. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

### **3.03 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cutting:
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces.
  - 2. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
  - 3. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400 - Firestopping, to full thickness of the penetrated element.
- I. Patching:
  - 1. Repair adjacent construction and finishes damaged during removal work and cutting work.
  - 2. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    - a. This includes painted surfaces.
    - b. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
  - 3. Match color, texture, and appearance.
  - 4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **END OF SECTION**

**SECTION 01 7800 - CLOSEOUT SUBMITTALS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

**1.02 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.01 PROJECT RECORD DOCUMENTS**

- A. General:
  - 1. Project Record Documents include:
    - a. Complete set of Record Drawings.
    - b. Complete set of Record Submittals.
    - c. Complete set of Specifications.
  - 2. Project Record Documents shall be submitted in electronic form.
    - a. File Format: Portable Document Format (PDF).
    - b. Files shall be named and organized in a searchable, easy to understand, system.
  - 3. Ensure entries are complete and accurate, enabling future reference by Owner.
  - 4. Record information concurrent with construction progress.
- B. Record Drawings: Record Drawings shall include the following:
  - 1. Complete set of Drawings.
    - a. Indicate and record actual construction including, but not limited to, the following:
      - 1) Show all systems and assemblies as they exist at completion of the Work.
      - 2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
      - 3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
      - 4) Field changes of dimension and detail.
      - 5) Details not on original Contract drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.

- C. Record Submittals: Record Submittals shall include the following:
  - 1. Complete set of Submittals, including resubmittals.
  - 2. Shop Drawings shall indicate all field changes and other variations from the Submittal as originally reviewed by Architect.
- D. Specifications: Specifications shall include the following:
  - 1. Complete Project Manual including all specifications, front end material, reports, and information available to bidders, as originally bid.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
  - 1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.

- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Include test and balancing reports.
- N. Additional Requirements: As specified in individual product specification sections.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. General:
  - 1. Operational and Maintenance Manuals include:
    - a. Operational and maintenance data.
    - b. Operational and maintenance data for materials and finishes.
    - c. Operational and maintenance data for equipment and systems.
  - 2. Operational and Maintenance Manuals shall be submitted both in electronic form and as hard copy/durable manuals.
    - a. Subject to Owner approval, hard copy/durable manuals may be omitted.
    - b. Electronic File Format: Portable Document Format (PDF).
      - 1) Files shall be named and organized in a searchable, easy to understand, system similar to the descriptions for the hard copy/durable manuals
- B. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- C. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- D. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- K. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Operation and maintenance data.
    - c. Field quality control data.
    - d. Photocopies of warranties and bonds.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

### **END OF SECTION**

**SECTION 01 7900 - DEMONSTRATION AND TRAINING****PART 1 GENERAL****1.01 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Finishes, including flooring, wall finishes, ceiling finishes.
  - 2. Fixtures and fittings.
  - 3. Items specified in individual product Sections.

**1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit not less than four weeks prior to start of training.
  - 2. Revise and resubmit until acceptable.
  - 3. Provide an overall schedule showing all training sessions.
  - 4. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

**1.03 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.
- B. Coordination: Coordinate demonstration and training of this section with project commissioning requirements.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

**3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  - 10. Review spare parts and tools required to be furnished by Contractor.
  - 11. Review spare parts suppliers and sources and procurement procedures.



- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

## **SECTION 02 4100 - DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.
- C. Abandonment and removal of existing utilities and utility structures.
- D. Salvaged items.
- E. Removed and reinstalled items.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 04 2000 - Unit Masonry: Salvaging existing brick.

#### **1.03 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).
- B. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

#### **1.05 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  - 1. Minimum of 5 years of documented experience.

### **PART 2 PRODUCTS - NOT USED**

#### **2.01 MATERIALS**

- A. Fill Material: As specified in Division 31.

### **PART 3 EXECUTION**

#### **3.01 SCOPE**

- A. Remove portions of existing building as indicated on Drawings including, but not limited to, the following:
  - 1. Remove all paving and curbs as indicated on drawings.
  - 2. Remove indicated foundation walls and footings completely.
  - 3. Remove concrete slabs on grade as indicated on drawings.
  - 4. Remove manholes and manhole covers, curb inlets and catch basins.
  - 5. Remove other items indicated, for salvage and relocation.
  - 6. Unless otherwise indicated, fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Division 31.

#### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with other requirements specified in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Prior to start of demolition operations, perform an engineering survey of building condition to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures.
  - 4. Use of explosives is not permitted.
  - 5. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

6. Provide, erect, and maintain temporary barriers and security devices.
  7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  8. Do not close or obstruct roadways or sidewalks without permit.
  9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
  2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, PCB's, and mercury.
- H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### **3.03 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
1. Where concrete cannot be cut full depth, cut concrete to a depth of at least 3/4 inch. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
1. Refer to Section 04 2000 - Unit Masonry for salvaging brick.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI (RWP). Do not use methods requiring solvent-based adhesive strippers.
- E. Carpet: Remove carpet and adhesive according to industry standard and below. Do not use methods requiring solvent-based adhesive strippers.
1. Remove carpet in manageable sections and dispose.
  2. Using a floor scraper, scrape residual of carpet and adhesive from concrete.
  3. Sand the floor by mechanical means starting with a heavy grit to remove the bulk of the left adhesive and then a finer grit (approx 300) for the finish sand to allow new finish to be applied.

### **3.04 EXISTING UTILITIES**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

### **3.05 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction as specified and/or indicated on Drawings .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove items indicated on Drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  - 3. Verify that abandoned services serve only abandoned facilities before removal.
  - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch as specified for patching new work.

### **3.06 SALVAGED ITEMS**

- A. Clean salvaged items.
- B. Pack or crate items after cleaning. Identify contents of containers.
- C. Store items in a secure area until delivery to Owner.
- D. Transport items to Owner's storage area on-site.
- E. Protect items from damage during transport and storage.

### **3.07 REMOVED AND REINSTALLED ITEMS**

- A. Clean and repair items to functional condition adequate for intended reuse.
- B. Pack or crate items after cleaning and repairing. Identify contents of containers.
- C. Protect items from damage during transport and storage.

- D. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

**3.08 EXISTING ITEMS TO REMAIN**

- A. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete

**3.09 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

## SECTION 05 5000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous framing and supports.
  - 2. Shelf angles.
  - 3. Metal bollards.
  - 4. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Requirements:
  - 1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

#### 1.2 COORDINATION

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

#### 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Shop primers.
  - 2. Shrinkage-resisting grout.
  - 3. Metal bollards.
- B. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
  - 1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
  - 2. Shelf angles.
  - 3. Metal bollards.
  - 4. Loose steel lintels.

#### 1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.5 FIELD CONDITIONS

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

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

#### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

#### 2.3 FASTENERS

- A. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

- B. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

## **2.5 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- I. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## **2.6 MISCELLANEOUS FRAMING AND SUPPORTS**

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

## **2.7 SHELF ANGLES**

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
  - 1. Provide mitered and welded units at corners.
  - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. Galvanize shelf angles located in exterior walls.
- C. Prime shelf angles located in exterior walls with zinc-rich primer.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## **2.8 LOOSE BEARING AND LEVELING PLATES**

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

## **2.9 LOOSE STEEL LINTELS**

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

## **2.10 GENERAL FINISH REQUIREMENTS**

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

## **2.11 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.



Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

- C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

### **3.2 INSTALLATION OF SHELF ANGLES**

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

### **3.3 INSTALLATION OF METAL BOLLARDS**

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
1. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- D. Fill bollards solidly with concrete, mounding top surface to shed water.
1. Do not fill removable bollards with concrete.

### **3.4 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES**

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

### **3.5 REPAIRS**

- A. Touchup Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
  2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

### **END OF SECTION**

**SECTION 07 9200 - JOINT SEALANTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Section 07 8400 - Firestopping: Firestopping sealants.
- E. Section 07 9100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.
- F. Section 08 8000 - Glazing: Glazing sealants and accessories.
- G. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

**1.02 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).
- C. ASTM C834 - Standard Specification for Latex Sealants 2017.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2023.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
- I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).
- J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
  - 5. Substrates for which use of primer is required.
  - 6. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where custom colors are not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: For each sealant color, submit at least three physical samples for color verification.
  - 1. Provide 1/2 inch wide joint sealant samples formed between two 4 inch long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- H. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least 5 years of documented experience.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
  - 1. Adhesion Testing: In accordance with ASTM C794.
  - 2. Compatibility Testing: In accordance with ASTM C1087.
  - 3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
  - 4. Allow sufficient time for testing to avoid delaying the work.
  - 5. Deliver to manufacturer sufficient samples for testing.
  - 6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
  - 7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- D. Owner may employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
  - 1. Contractor shall cooperate with testing agency and repair failures discovered.
  - 2. Otherwise, if Owner does not employ an independent testing agency, Contractor shall perform its own field quality control measures including the following:
    - a. Field Quality Control Plan and Log.
    - b. Field Adhesion Test Procedures.
- E. Field Quality Control Plan:
  - 1. Visual inspection of entire length of sealant joints.
  - 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 120 inches thereafter.
    - b. If any failures occur in the first 10 linear feet, continue testing at 48 inch intervals at no extra cost to Owner.
- F. Field Adhesion Test Procedures:
  - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
  - 2. Have a copy of the test method document available during tests.
  - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
  - 4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
  - 5. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
    - a. Record results on Field Quality Control Log.
    - b. Repair failed portions of joints.

**1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

**PART 2 PRODUCTS****2.01 JOINT SEALANT APPLICATIONS**

- A. Scope:
  - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    - a. Wall expansion and control joints.
    - b. Joints between door, window, and other frames and adjacent construction.
    - c. Joints between different exposed materials.
    - d. Openings below ledge angles in masonry.
    - e. Other joints as indicated.
  - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. Other joints as indicated.
  - 3. Do not seal the following types of joints.
    - a. Intentional weepholes in masonry.
    - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    - d. Joints where installation of sealant is specified in another section.
    - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
  - 1. Control and Expansion Joints in Concrete Paving: Self-leveling silicone traffic-grade sealant.
- C. Interior Joints: Use non-sag acrylic emulsion latex sealant, unless otherwise indicated.
  - 1. Interior Sides of Aluminum Framing in Exterior Walls: Use non-sag non-staining silicone sealant, unless otherwise indicated.
    - a. Includes, but is not limited to, curtain walls, storefronts, and metal-framed skylights.
  - 2. Control Joints in Interior Concrete Slabs: Self-leveling silicone "traffic grade" sealant.
  - 3. Column Isolation Joints in Interior Concrete Slabs: Self-leveling silicone "traffic grade" sealant.
  - 4. Floor Joints in Wet Areas: Self-leveling silicone "traffic grade" sealant; not for continuous liquid immersion
  - 5. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear, unless otherwise indicated.
  - 6. Joints between countertops and walls: Mildew-resistant silicone sealant; clear, unless otherwise indicated.
- D. Interior Wet Areas: Includes, but is not limited to, toilet rooms, showering areas, locker rooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

**2.02 NONSAG JOINT SEALANTS**

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Type S, Uses NT, A, G, M and O; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum.

2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  4. Hardness Range: Comply with one of the following:
    - a. 15 to 35, Shore A, when tested in accordance with ASTM C661.
    - b. 25 to 35, Shore A, when tested in accordance with ASTM D2240.
  5. Color: Custom color(s) to match Architect's sample(s).
  6. Cure Type: Single-component, neutral moisture curing.
  7. Service Temperature Range: Minus 40 to 250 degrees F.
  8. Products:
    - a. Momentive Performance Materials, Inc./GE; SCS9000 SilPruf NB: [www.siliconeforbuilding.com](http://www.siliconeforbuilding.com).
    - b. Pecora Corporation; 890NST: [www.pecora.com](http://www.pecora.com).
    - c. Sika Corporation; Sikasil WS-295 FPS: [www.usa.sika.com](http://www.usa.sika.com).
    - d. Tremco, Inc.; Spectrem 3: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Traffic Grade Silicone Sealant: ASTM C920, Grade NS, Type S, Uses T, M, and O; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum
  2. Hardness Range: Comply with one of the following:
    - a. 5 to 15, Shore A, when tested in accordance with ASTM C661.
    - b. 85, Shore 00, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's full range.
  4. Cure Type: Single-component, neutral moisture curing.
  5. Service Temperature Range: Minus 40 to 250 degrees F.
  6. Products:
    - a. Dow Corning; NS Parking Structure Sealant: [www.dowcorning.com](http://www.dowcorning.com).
    - b. Pecora Corporation; 311NS: [www.pecora.com](http://www.pecora.com).
    - c. Sika Corporation; Sikasil - 728 NS: [www.usa.sika.com](http://www.usa.sika.com).
    - d. Tremco, Inc.; Spectrem 800: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Type S, Uses NT, A, G, and O; mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: Comply with one of the following:
    - a. 15 to 35, Shore A, when tested in accordance with ASTM C661.
    - b. 25 to 35, Shore A, when tested in accordance with ASTM D2240.
  3. Color: Clear.
  4. Cure Type: Single-component, acetoxy or neutral moisture curing .
  5. Service Temperature Range: Minus 40 to 300 degrees F.
  6. Products:
    - a. Dow Corning; 786 Sealant M: [www.dowcorning.com](http://www.dowcorning.com).
    - b. Momentive Performance Materials, Inc./GE; SCS1700 Sanitary: [www.siliconeforbuilding.com](http://www.siliconeforbuilding.com).
    - c. Pecora Corporation; 898NST: [www.pecora.com](http://www.pecora.com).
    - d. Sika Corporation; Sikasil - GP: [www.usa.sika.com](http://www.usa.sika.com).
    - e. Tremco, Inc.; Tremsil 200 with fungicide: [www.tremcosealants.com](http://www.tremcosealants.com).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use. Siliconized.
1. Color: To be selected by Architect from manufacturer's full range.

2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
3. Products:
  - a. Franklin International Inc; Titebond Painter's Plus Caulk: [www.titebond.com](http://www.titebond.com).
  - b. Pecora Corporation; AC-20 +Silicone: [www.pecora.com](http://www.pecora.com).
  - c. Sherwin Williams; 950A Siliconized Acrylic Latex Caulk: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - d. Tremco, Inc.; Tremflex 834: [www.tremcosealants.com](http://www.tremcosealants.com).
  - e. Substitutions: See Section 01 6000 - Product Requirements.

### **2.03 SELF-LEVELING SEALANTS**

- A. Self-Leveling Silicone Sealant: ASTM C920, Type S, Grade P, Uses T, M and O; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
  1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  2. Hardness Range: Comply with one of the following:
    - a. 5 to 20, Shore A, when tested in accordance with ASTM C661.
    - b. 40 to 85, Shore 00, when tested in accordance with ASTM D2240.
  3. Color: To be selected by Architect from manufacturer's full range.
  4. Cure Type: Single-component, neutral moisture curing.
  5. Service Temperature Range: Minus 50 to 300 degrees F.
  6. Products:
    - a. Dow Corning; SL Parking Structure Sealant: [www.siliconeforbuilding.com](http://www.siliconeforbuilding.com).
    - b. Pecora Corporation; 310SL: [www.pecora.com](http://www.pecora.com).
    - c. Sika Corporation; Sikasil-728 SL: [www.usa.sika.com](http://www.usa.sika.com).
    - d. Tremco, Inc.; Spectrem 900SL: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.

### **2.04 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  3. Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.
- I. Installation of Two-Stage Joints at Precast Architectural Concrete Units:
  - 1. Joint system consists of two back-to-back sealant joints at each precast architectural concrete unit joint with a weep at the bottom of the unit joint per Precast/Prestressed Concrete Institute (PCI) recommendations and as follows:
    - a. Inner (Secondary) Seal: Inner secondary backer rod and sealant joint is installed a minimum of 2 to 2-1/2 inches beyond the exposed face of the precast architectural concrete panels within the panel joint itself.
    - b. Exterior (Primary) Seal: Following the installation of the secondary joint, the outer primary backer rod and sealant joint is installed at the face of the precast architectural concrete panels with a weep at the bottom of the joint. Leave open continuous air space between the primary backer rod and inner secondary seal.
    - c. Install 3/8 inch minimum weep openings in the exterior seal to allow water penetrating the exterior seal and contained by the inner seal to exit the cavity between joint seals.
      - 1) Do not install weeps below finish grades.
    - d. Near the junction of horizontal and vertical joints, the inner seal must turn out to the plane of the exterior seal at regular intervals to force water out of the joint.

### **3.04 FIELD QUALITY CONTROL**

- A. Owner may employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

### **END OF SECTION**

**SECTION 08 1610 - FRP-FACED ALUMINUM DOORS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Flush aluminum doors with fiberglass reinforced plastic (FRP) face sheets.
  - 1. Includes FRP-faced aluminum doors
- B. FRP Framing

**1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between door frames and adjacent construction.
- B. Section 08 7100 - Door Hardware: Hardware for FRP-faced aluminum doors.

**1.03 ABBREVIATIONS**

- A. FRP: Fiberglass reinforced plastic.

**1.04 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- B. AAMA 701/702 - Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals 2011.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- D. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- J. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- K. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics 2016.
- L. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates 2022.
- M. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- N. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films 2007 (Reapproved 2015).
- O. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.
- P. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.
- Q. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2017.
- R. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.



- S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- T. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each type of door and frame; include information on fabrication methods, hardware preparation, accessories, installation, and maintenance instructions.
- C. Shop Drawings: Include elevations of each opening type and details at each wall type.
  - 1. Include details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
- D. Selection Samples: Complete set of color and finish options, using actual materials, for Architect's selection.
- E. Verification Samples: Three actual pieces of products in each finish specified, not less than 4 inches square or 6 inches long for linear components.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver aluminum components in manufacturer's standard protective packaging, palletted, crated, or banded together.
- B. Inspect delivered components for damage and replace. Repaired components will not be accepted.
- C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
- D. Protect materials and finish from damage during handling and installation.

**1.08 FIELD CONDITIONS**

- A. Do not begin installation of interior aluminum components until space has been enclosed and ambient thermal conditions are being maintained at levels consistent with final project requirements.

**1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year manufacturer warranty for defects in workmanship and materials.
- C. Provide 25 year warranty on fiberglass reinforced plastic (FRP) face sheets covering delamination, bubbling, and panel corrosion.
- D. Provide 20 year warranty on aluminum finishes in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Flush Aluminum Doors with Fiberglass Reinforced Plastic (FRP) Face Sheets:
  - 1. Special-Lite, Inc.; SL-17 Door: [www.special-lite.com](http://www.special-lite.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Aluminum Insert Framing:
  - 1. Special-Lite, Inc.; 10-30 Series Inset Framing: [www.special-lite.com](http://www.special-lite.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 DESIGN CRITERIA**

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Factory install door hardware to the greatest extent possible.
- C. Accessibility: Conform to ICC A117.1 and ADA Standards.
- D. Door Dimensions and Shapes: As indicated on Drawings; dimensions indicated are nominal.
  - 1. Provide the following clearances:
    - a. Hinge and Lock Stiles: 1/8 inch.
    - b. Between Meeting Stiles: 1/4 inch.
    - c. At Top Rail and Bottom Rail: 1/8 inch.

**2.03 MATERIALS**

- A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy 5005, temper H14, stretcher leveled.
- B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.
- C. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:
  - 1. Ultraviolet stabilized.
  - 2. Surface Burning Characteristics: Flame spread index (FSI) of 76 to 200, Class C, and smoke developed index (SDI) of 450 or less; when tested in accordance with ASTM E84.
  - 3. Izod Impact Resistance: ASTM D256, 12 ft lbf/inch of width, minimum, with notched izod.
  - 4. Tensile Strength at Break: ASTM D638, 13,000 psi, minimum.
  - 5. Water Absorption: ASTM D570, 0.20 percent, maximum, after 24 hours at 74 degrees F.
  - 6. Flexural Strength: ASTM D790, 21,000 psi, minimum.
  - 7. Barcol Hardness: ASTM D2583, minimum of 50 units.
- D. Foam Insulation Fill Material:
  - 1. Manufacturer's standard polystyrene or polyurethane foam.
    - a. Compressive Strength:
      - 1) Polyurethane: 60 psi; ASTM D1621.
    - b. Thermal Resistance:
      - 1) Polyurethane: R-value 6.8 per inch, minimum; ASTM C518.

**2.04 DOORS**

- A. Flush Aluminum Doors with Fiberglass Reinforced Plastic (FRP) Face Sheets:
  - 1. Overall Door Thickness: 1-3/4 inches.
  - 2. Internal Framing: Extruded aluminum tubing, 1/8 inch minimum thickness, with heavy-duty plated steel through bolts in rails.
    - a. Top and Bottom Rails: 6 inches wide.
    - b. Side Stiles: 2-1/2 inches wide.
  - 3. Provide manufacturer's standard aluminum and steel reinforcements for door hardware; 1/8 inch minimum thickness.
  - 4. Facing: Seamless laminated FRP sheet.
    - a. Sheet Thickness: 0.12 inch, minimum.
    - b. Texture - FRP: Pebble grain.
    - c. Color: As selected by Architect from manufacturer's standard line.

5. Perimeter Edges: Extruded aluminum caps or returns that capture and secure edges of FRP face sheets.
  - a. Door Edge Profile: Hinged edge square, and lock edge beveled.
6. Core: Foam insulation fill material.
7. Aluminum Finish: Superior performing organic coating.
  - a. Color: As selected by Architect from manufacturer's standard line.
8. Hardware:
  - a. Weatherstripping: Replaceable pile type; at jambs and head of exterior doors.
  - b. Bottom Sweep: Manufacturer's concealed adjustable bottom brush.
  - c. Door Pulls: Provide recessed flush door pulls, unless otherwise indicated.
    - 1) Products:
      - (a) Special-Lite, Inc.; SL-82: [www.special-lite.com](http://www.special-lite.com).
      - (b) Substitutions: See Section 01 6000 - Product Requirements.
  - d. Balance of Hardware: Refer to Section 08 7100 - Door Hardware.

## **2.05 FRAMING**

- A. Fiberglass Framing System: Basis of Design Special-Lite AF-150 Fiberglass Framing System.
  1. Wall Thickness: 1/4".
  2. Includes integral door stop.
  3. Weatherstripping: Replaceable pile type.
  4. Corner Joints: Mitered.
  5. Finish: Architect to select from standard satin colors.

## **2.06 MISCELLANEOUS COMPONENTS**

- A. Louvers: Blades and frame of extruded aluminum, minimum 0.06 inch thick; size as indicated.
  1. Style: Sightproof inverted V or Y blades

## **2.07 FINISHES FOR ALUMINUM**

- A. Superior Performing Organic Coatings: Multiple coats, thermally cured polyvinylidene fluoride (PVDF) system; AAMA 2605.
  1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, with minimum 70 percent PVDF color topcoat and minimum dry film thickness 0.9 mil; color and gloss as indicated on drawings.
  2. Color: Two or three-coat custom color to match Architect's sample.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **2.08 ACCESSORIES**

- A. Replaceable Weatherstripping: AAMA 701/702 wool pile.
- B. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
  1. Provide concealed fasteners where possible.
  2. Exposed fasteners shall match finish of doors and frames.
- C. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.
- D. Laminating Adhesive: Manufacturer's standard low-VOC materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.
- B. Verify that frames installed by other trades for installation of doors of this section are in strict accordance with recommendations and approved shop drawings and within tolerances specified in manufacturer's instructions.

- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.02 PREPARATION**

- A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
- B. Replace components with damage to exposed finishes.
- C. Separate dissimilar metals to prevent electrolytic action between metals.

**3.03 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions.
- B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
- C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.
- D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.
- E. Install door hardware as specified in Section 08 7100.
- F. Comply with glazing installation requirements of Section 08 8000.
- G. Coordinate installation of electrical connections to electrical hardware items.

**3.04 FIELD QUALITY CONTROL**

- A. Provide services of FRP door manufacturer's field representative to observe for proper installation of system and submit report.

**3.05 TOLERANCES**

- A. Tolerances: Install framing systems in accordance with the following tolerances:
  - 1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length.
  - 2. Offset from Alignment: Maximum offset from true alignment between 2 identical members abutting end to end in line shall not exceed 1/16 inch.
  - 3. Diagonal Measurements: Maximum difference in diagonal measurements shall not exceed 1/8 inch.
  - 4. Offset at Corners: Maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch.

**3.06 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

**3.07 CLEANING**

- A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.
- B. Do not use abrasive, caustic, or acid cleaning agents.

**3.08 PROTECTION**

- A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.
- B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

**END OF SECTION**

**SECTION 08 7100 - DOOR HARDWARE****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
  - 1. Mechanical and electrified door hardware
  - 2. Electronic access control system components
  - 3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Section excludes:
  - 1. Windows
  - 2. Cabinets (casework), including locks in cabinets
  - 3. Signage
  - 4. Toilet accessories
  - 5. Overhead doors
- C. Related Sections:
  - 1. Division 01 Section "Alternates" for alternates affecting this section.
  - 2. Division 06 Section "Rough Carpentry"
  - 3. Division 06 Section "Finish Carpentry"
  - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
  - 5. Division 08 Sections:
    - a. "Metal Doors and Frames"
    - b. "Flush Wood Doors"
    - c. "Stile and Rail Wood Doors"
    - d. "Interior Aluminum Doors and Frames"
    - e. "Aluminum-Framed Entrances and Storefronts"
    - f. "Stainless Steel Doors and Frames"
    - g. "Special Function Doors"
    - h. "Entrances"
  - 6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
  - 7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
  - 8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

**1.02 REFERENCES**

- A. UL LLC
  - 1. UL 10B - Fire Test of Door Assemblies
  - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
  - 3. UL 1784 - Air Leakage Tests of Door Assemblies
  - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
  - 1. Sequence and Format for the Hardware Schedule
  - 2. Recommended Locations for Builders Hardware
  - 3. Keying Systems and Nomenclature
  - 4. Installation Guide for Doors and Hardware
- C. NFPA – National Fire Protection Association
  - 1. NFPA 70 – National Electric Code
  - 2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
  - 3. NFPA 101 – Life Safety Code
  - 4. NFPA 105 – Smoke and Draft Control Door Assemblies
  - 5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

**1.03 SUBMITTALS**

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
  - a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
  - b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
  - c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. Wiring Diagrams: For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.
    - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
  - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
  - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
  - c. Indicate complete designations of each item required for each opening, include:
    - 1) Door Index: door number, heading number, and Architect's hardware set number.
    - 2) Quantity, type, style, function, size, and finish of each hardware item.
    - 3) Name and manufacturer of each item.
    - 4) Fastenings and other pertinent information.
    - 5) Location of each hardware set cross-referenced to indications on Drawings.
    - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
    - 7) Mounting locations for hardware.
    - 8) Door and frame sizes and materials.

- 9) Degree of door swing and handing.
- 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
- 5. Key Schedule:
  - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
  - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
  - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
  - 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
  - 2. Provide Product Data:
    - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
  - 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
    - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Final approved hardware schedule edited to reflect conditions as installed.
    - d. Final keying schedule
    - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
    - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- E. Inspection and Testing:
  - 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
    - a. Fire door assemblies, in compliance with NFPA 80.
    - b. Required egress door assemblies, in compliance with NFPA 101.

#### **1.04 QUALITY ASSURANCE**

- A. Qualifications and Responsibilities:
  - 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
  3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
    - a. For door hardware: DHI certified AHC or DHC.
    - b. Can provide installation and technical data to Architect and other related subcontractors.
    - c. Can inspect and verify components are in working order upon completion of installation.
    - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
  4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
1. Fire-Rated Door Openings:
    - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
    - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
  2. Smoke and Draft Control Door Assemblies:
    - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
  3. Electrified Door Hardware
    - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
  4. Accessibility Requirements:
    - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
1. Keying Conference
    - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      - 2) Preliminary key system schematic diagram.
      - 3) Requirements for key control system.
      - 4) Requirements for access control.
      - 5) Address for delivery of keys.
  2. Pre-installation Conference
    - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Inspect and discuss preparatory work performed by other trades.
    - c. Inspect and discuss electrical roughing-in for electrified door hardware.
    - d. Review sequence of operation for each type of electrified door hardware.



- e. Review required testing, inspecting, and certifying procedures.
- f. Review questions or concerns related to proper installation and adjustment of door hardware.
- 3. Electrified Hardware Coordination Conference:
  - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

**1.06 COORDINATION**

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

**1.07 WARRANTY**

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
  - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
  - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

**1.08 MAINTENANCE**

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Certain products have been specified for their distinctive characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. These products are specified without the notation: "Acceptable Manufacturers", and substitutes will not be considered.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

## **2.02 MATERIALS**

- A. Fabrication
  - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
  - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
  - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
  - 1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  - 2. Use materials which match materials of adjacent modified areas.
  - 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- D. Cable and Connectors:
  - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
  - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
  - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

## **2.03 CONTINUOUS HINGES**

- A. Manufacturers:
  - 1. Scheduled Manufacturer:
    - a. Ives
  - 2. Acceptable Manufacturers:
    - a. Select
    - b. Best
- B. Requirements:
  - 1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
  - 2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
  - 3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
  - 4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
  - 5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.

6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

#### **2.04 MORTISE LOCKS**

- A. Manufacturers and Products:
  1. Scheduled Manufacturer and Product:
    - a. Accurate 9000M series
- B. Requirements:
  1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
  2. Provide locks manufactured from heavy gauge stainless steel to protect from corrosion.
  3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw 316 stainless steel mechanical anti-friction latchbolt.
  4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
  5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
    - a. Lever Design: Schlage 17A

#### **2.05 CYLINDERS**

- A. Manufacturers:
  1. Scheduled Manufacturer and Product:
    - a. Match existing key/cylinder system as determined by owner.
- B. Requirements:
  1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

#### **2.06 KEYING**

- A. Scheduled System:
  1. Existing key system:
    - a. Provide cylinders/cores keyed into Owner's existing keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
  1. Construction Keying:
    - a. Temporary Construction Cylinder Keying.
      - 1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
        - a) Split Key or Lost Ball Construction Keying System.
        - b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
        - c) 12 construction change (day) keys.
      - 2) Owner or Owner's Representative will void operation of temporary construction keys.
    - b. Replaceable Construction Cores.
      - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
        - a) 3 construction control keys
        - b) 12 construction change (day) keys.
      - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
  2. Permanent Keying:

- a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
  - 1) Master Keying system as directed by the Owner.
- b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
- c. Provide keys with the following features:
  - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
  - 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
- d. Identification:
  - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
  - 2) Identification stamping provisions must be approved by the Architect and Owner.
  - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
  - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
  - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
  - 1) Change (Day) Keys: 3 per cylinder/core.
  - 2) Permanent Control Keys: 3.
  - 3) Master Keys: 6.

## **2.07 DOOR CLOSERS**

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product:
    - a. LCN 4010/4110/4020 series
  - 2. Acceptable Manufacturers and Products:
    - a. Sargent 281 series
- B. Requirements:
  - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
  - 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
  - 3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
  - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
  - 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
  - 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
  - 7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
  - 8. Pressure Relief Valve (PRV) Technology: Not permitted.

9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## **2.08 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING**

### **A. Manufacturers:**

1. Scheduled Manufacturer:
  - a. Zero International
2. Acceptable Manufacturers:
  - a. National Guard
  - b. Reese

### **B. Requirements:**

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

## **2.09 FINISHES**

- a. Provide finishes as specified unless otherwise determined by owner/architect.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Where on-site modification of doors and frames is required:
  1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  2. Field modify and prepare existing doors and frames for new hardware being installed.
  3. When modifications are exposed to view, use concealed fasteners, when possible.
  4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### **3.03 INSTALLATION**

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
  - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
  - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
  - 1. Install construction cores to secure building and areas during construction period.
  - 2. Replace construction cores with permanent cores as indicated in keying section.
  - 3. Furnish permanent cores to Owner for installation.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- P. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

### **3.04 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

### **3.05 CLEANING AND PROTECTION**

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

**3.06 DOOR HARDWARE SCHEDULE**



- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):

A117A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	MARINE GRADE MORTISE LOCKSET (LESS TRIM)	9059M / 9159M (STOREROOM FUNC)		626	ACC
1	EA	LOCK LEVER TRIM	17A/N LEVERS		626	SCH
1	EA	MORTISE CYLINDER/CORE	TO MATCH EXISTING SYSTEM		626	B/O
1	EA	SURFACE CLOSER	4111 SCUSH SRI		689	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 (AS REQ'D) SRI		689	LCN
1	EA	BLADE STOP SPACER	4110-61 (AS REQ'D) SRI		689	LCN
1	EA	GASKETING/SEALS	BY DOOR/FRAME MANUFACTURER			B/O
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	654A		A	ZER

**END OF SECTION**

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**SECTION 09 9123 - INTERIOR PAINTING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Specification for Caynon Tone for clear block sealer is in Specification 07 1900 Water Repellent Acrylic Penetrating Sealer.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
  - 9. Glass.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits.

**1.02 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.03 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- G. SSPC-SP 13 - Surface Preparation of Concrete 2018.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
  - 3. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
  - 4. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- C. Paints:
  - 1. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 2. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - 3. Benjamin Moore; [www.benjaminmoore.com/#sle](http://www.benjaminmoore.com/#sle)
- D. Primer Sealers: Same manufacturer as top coats.
- E. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. Architectural coatings VOC limits of the State in which the Project is located.
  2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
  2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.
  4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

### 2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
  2. Top Coat(s): Interior Latex; MPI #44, 53, 54.
    - a. Products:
      - 1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #53)
      - 2) PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell. (MPI #44)
      - 3) PPG Paints Speedhide Zero Interior Latex, 6-4510XI Series, Semi-Gloss. (MPI #54)
      - 4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat B30W12651 (MPI #53).
      - 5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)
      - 6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eggshell. (MPI #52)
  3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Eggshell: MPI gloss level 3; use this sheen at gypsum board, except at ceilings and wood.
    - c. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
    - d. Semi-Gloss: MPI gloss level 5; use this sheen at masonry and metals .
  4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:

1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior Latex - Steel Doors and Door Frames; #141.
  - a. Products:
    - 1) PPG Paints Pure Performance Interior Latex, 9-510XI Series, Semi-Gloss. (MPI #141)
    - 2) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46W01151 Semi-Gloss. (MPI #141)
4. Top Coat(s): Interior Light Industrial Coating, Aluminum, Ferrous Metal Galvanized Steel except Steel Door and Frames Water Based; MPI #153.
  - a. Products:
    - 1) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel. 4216 HP Series, Semi-Gloss. (MPI #153)
    - 2) Sherwin-Williams Pro Industrial DTM Acrylic Semi-Gloss, B66W01150 Series. (MPI #153)
5. Top Coat Sheen:
  - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- C. Paint I-OP-MD-WC - Medium Duty Vertical: Including Structural Glazed Facing Tile.
  1. Two top coats and one coat primer.
  2. Top Coat(s): High Performance Architectural Interior Latex; MP #141.
    - a. Products:
      - 1) PPG Paints Pure Performance Interior Latex, 9-310XI Series, Eggshell. (MPI #138)
      - 2) PPG Paints Pure Performance Interior Latex, 9-510XI Series, Semi-Gloss. (MPI #141)
      - 3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
      - 4) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
  1. Shop primer by others.
  2. One top coat.
  3. Top Coat: Latex Dry Fall; MPI #118.
    - 1) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog Latex, 6-725XI Series, Flat. (MPI #118)
  - b. Products:
    - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
    - 2) Substitutions: Section 01 6000 - Product Requirements.
  4. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen at exposed ceiling.
  5. Primer: As recommended by top coat manufacturer for specific substrate.
- E. Paint I-TR-C - Solid Color Stain Finish on Concrete Floors.
  1. 1 coat stain.
  2. Stain: Solid Color Stain for Concrete.
    - a. Products:
      - 1) PPG Paints Perma-Crete Color Seal WB Interior/Exterior Acrylic Concrete Stain, 4-4210XI Series, Satin.
      - 2) H&C; Colortop Water-Based Solid Color Concrete Stain.
      - 3) Substitutions: Section 01 6000 - Product Requirements.

- F. Paint I-TR-DE - Interior Surfaces to be Finished with Dry Erase Coating.
  - 1. Intermediate Coat Dry Erase Two coats
    - a. PPG; Speedhide Zero Interior Zero-VOC Latex Semi-Gloss, 6-4500 Series; MPI #54
  - 2. c. Sherwin Williams; ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series MPI #52
  - 3. Top Coat(s): Dry Erase Clear Coating, Waterbased Polyurethane.Two Coats
    - a. Products:
      - 1) Sherwin-Williams Dry Erase Clear Gloss Coating; DFT 4.0 mils
      - 2) MDC; FUSE Dry Erase Coating; DFT 4.0 mils.
      - 3) IdeaPaint; IdeaPaint Create White; DFT 5.0 mils.
      - 4) Benjamin Moore; Notable Dry Erase Paint; DFT 3.5 mils.
      - 5) Substitutions: Section 01 6000 - Product Requirements.
  - 4. Top Coat(s): Dry Erase White Coating, Waterbased Polyurethane.
    - a. Products:
      - 1) MDC; FUSE Dry Erase Coating; DFT 4.0 mils.
      - 2) IdeaPaint; IdeaPaint Create White; DFT 5.0 mils.
      - 3) Benjamin Moore; Notable Dry Erase Paint; DFT 3.5 mils.
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 5. Sheen: Gloss.
- G. Paint I-OP-AC - Acoustical Restoration Coating over Interior Ceilings (Acoustical Ceiling Tiles):
  - 1. One top coat.
  - 2. Acoustical Tile and Ceiling Cleaner: As recommended by manufacturer.
  - 3. Primer: As recommended by manufacturer.
  - 4. Top Coat: Acoustical Tile and Ceiling Coating, Vinyl Acrylic Resin.
    - a. Products:
      - 1) ProCoat Products ProCooustic Acoustical Tile and Ceiling Coating.
      - 2) Acoustical Surfaces, Inc.; Sonokote by Romabio; WFT as recommended by manufacturer..
      - 3) Substitutions: Section 01 6000 - Product Requirements.
- H. Paint I-TR-F - Fire-Retardant Coating, Intumescent:
  - 1. One coat of fire-retardant primer sealer.
- I. Paint FI-OP-3A - Fabrics/Insulation Jackets, Alkyd, 3 Coat:
  - 1. Semi-gloss: Two coats of alkyd enamel.

## 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer - Structural Glazed Facing Tile and Hard Tile, Insulated Piping , Insulated Ductwork, Existing Brick, Previously Painted Surfaces, and Concrete ; MPI #3.
    - a. Products:
      - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #3)
      - 2) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer (Existing Brick), LX02W50. (MPI #3)
      - 3) Sherwin Williams; PrepRite ProBlock Interior/Exterior Latex Primer/Sealer, B51-W60020 Series (MPI #3).
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 2. Interior/Exterior Latex Block Filler; MPI #4.
    - a. Products:
      - 1) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI . (MPI #4)
      - 2) Sherwin-Williams PrepRite Interior/Exterior Latex Block Filler, B25W00025. (MPI #4)

- 3) Substitutions: Section 01 6000 - Product Requirements.
3. Interior Latex Primer Sealer - Gypsum Board; MPI #50.
  - a. Products:
    - 1) PPG Paints Pure Performance Interior Latex Sealer, 9-900. (MPI #50).
    - 2) Substitutions: Section 01 6000 - Product Requirements.
4. Alkali Resistant Water Based Primer - Dry Erase Primer Gypsum; MPI #3.
  - a. Products:
    - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #3)
    - 2) Sherwin Williams; PrepRite ProBlock Interior/Exterior Latex Primer/Sealer, B51-W60020 Series (MPI #3).
5. Interior Rust-Inhibitive Water Based Primer (Aluminum and Non-Galvanized Ferrous Metals); MPI #107.
  - a. Products:
    - 1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.
    - 2) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)
    - 3) Substitutions: Section 01 6000 - Product Requirements.
6. Interior Water Based Primer Galvanized Metal; MPI #134.
  - a. Products:
    - 1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series. (MPI #134)
    - 2) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #134)
    - 3) Substitutions: Section 01 6000 - Product Requirements.
7. Stain Blocking Primer, Water Based; MPI #137.
  - a. Products:
    - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #137)
    - 2) Sherwin Williams; Multi-Purpose Latex, B51W00450 (MPI #137).
    - 3) Substitutions: Section 01 6000 - Product Requirements.
8. Latex Primer for Interior Wood; MPI #39.
  - a. Products:
    - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #39)
    - 2) Substitutions: Section 01 6000 - Product Requirements.
9. Bonding Primer, Water Based for Dryfall; MPI #17.
  - a. Products:
    - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #17)
    - 2) Sherwin Williams, Multi-Purpose Latex Primer/Sealer B51W00450 (MPI #17).

## **2.05 CONCRETE STAINS AND SEALER**

- A. General:
  1. Locations:
    - a. Use at following locations: Unless otherwise indicated, unfinished exposed concrete floors, equipment pads, ramps, steps, and stairs are to be finished using concrete stains.
- B. Concrete Stains:
  1. For traffic surfaces:
    - a. Water-based, film forming, solid color, acrylic concrete stain; two coats.
      - 1) Benjamin Moore; Insl-X Tuffcrete WB Acrylic Waterproofing Concrete Stain, CST-2XXX; DFT 1.0 mils.
      - 2) H&C: H&C Colortop Water-Based Solid Color Concrete Stain; DFT As recommended by manufacturer.

- 3) PPG; Perma-Crete Color Seal WB Interior/Exterior Concrete Stain, 4-4210XI Series, DFT 1.5 mils.

## **2.06 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Plaster and Stucco: 12 percent.
  - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  - 5. Concrete Floors and Traffic Surfaces: 8 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Acoustical Panel Ceilings:
  - 1. Pretreat ceiling water stains according to manufacturer's written instructions.
  - 2. Pretreat tiles saturated with grease or nicotine according to manufacturer's written instructions.
- H. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- I. Masonry:
  - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  - 2. Prepare surface as recommended by top coat manufacturer.
- J. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

- K. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- L. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high-alkali surfaces.
- M. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- O. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- P. Ferrous Metal - Non-galvanized:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
    - a. Re-prime entire shop-primed item.
  - 4. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning." Protect from corrosion until coated.
- Q. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- R. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- S. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
- T. Previously Painted Existing Surfaces:
  - 1. Remove all loose paint, dust, dirt, mold, mildew, oil, grease, rust, loose mill scale, mortar, and any other surface contamination.
  - 2. Scrape all loose, blistered, peeling, scratched or otherwise imperfect paint down to bare substrate and sand adjacent tightly adhering paint to feather edge.
    - a. Tightly adhered existing paint may remain.
    - b. Spot prime all bare areas with appropriate primer before re-priming entire surface.
- U. Structural Glazed Facing Tile and Hard Tile Surfaces:
  - 1. Remove all dust, dirt, mold, mildew, oil, grease, mortar, and any other surface contamination.
  - 2. Mechanically abrade surface to achieve a surface profile as recommended by the paint manufacturer.

### 3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.



**3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.
- C. Adhesion Test to be performed per ASTM D3359 Method A (5mils or less) or B (over 5mils)
- D. All coatings shall be inspected as follows:
  - 1. Coatings shall be rejected for the following:
    - a. Lacking minimum dry film thicknesses.
      - 1) Inspector may test for proper dry film thickness using methods as recommended by the inspector.
    - b. Poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, and corners.
    - c. Damage from touching, or disturbing paint in any other manner, before sufficiently dry.
    - d. Damage from application to moist surfaces or damage caused by inadequate protection from the weather.
    - e. Damage or contamination of paint from blown contaminants including but not limited to dust.
  - 2. Coatings shall be rejected if any of the following are evident under natural lighting for exterior surfaces and final lighting source, including daylighting, for interior surfaces:
    - a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.
    - b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.
    - c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.
- E. Visible defects are defined as follows:
  - 1. Brush and roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  - 2. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- F. Coatings rejected by the inspection shall be repaired or replaced at the expense of the Contractor.
- G. Small affected areas shall be touched up.
  - 1. Large affected areas shall be repainted.
  - 2. Small and large areas shall be as defined by the Architect.
  - 3. Areas without sufficient dry film thickness shall be repainted.
  - 4. Paint runs and sags shall be removed by scraper or sanding and repainted.

**3.05 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**3.07 SCHEDULE - PAINT SYSTEMS**

- A. Concrete, Concrete Masonry Units (CMU), Concrete Block, Brick Masonry: Finish surfaces exposed to view.
  - 1. Interior: CI-OP-3L, semi-gloss.
- B. Structural Glazed Facing Tile: Finish surfaces exposed to view:
  - 1. Interior: I-OP-MD-WC, eggshell.
  - 2. Interior: I-OP-MD-WC, semi-gloss.
- C. Gypsum Board: Finish surfaces exposed to view.

1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
2. Interior Walls: GI-OP-3A, semi-gloss.
- D. Wood: Finish surfaces exposed to view.
  1. Interior trim and frames: WI-OP-3A, semi-gloss.
- E. Steel Doors and Frames: Finish surfaces exposed to view; MI-OP-MD-DT, semi gloss.
- F. Steel Fabrications: Finish surfaces exposed to view.
  1. Interior: MI-OP-3L, semi gloss.
- G. Galvanized Steel: Finish surfaces exposed to view.
  1. Interior: MGI-OP-3L.
- H. Shop-Primed Metal Items: Finish surfaces exposed to view.
  1. Finish the following items:
    - a. Elevator pit ladders.
    - b. Exposed surfaces of steel stairs and railings.
- I. Pipe and Duct Insulation Jackets: Finish surfaces exposed to view; FI-OP-2L, flat.

**END OF SECTION**

## **SECTION 13 1100 - SWIMMING POOLS**

### **PART 1 GENERAL**

#### **1.01 SUMMARY OF WORK (FOR GENERAL GUIDANCE-NOT INCLUSIVE)**

- A. Introduction
  - 1. Provide labor, materials, equipment, and services necessary to renovate the Wylie Elementary and Dexter High School pools. This work must include the new structure and finishes as well as products listed in Part 2 of Section 131100.
- B. Work included in this section:
  - 1. It is the intent of this section to place the entire responsibility for the renovation of the pools and associated spaces under one vested CONTRACTOR. Under this section the Swimming Pool Contractor will provide but is not necessarily limited to the following:
    - a. Provide equipment and services required for erection and delivery onto the premises the equipment or apparatus provided. Remove equipment from premises when no longer required.
    - b. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction.
    - c. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for related excavations. Reference Division 31 - Earthwork.
    - d. Provide electrical conduit, wiring, junction boxes etc. to low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)
    - e. Coordinate for required bonding and grounding of the new structure, fittings, and equipment, as required.
    - f. Provide necessary piping and valving as shown on the drawings and specified herein.
    - g. Provide individually sized housekeeping pads for the pool pump and strainer. Provide housekeeping pads for pool equipment as required in the drawings.
    - h. Construct the cast in place concrete surge tank as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, and embedded items (piping, anchors, etc.) for the Surge Tank. Reference Section 131101 – Swimming Pool Cast-in-Place Concrete. Before commencing the placement of concrete, verify electrical bonding of the embedded items and reinforcing steel. Also, coordinate and arrange required electrical, plumbing and or building inspections.
    - i. Provide for the storage of pool related equipment, materials, and systems. Items are the responsibility of the CONTRACTOR until accepted by owner.
    - j. Obtain final acceptance by jurisdictional health department(s).
    - k. Start, test, calibrate and adjust 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.
- C. Related work specified in other sections:
  - 1. 131101 – Swimming Pool Cast-in-Place Concrete
  - 2. 131105 – Selective Demolition
  - 3. The following work related to the swimming pools must be completed by other trades.
    - a. Provide, erect, and maintain necessary barricades, signs, lights, and flares for pool construction to protect workers and the public.
    - b. Construct pump pit including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Section 131101 – Swimming Pool Cast-in-Place Concrete.
    - c. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange required electrical, plumbing and or building inspections that must be performed on embedded items. Reference Division 26 - Electrical.

- D. Related work specified in Electrical sections. Reference Division 26 – Electrical. Work that must completed by others.
1. Provide power to Variable Frequency Drive pool pump starters and power from VFD to the pool pump motor.
  2. Ground and bond 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.
  3. Obtain permits, inspections, and approvals of wiring including grounding and bonding of metal components associated with the pool in accordance with Local, State and National Electrical Codes.
  4. Provide power, conduits, electrical boxes, and wiring for the underwater lights and junction boxes, as required.
  5. Confirm electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

## 1.02 QUALITY ASSURANCE

- A. The specifications and drawings illustrate and detail removal of the existing Wylie Elementary vacuum sand filter, filter pumps, partial mechanical room piping; construction of a new surge tank and pump pit; new underwater lights, drain covers, and valve extensions and fiberglass cover for existing High School Vacuum Sand filter; and replacement of the recirculation equipment including pumps, and regenerative media filter at the Wylie Elementary School. Certain technical aspects of the design are common only to pool systems planned for public use. Understanding these aspects, their functions and interaction through experience is vital to completing a successful operating system. It is a mandatory requirement that bidders will have achieved such experience as a prerequisite for bidding this project.
1. If the SWIMMING POOL CONTRACTOR is submitting on this project as the PRIME CONTRACTOR, the SWIMMING POOL CONTRACTOR must include a written performance bond from an approved surety company registered in the State of Michigan certifying that the SWIMMING POOL CONTRACTOR will provide 100% Performance, Labor, and Materials on this Project.
  2. If the Contractor has not received prior written approval for this project or has not been included in the pre-approved list of Contractors, they must submit a list of projects meeting the aforementioned qualifications, including contact information of the General Contractor must be submitted for review and approval at least 10 days prior to bidding of the project.
  3. The Owner reserves the right to reject a bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the contract and to complete the work described or if the bidder does not have the qualifications stated herein. Subject to compliance with item 2 above on this specification.
  4. The following bidders have been pre-approved. Bidders must meet the requirements listed above.

Acapulco Pools  
Bernie Gall  
1550 Victoria St. N.  
Kitchener, Ontario N2B3EZ  
Phone: 519.743.6357

Aquatic Source  
Nick Shelton  
190 Summit Street  
Brighton, MI 48116  
Phone: 248-921-1340

Baruzzini  
Tony Baruzzini  
1281 S. Old US Hwy 23  
Brighton, MI 48114  
Phone: 810.229.8996

B & B Pools  
Timothy Sedmak  
31071 Industrial  
Livonia, MI 48150  
Phone: 734.427.3242

Buddenbaum & Moore

Capri Pools

Bill Buddenbaum  
PO Box 990  
Noblesville, IN 46062  
Phone: 317.214.7443

Dave Wiecher  
124 Point West Blvd  
St. Charles, MO 63301  
Phone: 314.351.6020

Helm Group  
Gary Statdfield  
2279 East Yellow Creek Road  
Freeport, IL 61032  
Phone: 815.235.1955

High Tech Pools  
Frank Duale  
31330 Industrial Pkwy  
North Olmstead, OH 44070  
Phone: 440.979.5070

Spear  
Sam Blake  
12966 N County Road 50W  
Roachdale, IN 46172  
Phone: 765.522.1126

Westport Pools  
Ryan Casserly  
156 Weldon Pkwy  
Maryland Heights, MO  
63043  
Phone: 314.432.1801

### **1.03 REGULATORY AGENCY REQUIREMENTS AND ENGINEERING SERVICES**

- A. The system must comply with necessary pre-construction approvals obtained by the Owner and Owner's Consultants from local regulatory agencies governing the design and construction of public swimming pools.
- B. Give necessary notices, obtain permits, and pay government fees, and other costs in connection with his work, including the filing of necessary as-built drawings, prepare documents and obtain necessary approvals of governmental departments having jurisdiction over their work. Obtain required certificates of inspection for his work and deliver same to the Owner and Owner's Consultants before requesting acceptance and final payment for the work.
- C. Include in the work, without extra cost to the Owner, labor, materials, services, apparatus, or drawings in order to comply with applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and/or specified.

### **1.04 COORDINATION AND CLARIFICATION**

- A. Coordinate with other contractors or subcontractors work relating to this section.
- B. Must establish with other contractors or subcontractors, having related work in this section, that work necessary to complete the project 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, notify the Engineer through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

### **1.05 CONTRACTOR'S ALTERNATE PROPOSAL**

- A. Submit 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 include the construction methods and equipment as specified and detailed. Proposed system substitutions must have prior written approval by the Engineer.
- C. If there is a deviation from the basis of design equipment, confirm that engineering criteria are appropriate for the substituted equipment.
- D. Substitutions of specified construction methods and equipment must include a complete submittal as required by these specifications and drawings of appropriate scale incorporating required changes. 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 Engineer on the bid date.

- E. Changes or modifications to the Contract Documents that are not authorized by the engineer are the sole responsibility of the Contractor.

#### **1.06 SUBMITTALS**

- A. Submittals must be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.
- B. One (1) set of shop drawings and engineering data must be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage must include items for the pools, reference swimming pool structural specifications. The second stage must be for remaining items. Each section of items must be prefaced by a cover sheet listing the items submitted within the section. Electronic submittals must be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.
  - 1. Engineering data covering systems, equipment, structures, and fabricated materials, which will become a permanent part of the work under this contract, must be submitted for review. This data must include drawings and descriptive information in sufficient detail and scale to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, must be provided indicating that equipment will fit in the space allotted and as shown on the drawings.
  - 2. Submittals regardless of origin must be stamped with the approval of the CONTRACTOR and identified with the name and number of this contract, CONTRACTOR'S name, and references to applicable specification paragraphs and contract drawings. Each submittal must indicate the intended use of the item in the work. When catalog pages are submitted, applicable items must be clearly identified. The current revision, issue number, and date must be indicated on drawings and other descriptive data.
  - 3. The submittals will not be accepted from anyone but the CONTRACTOR. Submittals must be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.
  - 4. The CONTRACTOR'S stamp of approval is a representation that the CONTRACTOR accepts full responsibility for determining and verifying quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.
  - 5. Each submittal must include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.
  - 6. Deviations from the contract documents must be identified on each submittal and must be tabulated in the CONTRACTOR'S letter of transmittal. Such submittals must, as pertinent to the deviation, indicate essential details of changes by the CONTRACTOR (including modifications to other facilities that may be a result of the deviation) and required piping and wiring diagrams.
  - 7. The CONTRACTOR must accept full responsibility for the completeness of each submission, and, in the case of a resubmission, must verify that exceptions previously noted have been considered. In the event that more than one resubmission is required because of failure of CONTRACTOR to respond to exceptions and rejections previously noted, CONTRACTOR must make further resubmissions in person at the consultant's office.
  - 8. The need for more than one resubmission, or a delay in obtaining review of submittals, will not entitle the CONTRACTOR to an extension of the contract time unless delay of the work is directly caused by a change in the work authorized by a change order.
  - 9. Review of drawings and data submitted by CONTRACTOR will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of dimensions, quantities,

and details of the material, equipment, device, or item shown. Review of submittals does not relieve CONTRACTOR from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.

10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections must be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.
  11. Resubmittals must bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. Resubmittals must be indexed, tabbed, referenced to the specifications, and bound in a three-ring binder and submitted at one time.
  12. When corrected copies are resubmitted, the CONTRACTOR must, in writing, direct specific attention to revisions and must list separately revisions made other than those called for on previous submissions.
  13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies must be provided unless specifically requested to do so for record.
- C. Permits, Receipts and Test Reports
1. Provide the Architect with copies of permits and receipts for fee payments.
  2. Submit a sample format for each test report intended for use. Submit test reports required herein only on approved forms.
- D. Include complete product data indexed, tabbed, and referenced to specifications with 8 1/2" x 11" cover sheet covering:
1. Paragraph 2.01 - Pumping Equipment
  2. Paragraph 2.02 - Filtration Equipment
  3. Paragraph 2.03 - Recirculation Fittings
  4. Paragraph 2.04 - Piping Systems
  5. Paragraph 2.05 - Flow Meters
  6. Paragraph 2.06 - Water Level Controllers
  7. Paragraph 2.07 - Deck Equipment, Inserts, and Anchors
  8. Paragraph 2.08 - Waterproofing
  9. Paragraph 2.09 – Sealants
  10. Paragraph 2.10 - Underwater Lights
- E. Include engineering/construction drawings for the pool structure.
1. Reference Section 131101 – Swimming Pool Cast-in-Place Concrete
- F. Include engineering construction drawings for pool piping.
- G. Reference Section 131105 – Selective Demolition

#### **1.07 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS**

- A. Detailed operation and maintenance information must be supplied for equipment requiring maintenance or other attention. The equipment supplier and/or CONTRACTOR must prepare an operation and maintenance manual for equipment. Parts lists and operating, and maintenance instructions must be provided.
- B. Each operation and maintenance manual must 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 startup, routine and normal operation, regulation, and control, shut down and emergency conditions.
  4. One (1) copy of instructional videos.
  5. Operating cycles must be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram must be provided in the pool equipment room. The diagram must 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 is 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 pool mechanical equipment.
7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures that must be followed for the following:
  - a. Emptying and refilling the pools including de-watering during the period that the pools will be empty.
  - b. Water level control adjustment and chemical control operation.
  - c. Normal surge tank operation and balancing.
  - d. Filter operation and backwashing
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. One set of applicable submittals must be included in each manual.
- C. The operation and maintenance manuals must be in addition to instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the CONTRACTOR.
- D. Manuals and other data must be printed on heavy, first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams must be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practical, larger drawings must be folded separately and placed in envelopes that are bound into the manuals. Each envelope must bear suitable identification on the outside.
- E. Six (6) bound volumes of each manual must be submitted. Parts lists and information must be assembled in substantial manuals and permanent, three-ring or three-post binders. Material must be assembled and bound in the same order as specified, and each volume must have a table of contents and suitable index tabs.
- F. Material must be marked with project identification. Non-applicable information must be marked out or deleted.
- G. Shipment of equipment will not be considered complete until required manuals and data have been received.

#### **1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver material in manufacturer's original, unopened containers and crates with 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 materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.
- E. Remove damaged materials from site.



## **1.09 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, provide satisfactory evidence as to the kind and quality of materials and equipment.
- B. The CONTRACTOR must agree to repair or replace 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. Warranties must be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified. Submit warranties covering, but not limited to the following:
  - 1. Defects in material or workmanship of the surge tank structure causing a loss of water for a period of three (3) years.
  - 2. Defects in material, workmanship, and installation of the pool pumps for a period of one (1) year.
  - 3. Manufacturer's minimum eighteen (18) month warranty against defective materials, components, and workmanship in the variable frequency drive system.
  - 4. Manufacturer's minimum fifteen (15) year warranty on the filter tank and lining against defective materials or workmanship of the tank and components. (Additional warranty time may be purchased from the manufacturer.) Prorated warranties are not acceptable. Flexsol 3000 lined vessels must carry a fifteen (15) year limited non-prorated warranty. The filter manufacturer must bear the responsibility for suitability of lining and must be the sole source for the specified warranty. Internal tube elements must carry a fully rated 10-year warranty. Valve bodies and the regenerative media filter controller must carry a 5 year fully rated warranty. Valve operators and system accessories including the bump tire, quick exhaust valve and solenoid valve must carry one-year warranty as provided by the product manufacturer. Unless otherwise specified, workmanship must be guaranteed first class and carry a one (1) year warranty.
  - 5. Defects in material, workmanship, and installation of the pool piping system and recirculation fittings for a period of three (3) years.
  - 6. Manufacturer's minimum one (1) year warranty against defective materials, components, and workmanship in the pool water level control system.
  - 7. Defects in material, workmanship and installation of the surge tank waterproofing finish against delamination for a period of one (1) year.
  - 8. Manufacturer's minimum two (2) year warranty against defective materials, components, and workmanship in the pool underwater lights.

## **1.10 SYSTEM TRAINING**

- A. A qualified representative of the CONTRACTOR performing work under this section must 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 must 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 must be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.
- D. Training periods to consist of 12 hours of on-site training and scheduled as follows:

1. 8 hours of initial training on the new pool equipment systems and design and must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the "Part 2 – Products" section of this specification.
2. 4 hours of training after the Owner's staff has had experience operating the system. This time may be requested 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.
3. Provide a project specific video recording instruction manual in addition to the training sessions. The video instructions must be project specific and must include information on the care, operation, adjustment, and maintenance of items provided by the CONTRACTOR under the "Part 2 – Products" section of this specification. This video recording must be done separate from the Owner training.
4. The CONTRACTOR must include one (1) copy of video recording instructions in each Operations and Maintenance Manual.

#### **1.11 POOL FILL WATER QUALITY**

- A. The Owner is to bear the cost of the water required for one (1) complete filling of each pool. 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. Subsequent fillings or partial fillings (more than 25%) of the pool is by the CONTRACTOR, at its own expense.
- B. 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. Provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity	80 - 120 PPM
Langelier saturation index	-0.3 - +0.3
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

#### **1.12 START-UP CHEMICALS**

- A. The CONTRACTOR must maintain the chemical balance of the pool water (including the cost of chemicals required) until the pool and mechanical systems 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 after the owner begins using the pool.
- C. Chemicals must be provided to the Owner must include those required by the chemical feed systems provided.

#### **1.13 RECORD DRAWINGS**

- A. Provide a complete set of record drawings of the entire pool systems within the scope of the renovation including sub-systems. The CONTRACTOR is permitted to obtain original documents and copy them for this purpose only. Provide the record set on compact disk (AutoCAD Release 2022 or compatible software).

### **PART 2 PRODUCTS**

#### **2.01 PUMPING EQUIPMENT**

- A. Proposed substitutions must include a mechanical drawing incorporating required changes in layout, piping, and valves. The cost of such changes must be included in the price of the substitute. Confirm correct pump motor voltage prior to ordering pump. Motors must be capable of continuously running without overloading at points on the characteristic curve of the pump without overload or damage. Confirm by 1/4-inch scale shop drawing that the pumps provided will fit within the available space and can be reasonably removed for servicing.
  1. Pumps must be certified by the National Sanitation Foundation (NSF) and bear the certification mark.

2. The impeller must be trimmed to a maximum diameter based on the most limiting condition of either the diameter of the maximum non-overloading rated motor horsepower at the design point or a diameter resulting in 10% greater head than the specified head.
  3. Pump motor must be totally enclosed, fan cooled (TEFC) and premium efficiency of the horsepower and speed specified. A pump requiring larger horsepower is not acceptable unless submitted as a substitute and approved by the engineer, in which case necessary electrical revisions must be coordinated and provided.
  4. Entire pumping unit must be mounted on a base using cap screws to preserve the back-pull-out feature of the pump. Pumps must not be secured with floor studs or "all-thread." The pump base must be coated with the same epoxy coating as the pump.
  5. Recirculation Pump – Metallic Components
    - a. Provide horizontally mounted centrifugal pumps as shown on the drawings and described in these specifications. Each pump must be of a straight centrifugal, end suction, bronze fitted, close coupled type.
    - b. Pumps manufactured by Paco, Griswold, Aurora or Herborner are considered equal, provided they meet the requirements.
    - c. Pump casing must be cast iron fitted with a replaceable bronze case wear ring. Mechanical seals must be provided specific for a chlorinated water application. Pump impeller must be enclosed type of cast bronze or 316L stainless-steel, statically, and dynamically balanced, and trimmed for the specified design conditions. If a VFD must be used in conjunction with a pump, the impeller must be trimmed to the maximum diameter based on the rated motor horsepower. Bronze materials must be suitable for use in a chlorinated environment. Suction and discharge flanges must be provided and tapped for gauge connections. Provide steel or cast-iron bases with equivalent epoxy coating for corrosion protection.
    - d. Provide a fusion-bonded epoxy coating on wetted parts to protect pump internals from corrosion, including pump volute interior and complete pump impeller (bronze impellers only). Sandblast to bare, white metal. Thickness must be 8 to 12 mils (heavy film). Verify thickness by non-destructive testing. Coat parts as recommended by manufacturer, including preheating parts to 400 degrees and electrostatic deposition or fluidized bed technique. Provide primers if required to resist chlorinated water <10 ppm. Coating must be Scotchkote 134 manufactured by Fusesco or approved equal.
    - e. Provide a hair and lint strainer, for each pump, of fiberglass or epoxy coated stainless-steel construction with a clear observation top in the sizes (or pipe sizes) indicated on the drawings. Verify and coordinate pipe and pump suction sizes in the field. Strainer must be a straight non-reducing type with an approved tapered eccentric reducer at the front of the pump at recirculation pump PP1.
      - 1) Basis of Design: As manufactured by MerMade Filter Inc., or Neptune/Benson Inc., or Fluidtrol Process Technologies, Inc.
    - f. Recirculation pumps must be provided by the same manufacturer. Confirm voltages prior to ordering pumps.
  6. Other System Pumps and Motors
    - a. Provide two (2) permanent utility pumps. The pump shall be a 1 HP, 3450 RPM, 460-volt, 3 phase, 60 cycle unit capable of 60 GPM at 25 ft. TDH. The pumps must be provided with a normally open float valve switch, and assembled chain kit. The pump must be provided with emergency power or battery back-up.
      - 1) Basis of Design: Pump to be a Goulds WE1034H or approved equal.
- B. Variable Frequency Drive Starters
1. Provide variable frequency drive starters (VFD) for the recirculation pump. VFDs must be Eco-Flow-C by H2Flow Controls, AcuDrive by Pentair, GreenDrive by Neptune Benson, or approved equal.
    - a. Basis of Design: AcuDrive by Pentair
  2. Ensure that equipment is provided with the correct operating voltage and that interconnected electrical and electronic equipment must adequately communicate and

operate the specified pumping equipment. Equipment installations must meet or exceed the requirements of the National Electric Code and other local and state regulations.

3. Variable Frequency Drive Capabilities

- a. Provide complete VFD as specified herein or in the equipment schedule for loads designated that must be variable speed or variable flow.
- b. The VFD must convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD must be a six-pulse input design, and the input voltage rectifier must employ a full wave diode bridge. The output waveform must closely approximate a sine wave. The VFD must be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.
- c. Indoor Applications: VFD must be fully enclosed in a corrosion resistant NEMA 12/IP54 UL listed enclosure.
- d. VFD and required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect.
- e. VFD must have a fused disconnect and battery back-up, for the purpose of maintaining programming in the event of a power outage.
- f. The VFD must produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.
- g. The VFD must provide rated RMS fundamental output voltage. The VFD must utilize VVC<sup>PLUS</sup>, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. This allows the motor to operate at a lower temperature rise, extending its thermal life.
- h. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.
- i. The VFD must offer a programmable motor parameter that allows the total number of poles of a motor that must be programmed to optimize motor performance.
- j. VFD must automatically boost power factor at lower speeds.
- k. The VFD will be capable of running either variable or constant torque loads. In either CT or VT mode, the VFD must be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.
- l. An Automatic Energy Optimization (AEO) selection feature must be provided in the VFD to minimize energy consumption in variable torque applications.
- m. VFD must offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.
- n. Switching of the input power to the VFD must be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.
- o. Switching of power on the output side between the VFD and the motor must be possible with no limitation or damage to the VFD and must require no additional interlocks.
- p. An Automatic Motor Adaptation (AMA) function must measure motor stator resistance and reactance to optimize performance and efficiency.
- q. Cooling must be via an aluminum heat sink and must prevent the introduction of ambient air to the electronics for cooling. With the exception of the water-resistant heat sink fan, electronics must be fully sealed within the enclosure.
- r. The VFD must have temperature-controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.
- s. VFD must provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage.

4. Harmonics:

- a. The VFD must provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor.

- b. The VFD must be provided with line-side harmonic reduction, as required, to ensure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met.
  - c. Harmonic solutions must be designed to withstand up to 2%-line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.
  - d. Harmonic solutions must be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.
5. Protective Features:
- a. VFD must have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.
  - b. VFD must include circuitry to detect phase imbalance and phase loss on the input side of the VFD.
  - c. Printed Circuit boards must be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard.
  - d. Automatic "No-Flow Detection" must be available to detect a no-flow situation in pump systems where valves can be closed. This must be functional in closed loop control or when controlled by an external signal.
  - e. Dry-pump detection must be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer must be included to prevent nuisance tripping.
  - f. End-of-Pump curve detection must stop motor when the pump is operating outside of its programmed pump curve.
  - g. VFD must provide a flow compensation program to reduce energy by adjusting the Setpoint to match changes in flow (friction loss).
  - h. VFD must include current sensors on three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
6. Interface Features:
- a. VFD must provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.
  - b. VFD Keypad must feature an INFO key that, when pressed, must display the contents of the programming manual for the parameter that is currently viewed on the display.
  - c. VFD Display must have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.
  - d. A red FAULT light, a yellow WARNING light and a green POWER-ON light must be provided. These indications must be visible both on the keypad and on the VFD when the keypad is removed.
  - e. Two-level password protection must be provided to prevent unauthorized changes to the programming of the VFD.
  - f. A quick setup menu with factory preset typical parameters must be provided on the VFD to facilitate commissioning.
  - g. A digital elapsed time meter and kilowatt hour meter must be provided in the display.
  - h. VFD must offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses.
  - i. A battery back-up must be provided to maintain internal clock operation during power interruptions.
  - j. Inputs and outputs must be optically isolated.
  - k. The VFD must have two analog signal inputs. Inputs must be programmable for either 0 -10V or 0/4-20 mA.
  - l. One programmable analog output must be provided for indication of the drive status. This output must be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal must be 0/4-20 mA.

- m. The run permissive circuit must be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
  - n. The VFD must be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port.
- 7. Adjustments:
  - a. The VFD must have an adjustable output switching frequency.
  - b. Four complete programming parameter setups must be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to program for up to four alternate control scenarios without requiring parameter changes.
  - c. In each programming setup, independent acceleration and deceleration ramps must be provided. Acceleration and deceleration time must be adjustable over the range from 0 to 3,600 seconds to base speed.
  - d. The VFD must have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature must offer a Semi-Automatic program to simplify the set-up.
  - e. VFD must include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.
  - f. The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after a self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts must be adjustable from 0 through 600 seconds.
  - g. An automatic "on-delay" function may be selected from 0 to 120 seconds.
  - h. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.
- 8. Bypass
  - a. Provide a manual bypass in conjunction with the VFD for the recirculation pumps consisting of a door interlocked main fused-disconnect pad lockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at a programmable speed or flow rate from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. In BYPASS Position, a soft starter will be in the circuit to allow the motor to avoid an across the line start. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to give an operational test while continuing to run the motor at full speed in bypass.
- 9. Individual VFD options such as bypass, motor selection contactors, etc. must be incorporated by the manufacturer onto a single panel with single input feed and main disconnect function. Enclosures must be UL listed and fully assembled by the VFD manufacturer.
- 10. Service Conditions:
  - a. The ambient operating temperature of the VFD must be -10°C to 50°C (14 to 122°F).
  - b. 0 to 95% relative humidity, non-condensing.
  - c. Elevation to 3,300 feet (1000 meters) without derating.
  - d. VFD's must be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% is acceptable.
- C. Pump Gauges
  - 1. Pressure gauges must be provided on the discharge of the pumps.
  - 2. Compound gauges must be provided at the intake port of the pumps, after the hair and lint strainer.
  - 3. Gauges must be liquid filled, 316L stainless-steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion

resistant white scale with black divisions and numerals, 300 Series stainless-steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

- a. Basis of Design: Gauges must be as manufactured by Weksler Instrument Corporation or approved equal.
4. Scale ranges must be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges must be calibrated in psig (0-60 psi) and compound gauge must be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).
5. A stainless-steel filter type pressure snubber must be provided for each pressure gauge consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

## **2.02 FILTRATION EQUIPMENT**

- A. The filter system must consist of a regenerative media filter tank as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes operational data and instructions and indicates startup date.
- B. It is the intent of these specifications to describe a filtration system complete in every respect with accessory items and supplied and warranted by one manufacturer.
- C. Regenerative Media Filters with Pre-Coat in a Closed Loop
  1. Filter System
    - a. Basis of Design: The filter system under this section must be a Defender by Neptune-Benson, Regenerator by Paddock or approved equal. System design based upon Paddock.
    - b. It is the intent of these specifications to describe a filter system complete with accessory items supplied and warranted by one manufacturer.
    - c. The primary components of the system consist of the main filter tank, flex tube filter elements, element assembly, bump mechanism, vacuum transfer system, sight glass, pressure gauge panel, inspection (viewing) window, valves, pressure transducers and automatic filter controller.
    - d. Components and related subassemblies must be factory assembled and tested prior to shipment.
  2. Filter Tank
    - a. The filter tanks must have a 45" side shell, suitable for 50 psi working pressure and hydrostatically tested to 75 psi. Tank shell must be not less than 1/4" thick. Bottom dished head must be not less than 1/4" thick. Top flat head must be not less than 1 1/2" thick. Material must be Type A-36 carbon steel.
    - b. Welding must be performed by qualified operators. Joints must be butt or fillet welded inside and out by manual or automatic process. Welded joints must have complete penetration and fusion with little or no reduction of the thickness of the base metal. Welds must be free of coarse ripples, grooves, overlaps, abrupt ridges, or valleys. Welded surfaces must be chipped and brushed clean, when necessary, leaving no slag or splatter.
    - c. Tank legs must be constructed of 6" x 2 1/2" channel legs 1/4" thick. Filter models 24", 27" and 33" must have three (3) legs. Filter models 41", 49" and 55" must have four (4) legs. The material must be Type A-36 carbon steel. Bearing plates must be 10" x 5" x 1/2" type 304L stainless-steel. The bearing plate must have two (2) 5/8" drilled holes to secure to the floor with the 1/2" x 4 1/2" stainless-steel concrete anchors provided. The legs must be designed with bolted connections to minimize overall tank height for shipping and access into the mechanical room.
    - d. The tank head must be bolted to the shell with 7/8" diameter T304 stainless-steel threaded rods and nuts, 9" on center around the tank perimeter.
    - e. Tank must be equipped with a UL listed grounding lug.
    - f. Tanks must incorporate connections for filter influent, effluent, drain; 1-1/2" vacuum transfer piping, 6" viewing window, hardware to facilitate cleaning of tube elements

- and interior inspection of filter and lift shaft gland. Refer to the drawings for pipe and connection sizes.
- g. Tanks must include brackets for mounting of automatic controller, gauge panel, filter / regulator, vacuum transfer blower and vacuum hose rack.
  - h. The filter tank must include an integrally mounted hydraulic lifting device (davit). The davit assembly must be designed to lift the filter head and include a pivot mechanism allowing the head to rotate 180°, for access to the tube sheet.
3. Flexsol 3000 Interior Lining
    - a. Interior surfaces must be grit blasted to white metal condition with a 3-4 mil profile. Blasted surfaces must be cleaned of dust or blast residue and primed as soon as is practical on the same day blasting is done.
    - b. Flexsol 3000 must be a urethane, 100% solid plural component lining. Hardness must be 75 durometers on the Shore D scale. Break tensile strength must be 4,000 psi with elongation of less than 10%. Adhesion must be greater than 2,500 psi.
    - c. Application of Flexsol 3000 lining must be done by experienced applicators using a high pressure, high temperature plural component system. Wetted surfaces including flange faces, manway rings and manway covers must be lined to 100 mils +/- 10 mils WFT.
    - d. Hardness must be verified after curing to ASTM D 2240 standard.
    - e. Flexsol 3000 lining must meet the NSF toxicity standard unconditionally and must be approved for use with the NSF approved filter.
  4. Exterior Coatings
    - a. Exterior surfaces must be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces must be cleaned of dust or blast residue.
    - b. Two coats of high solids enamel must be applied for a total developed film thickness of 5-8 mils.
    - c. Manufacturer is to supply minimum 16 oz of high solids enamel touch-up paint.
  5. Internal Components
    - a. The filter must consist of flex tube elements, filter tube sheet, stainless-steel lift shaft and internal flow diversion assembly.
    - b. The filter elements must be flexible tubes that provide the support structure for the media. The outer wall of the element must be fabricated of multi-filament high strength polyester braid. The element must have an internal T316 stainless-steel spring, which acts a support structure for the braided filament.
    - c. The filter element tube sheet must be fabricated of T316 stainless-steel and provide both support for the top of the element assembly as well as watertight seal to prevent media from escaping the filter tank.
    - d. The lifts shaft must be fabricated from T316 stainless-steel and provide the internal connection between the filter element tube sheet and the external bump mechanism.
    - e. The filter influent connections must be fitted with a T316 stainless-steel flow diversion assembly to eliminate disturbance to the filter elements during operation.
    - f. Stainless-steel wetted fasteners must be Type 316.
  6. Bump Mechanism
    - a. The bump mechanisms must include a pneumatically operated tire mounted externally on the filter tank heads. The tire is alternately pressurized then depressurized causing the connected filter element assembly to move in an upward then downward fashion. This movement must provide the means of dislodging the media and accumulated solids, which then recoat the filter element.
  7. Vacuum Transfer System
    - a. The vacuum transfer systems must be provided to allow the recharging of media into the filter for either bag or bulk media.
    - b. The vacuum must be a 5 peak HP, 115V, single phase motor, 60 Hz or 50 Hz, cULus listed.
    - c. Vacuum must be supplied with mating electrical connections pre-wired into automatic filter controller for field final connection in a pre-assembled junction box.



- d. In-line filters with dual connections must be provided to prevent dust and media from being drawn into the blowers.
- e. Provide three (3) 1-1/2" SCH 80 PVC ball valves: for the vacuum drain line, the blower inlet, and the vacuum hose.
- f. Provide necessary pipe, fittings, and hardware for field plumbing of the vacuum transfer system.
- g. Provide ten (10) feet of 1-1/2" vacuum hose with required fittings.
- 8. Automatic Filter Controller
  - a. The automatic controller must provide total control of the system's filtration and regeneration cycles and provide necessary equipment interlocks and timing mechanisms to execute the filter program.
  - b. The controller must include an adjustable pressure switch, factory set to 50 psi. The switch must stop the recirculating pump and close the pneumatic valves if air pressure falls to 50 psi.
  - c. The controller must contain at least two microprocessors that will monitor the functions of the system.
  - d. The controller must control operation of the following functions:
    - 1) Bump cycle / manual or automatic
    - 2) Pre-coating of the filter elements
    - 3) Stopping and starting of the main recirculating pumps
    - 4) Opening and closing of pneumatically operated valving
    - 5) Vacuum transfer system
    - 6) Heater cool down delay
    - 7) Auxiliary contacts to interlock chemical control or other equipment.
    - 8) Keyed switch to activate continuous, intermittent bump cycle for flex tube cleaning.
    - 9) 7-inch high-resolution LCD Screen with touch-screen interface
  - e. The controller panel must display the following functions:
    - 1) Filter status
    - 2) Precoat status
    - 3) Last bump
    - 4) Recirculating pump status
    - 5) Vacuum transfer pump status
    - 6) System power
    - 7) Low pressure alarm
    - 8) Recirculating pump off alarm
    - 9) Pressure differential
    - 10) Flow rate (operational feature when interlocked with VFD)
    - 11) Step-by-step animated graphics
  - f. The controller enclosure must be NEMA 4X/IP66 approved system.
  - g. The automatic filter controller will provide signal power to the main recirculating pump motor starters. The unit requires a device or variable frequency drive (VFD) and must be installed with control wiring.
  - h. The automatic filter controller must be 120V, 1 phase, 20 amp rated and must be UL labeled.
- 9. Flow Meter
  - a. A digital flow meter must be included with a 4-20mA, 0-10 VDC analog output.
  - b. The flow meters must be wired into the VFDs to provide automatic speed control of the filter pump motors.
  - c. The VFDs must compensate for varying filter head losses by maintaining the specified flow rate with the 4-20mA output signal of the flow meters.
- 10. Filter / Regulator
  - a. The filter must include a combination filter / regulator. The regulator must be adjustable from 0 – 120 PSI. 1/2" FPT connections must be provided for field installation of air lines.
- 11. Water Separator

- a. One water separator with automatic drain must be included for the air compressor supplied. 1/2" FPT connections must be provided for field installation of air lines.
12. Air Compressor
  - a. The filtration systems will require one (1) air compressor per mechanical room. The following is the minimum requirement: 20-gallon tank, 2 HP, 120 V, 1 phase, 15-amp, 5.2 CFM @ 90 psi, air pressure gauge, pressure relief valve, belt guard, pressure switch, air filter, tank drain.
13. Pneumatic Actuators
  - a. The filter must include pneumatic actuators for one (1) effluent valve and one (1) precoat valve.
  - b. The actuators must be double acting with valve mounted drilling to ISO 5211.
  - c. The actuators must include two (2) 1/8" FPT ports for open / close connections. Flow control valves with quick connect fittings must be provided at the port to allow speed control adjustment for the open / close function of the actuators.
  - d. Materials of Construction
    - 1) Body: aluminum alloy, extruded acc. to ASTM 6063, anodized acc. To UNI 4522.
    - 2) Ends: Diecast in aluminum alloy acc. To ASTM B179, epoxy-polyester coated.
    - 3) Pistons: Diecast in aluminum alloy acc. To ASTM B179.
    - 4) Pinion: Nickel-plated steel.
    - 5) Slideways: Acetal resin (LAT LUB 731320T).
    - 6) Fasteners: AISI 304 Stainless-steel.
    - 7) Springs: Epoxy coated steel, pre-compressed.
    - 8) Seals: NBR Nitrile rubber.
    - 9) Lubricant: MoS2.
  - e. The actuators must be factory lubricated to allow for 1,000,000 maneuvers.
  - f. The actuators must have adjustable travel stops for both directions.
  - g. Working temperature limits: 4° F to 186° F.
14. Fiberglass Eccentric Reducing Flanged Precoat Tees
  - a. Eccentric reducing precoat tees must be constructed of fiberglass with flanged connections. The tee must be equipped with influent, effluent connections as well as a precoat line branch connection sized in accordance with the drawings.
  - b. Flanged connections must be ANSI 125# dimensions.
  - c. Reducing tees must include a 4" FPT gauge connection.
  - d. Reducing tees must be designed for 50 psi operating pressure as manufactured by Neptune-Benson.
15. Solenoid Valves
  - a. The filter must include three (3) single solenoid, 4-way valves mounted on a multi-station manifold for operation of the pneumatic actuators and bump mechanism
  - b. The solenoids valves must include lighted DIN connectors.
  - c. The solenoid valves must be factory lubricated and must not require field lubrication.
  - d. The solenoid valves with multi-station manifold must be located on the bottom of the automatic filter controller, factory wired and include quick connect fittings for attachment to the pneumatic actuators and bump mechanism.
  - e. The solenoid valves must be SMC Series SY 7000.
16. Valves
  - a. Valves 3" – 12" must be constructed with cast aluminum ASTM S12A housing and fully coated with Rilsan on interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless-steel shaft. Valves 14" and larger must be constructed with cast iron housing fully coated with nylon and with nylon coated ductile iron disc.
  - b. Valves must be butterfly valves and must be provided for the influent, effluent and precoat lines.
17. Trash Pump
  - a. Provide one (1) cast iron sewage/trash pump for filter media change discharge to the existing backwash retention above the first floor pool mechanical room. Pump is to

be self-priming with a working pressure of 150 PSI. Provide with silicon carbide / Buna-N mechanical seal and o-ring and a stainless steel semi-open clog resistant impeller. Pump to have an easy clean-out design.

18. Packaging
  - a. For loading and unloading, filter tank diameters 24" – 41" must be bolted to individual wooden pallets. Filter tank diameters 49" and 55" must be equipped with temporary lifting legs. Tanks must be shrink wrapped to prevent damage during transport.
  - b. The components must be carefully packaged in a totally enclosed wooden crate to prevent damage during transport.
19. Media
  - a. Media must be expanded perlite with a median particle size of 37 microns. Percentage retained on a +150 Tyler Mesh must not be less than 8% or more than 25%. Darcy permeability must be between 1.2-1.85.
  - b. The media must contain no more than 1 tenth of one percent (.001) of crystalline silicate.
  - c. The media must be certified by the manufacturer for use in the filter. The media must be NSF listed in Standard 61 and Standard 50.
  - d. The media must be Harborlite Aquaperl as supplied by World Minerals, Techflo 2000x, or approved equal.
  - e. The filter must be provided with six (6) charges of perlite media.
20. Filter Cleaner
  - a. The filter must be furnished with one (1) charge of chemicals for cleaning and degreasing of filter tube elements.
21. Quality Assurance
  - a. Documented at least three (3) completed installations of the filtration system or a qualified manufacturer's representative is required for on-site installation supervision.
- D. Vacuum Sand Filter
  1. Filter Cover
    - a. Provide a filter cover for Paddock Compak VSC-30 Vacuum Sand Filter.
    - b. Cover material must be HDPE
  2. Valve Extensions
    - a. Provide eight replacement valve extensions for Paddock Compak VSC-30 Vacuum Sand Filter.

## **2.03 RECIRCULATION FITTINGS**

- A. Main drains covers must have PVC grating as sized on the drawings. Grate openings must not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.5 fps. The grate fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. Exposed edges of main outlets must be rounded and smooth, free of burrs and sharp edges. Main drain covers must comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2017.
- B. Anti-vortex plates must be provided at the suction points of the main recirculation pump(s) in the surge tank(s). Each plate must be connected to the suction pipe via a PVC flange and must be ½ in. thick with minimum dimension of at least 2.5 times the connecting pipe diameter. The plate must be located 4 inches above the finished floor of the surge tank. Four (4) 3/4 in. stainless-steel threaded rods, nuts, anchor bolts and washers must be used to fix the offset distance and provide a secure base for the suction pipe. Manufactured fiberglass or PVC anti-vortex plates by Daldorado, Neptune-Benson or approved equal.

## **2.04 PIPING SYSTEMS**

- A. General
  1. Provide recirculating piping between the surge tank, the overflow, the filter room, and the filter drain discharge.
  2. Provide necessary pipe supports and support systems required to support associated piping and valves.

3. Provide 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 and must be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.
  2. PVC swimming pool piping must be NSF approved and conform to the requirements of ASTM D-1785.
  3. PVC pipes must 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 filter room must be Schedule 80 PVC.
  5. Swimming pool piping below the filter room floor or deck must be NSF approved, Schedule 80 PVC.
  6. PVC and CPVC fittings must be the product of one manufacturer. Molded fittings must be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute. Fabricated fittings must be as manufactured by Harrison Machine, Plastinetics, or acceptable substitute.
  7. Splash collar(s) for the fill funnel(s) must be clear Schedule 80 PVC and manufactured from a Type I, Grade I PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe must be manufactured in compliance to ASTM D1785.
  8. Flanged plumbing connection hardware must be stainless-steel.
  9. Materials must be installed by workmen thoroughly skilled in their trades and work must present a neat and mechanical appearance when complete. At no additional expense to the Owner, replace or correct work not judged acceptable by the Architect, Owner's testing agency, or their consultants.
  10. Support hardware, brackets, fasteners, hangers, etc. furnished and installed in the surge tank must be 316L stainless-steel.
  11. No installation allowed 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.
  12. Piping must be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness. Pneumatic (air) pressure test not allowed.
  13. Provide water seals for watertight penetrations of concrete walls and floor slabs.
    - a. Pool Concrete: Water seals must be coupling or sleeve type with a thermo welded or molded flange and the O.D. must be sized to 150% of the O.D. of the pipe. The thermo-welded type must be welded from both sides. Water seals must be located at the centerline of the wall or slab being penetrated prior to placing the concrete to assure a watertight seal. Manufactured fiberglass and PVC water seal fittings by Daldorado, A.S.A. Manufacturing, Aqualogic or approved equal.
    - b. Pump Pit: Link seals must be provided in the sizes and quantities shown on the drawings and installed to provide a flexible watertight penetration. Metal parts must be made of 316L stainless-steel. Links must form a continuous rubber seal that is tightened with a series of stainless-steel bolts to form a watertight seal. Link seals must be manufactured by GPT, Calpico Inc. or approved equal. Xypex Patch'n Plug or approved equal must be used to seal pipe penetration. Link seals must be installed with either a cored hole or a Century Line pipe sleeve.
    - c. Surge Tank: Water seals must be coupling type with a thermo welded or molded flange and the O.D. must be sized to 150% of the O.D. of the pipe. The thermo-welded type must be welded from both sides. Water seals must be located at the centerline of the wall or slab being penetrated prior to placing the concrete to assure a watertight seal. Manufactured fiberglass and PVC water seal fittings by Daldorado, A.S.A. Manufacturing, Aqualogic or approved equal. Link seals are also acceptable with a cored hole or a Century Line pipe sleeve.
    - d. Renovation:

- 1) For wall penetrations with no permanent dry-side access, provide Synkoflex FR Waterstop (trim as required), Xypex Patch and Plug, Xypex Concentrate and Dry-Plug, and Xypex Megamix II or Non-Shrink Grout.
  14. Adhere to the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.
  15. Mechanical equipment must be connected into the recirculation piping system must be connected utilizing flanged or union connections.
  16. Provisions must be made to purge pipes in the system.
  17. Concentric reducers must 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 must be manufactured by Cooper B-line (basis of design), Inc, TOLCO, and Anvil International or approved equal.
  2. 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.
  3. Multiple or Trapeze Hangers
    - a. Trapeze hangers must 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.
  4. 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.
  5. Floor Supports
    - a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line model B3092 and B3088T or B3090 and B8088. Pipe saddle must be screwed or welded to appropriate base stand.
  6. Vertical Supports
    - a. Steel riser clamp sized to outside diameter of pipe, B-Line model B3373.
  7. 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 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.
  8. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels must 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 must be used where piping must be suspended from building steel. Clamp type must be selected on the basis of load supported and load configuration.
  - 2) C-Clamps must be locknuts and cup point set screws similar to B-Line model B351L or B3036L. Top flange c-clamps must be used when attaching a hanger rod to the flange of structural steel, B-Line model B3034 or B3033 or approved equal. Refer to manufacturer's recommendations for set screw torque. Retaining straps must be used to maintain the clamp position on the beam where required.
  - 3) Center load beam clamps must be used where specified. Steel clamps must be B-Line models B3050 or B3055. Forged steel beam clamps with cross bolt must be B-Line B3291-B3297 series or approved equal as required to fit beams.
- b. Concrete Inserts
  - 1) Cast in place spot concrete inserts must be used applicable, either steel or malleable iron body, B-line B2500 or B3014 or approved equal. Spot inserts must 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 must be used where applicable. Channels must 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 must 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 must 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. Hangers must be zinc plated in accordance with ASTM B633 or must have an electro-deposited green epoxy finish.
  - 2. Strut channels must be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 or must have an electro-deposited green epoxy finish.
  - 3. Zinc Plated hardware is not acceptable for use in chemical rooms.
- G. Valves
  - 1. Valves 3 inches and larger must be butterfly type valves, with PVC body, 150# SWP with stainless-steel shaft, PVC or 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 insulated piping must be provided with handle for manual operation. Valve components must be suitable for swimming pool chlorinated water service. Butterfly valves must 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 must be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal with socket end connectors.
  - 3. Check valves must 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. Provide check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Check valves must be Technocheck Corp., model 5050, with epoxy coated cast iron body and bronze swing plates on a stainless-steel spring, Colonial Valve model 601N or 601NP PVC valve with EPDM O-ring and stainless-steel spring or approved equal, for installation between 150 lb. flanges.

4. Modulating float valve in the surge tank must have PVC body and stainless-steel wafer disc. Hardware must be non-corrodible. The float-operated valves must be provided horizontally on the main drain lines in the surge tank. Valve must consist of non-corrosion components including shaft, float arm, pins, and floats. Valve must be suitable for mounting on a 125E class standard PVC flange. The float arm leverage weight and pivot lengths must be adjustable to obtain desired ratio of surge tank level change to pool gutter overflow level change. Two floats and stabilizer required. Valve must be model FV-D XWB (Extra Weight Ball) as manufactured by MerMade Filter, Inc. or approved equal manufactured by Neptune-Benson, EPD, or Fluidtrol Process Technologies, Inc.
  5. Submerged valves up to 3 inches must be PVC true union ball valves. Submerged valves over 3 inches must be PVC bodied, wafer type, butterfly valves with stainless-steel handle extensions as required. Valves must be by approved manufacturers listed above. Submerged valves must be provided with stainless-steel connectors. The stem housing extensions must be properly supported and braced.
  6. Butterfly type valves 8 inches and larger must be fitted with a watertight gear operator.
  7. Valves located 7 feet or greater off the floor must be fitted with a chain operator.
  8. Submerged valves, valves buried below grade, or valves not readily accessible, must be provided with a stainless-steel reach rod and handle.
  9. Valve hardware must be 316L stainless-steel and meet ANSI hardware installation guidelines.
- H. Pipe and valve identification
1. Exposed pool piping must be equipped with color coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. Verify that pool piping identification is in accordance with local and state health regulations.
  2. Valves must be identified with minimum 1-1/2-inch diameter plastic laminate engraved tags with minimum 1/2-inch-high numbers. Tags must be fastened to valves with a nylon attachment (zip tie). Valves must be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram that must be prepared.

## **2.05 FLOW METERS**

### **A. Flow Meter**

1. Recirculation flow meters (2 required) must be provided according to the manufacturer in the filtered water return lines to each of the pools. Flow sensor must be the GF Signet 2551 insertion magmeter. Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy must be +/- 2% of reading.
2. Backwash piping flow meter (1 required) must be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale must be permanently etched or imprinted on the meter. Flow rate indicator must be of stainless-steel material. Scale range must be appropriate for specific flow rate. Pipe size to accommodate backwash rate. Backwash piping flow meter must be BLUE-WHITE series F-300 or approved equal.

## **2.06 WATER LEVEL CONTROLLER**

### **A. In Surge Tank Water Level Controller**

1. Provide a water level sensing and control system for the pool that will monitor the water level in the surge tank and automatically activate the auto water make-up control valve. For sensing water level and activating make-up water control valve for each pool, use Series ELC-810 Controller housed in a watertight NEMA 4X UL94 5V UL flammability rated polycarbonate enclosure to meet IP66 and NEMA 4, 4X, 12 and 13 ratings. The Controller must utilize two sensors to control water level. ELC-810 series must have a menu-driven LCD display screen and utilize a five-switch user interface for navigation through the menu. The menu must allow changing the following settings: delay to shutoff, alternate sensor option, maximum time on, manual override, delay to normal, type of sensor, high level option, flow sensor active, and sounder with alarm. Menu settings must be capable of password protection. The Controller must be capable of displaying the following data: last fill time, last drain time, last alarm. The Controller must be capable of determining the following: maximum time on exceeded, over current to solenoid valve, no

- valve/valve wiring problem, and sensor not working properly. The Controller must have a low voltage interlock with auto water make-up solenoid valve, must provide adjustable time delay for increasing level and manual override; and requires 115 VAC, 1 phase, 60 Hz power. Manufactured by AquatiControl Technology, model ELC-810-DS-ST-XXX (Coordinate the specific length(s) of cable required for each controller prior to ordering). Refer to drawings for additional information.
2. Provide a proximity switch sensor that must be sensitive to within +/- 1/8" (4mm) of nominal water level. Supply voltage to sensor must be 12V to 24V DC from Controller. Current consumption must be < or = 15mA. Response frequency must be 100Hz. Maximum control output must be 200mA. Sensor operating temperature must be -25 Deg. C to 70 Deg. C. Operating humidity must range from 35% RH to 95% RH. Sensor must be mounted in a 1" SCH80 PVC pipe (length must be determined by depth of surge tank). Sensing pipe must be mounted to surge tank wall with composite/non-metallic hangers and stainless-steel hardware. Sensing pipe must be capable of being submerged under water safely. Refer to drawings for additional information.
  3. Wiring from the sensor to the Controller must be provided and must be connected to the terminal points mounted within a corrosion resistant, nonmetallic NEMA 4X enclosure. Wiring connections must be made through the bottom of the enclosure. The enclosure size must be no less than 8" wide x 5" high x 4" deep. The access door must be the entire front face panel of the enclosure. Confirm location in field.
  4. Major components must be plugged in using WAGO terminal blocks for ease of installation and replacement. Unit must be designed to activate a 24-volt AC solenoid valve.
  5. Provide a make-up water solenoid valve, normally closed, stainless-steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information. Such as ASCO or approved equal.
  6. Discharge of make-up water must be into a fill funnel and piping to the surge tank. Refer to the Drawings for additional information.

## **2.07 DECK EQUIPMENT, INSERTS & ANCHOR SOCKETS**

- A. The following items must be supplied unless otherwise noted. Proprietary names are to designate performance only. Equal products will be accepted.
  1. Surge tank access hatch (1 required) must be provided as shown on the drawings. The access hatch must be a single door 3'-2" x 2'-6" with 1" fillable pan to receive ceramic tile and grout or concrete fill to match the surrounding deck. The frame must be ¼ inch extruded aluminum with built in neoprene cushion and continuous anchor flange. Door must be ¼" aluminum plate reinforced with aluminum stiffeners as required. Door must be equipped with heavy continuous stainless-steel hinges and must have compression spring operators for easy operation. Door must open to 90 degrees and lock automatically in that position. Door must be built to withstand a live load of 150 lbs. per square foot and equipped with a continuous Type 316L stainless-steel hinge, tubular type, and an automatic hold open arm with release handle. Hardware must be type 316L, 18-8, stainless-steel. A flush lift handle and a snap lock with removable key wrench must be provided. Factory finish must be mill finish with bituminous coating applied to the exterior of the frame. The access door must be Type TER-3 single leaf pan type door as manufactured by the Bilco Company.
  2. Sleeves for surge tank valve extensions must be Spectrum Products Valve Extension Body #1910387 with Lid and Key #36450, or Spectrum Products Bronze Anchor Kit 1.90-inch O.D. x 6-inch-deep Anchor (field modification required) with Lid and Key #23638-00.
  3. Surge tank and pump pit ladder rungs must be ½ inch Grade 60 steel encased with co-polymer polypropylene plastic as manufactured by M.A. Industries, Inc, or approved equal.
  4. Mechanical Room Grating – Over the pump pit, the contractor to supply Duradek I-6500 series 2" fiberglass grating, with a minimum open area of 65% as manufactured by Strongwell or approved equal. Grating sections shall be cut to fit in the field to accommodate existing and constructed dimensions. Grating shall be installed flush with



floor slab and anchored with corrosion resistant fasteners. Grating to be installed in segments so they can be removed for access and servicing as needed.

## **2.08 WATERPROOFING**

### **A. Products**

1. Interior surfaces of the surge tank and surge tank overflow tank with NO additional finishes: Apply two (2) coats of Vandex BB White, Xypex Modified, Xypex Megamix I, Miracote BC Pro or Basecrete directly to surfaces of the tanks.

### **B. Surface Preparation**

1. Surface must be structurally sound and free of foreign substances and debris that could reduce or impair adhesion. Surfaces must be roughened by sand blasting or water blasting. Shot blasting, scarifying, or grinding can also be accepted methods of surface preparation. Surface defects or holes must be patched per manufacturer's recommendations.
  - a. National Plasterers Council Surface Preparation Definitions
    - 1) Pressure Washing: The washing or cleaning of a surface by a stream of water ejected from a nozzle at high velocity, typically in the range of 1,000 psi – 4,000 psi.
    - 2) Water Blasting: The cutting, abrading, or removal of a surface or substrate by a stream of water ejected from a nozzle at ultra-high velocity, typically in the range of 10,000 psi – 40,000 psi.

### **C. Application**

1. Do not apply materials under conditions where the ambient air temperature is less than 40 degrees Fahrenheit, or to a frozen substrate.
2. Mixing of products, quantities and application procedures must be done in accordance with the manufacturer's recommendations.

## **2.09 SEALANTS**

- ### **A. Provide sealed expansion joints as shown on the pool and pool structural drawings or noted on the construction/expansion joint layout, and as required. Expansion joints must be constructed and sealed as indicated and in accordance with the manufacturer's recommendation. Sealant must be manufactured by LATICRETE International, Inc., Mapei, or Deck-O-Seal.**

1. For submerged joints:
  - a. Latasil, one component, neutral cure, high performance, 100% silicone sealant in the color(s) as selected. Must be used in conjunction with Latasil 9118 Primer per manufacturer's recommendations.
  - b. Mapesil T, 100% silicone sealant in the color(s) as selected.
2. For joints behind the coping, or other horizontal deck joints:
  - a. Deck-O-Seal, two component (gun-grade or pourable, self-leveling), high resilience, non-sag, non-flowing, polysulfide-based sealing compound in the color(s) as selected. Must be used in conjunction with P/G Primer per manufacturer's recommendations.

### **B. Material Storage**

1. Materials must be stored in the original unopened factory containers in a cool dry location at 60 to 80 degrees F. Protect from the elements and the hazards of construction.

### **C. Joint Preparation**

1. Clean the joints of deleterious material, to sound, clean and dry substrate.
2. If the joint is existing and part of a renovation, inspect and verify that joints have firm, solid sub-surface support up to the underside of the structural slab. Identify those joints that do not have such support and fill voids under the joint with a cement slurry (being careful not to fill the joint space itself) consisting of the following:
  - a. Two (2) parts water (by weight) 10 gallons
  - b. One (1) part Portland cement 47 lb. bag
  - c. ¼ to ½ part bentonite ½, 50 lb. bag

3. In mixing the slurry it is recommended that the water be added first, then the cement, and finally the bentonite. The more bentonite the faster the set. Do not get the slurry on the joint itself.
  4. Joint must be formed or filled with an approved, resilient, non-asphaltic, closed cell, polyethylene joint filler material down to firm substrate. Allow space at the top of the joint for the installation of approved closed cell polyethylene backer rod and install same to the required depth below the surface of the slab to control the depth of the sealant bead to within manufacturer requirements.
- D. Surface Preparation
1. Concrete surfaces to receive sealant must be fully cured, clean, dry, and free of dirt, dust, curing compounds and other foreign material that might compromise the adhesion and performance of the sealant. Curing aids, form release agents and joint former residue must be completely removed, if necessary, by sand blasting and/or grinding. Loose dust must be brushed off.
  2. Prime surfaces to receive Latasil sealant with Latasil 9118 Primer prior to sealant application, and surfaces to receive Deck-O-Seal sealant with P/G Primer prior to application.
- E. Application
1. Apply sealant in accordance with the manufacturer's recommendations.
  2. Tool the joint immediately after application to ensure a firm, intimate contact with the joint interface.
  3. Remove excess sealant and smears from adjacent surfaces with Xylol or Toluol before sealant cures.
  4. After the sealant has fully cured (generally a minimum period of five days at 72 degrees and 50% humidity), paint the surface of the sealant with a chlorine resistant chlorinated rubber or equivalent pool paint, such as Ramuc, in a compatible color as selected by the Architect. NOTE: Latasil cannot be painted.

## **2.10 UNDERWATER LIGHTS**

- A. Underwater lights must be equivalent to 500 watts of incandescent light. Underwater lights must 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 pool underwater lights must be 120VAC 55 watts LED-type, and equivalent to 500 watts of incandescent light. Fixture housing must be stainless-steel construction with minimum wall thickness of 0.020 inch per UL 676 underwater pool lighting standard. The niche must be stainless-steel with cast brass mounting ring or PVC plastic with stainless-steel mounting ring. Brass construction pressure grounding lug on interior and exterior services. Lens must be 8-3/8 diameter clear tempered heat resistant glass. Gasket must be single piece "U" shaped santoprene or silicone. Fasteners must be silicon-bronze or stainless-steel. The light fixture must 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 must be a watertight seal and epoxy encapsulated. Light fixture must be IntelliBrite 5g White LED pool light series by Pentair Commercial Pool and Aquatics or approved equal. Underwater lights must be provided with cord length as required to allow for deck relamping of fixtures.
- C. Junction boxes must be provided in the quantities required and must be located at least 8" above the pool coping and 5' from the pool edge. Refer to the Electrical drawings. Cord length must be sufficient to run from fixture to the junction box with sufficient cable in the niche to re-lamp the fixture on the deck. Provide junction boxes that must be installed by Electrical.

### **PART 3 EXECUTION**

#### **3.01 EXISTING CONDITIONS, INSPECTION AND PREPARATION**

- A. Carefully examine the contract documents for requirements that affect the work of this section. Prior to starting work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that work by others, related to this section, has been completed. This includes earthwork, concrete work, and mechanical, electrical, and plumbing connections.
- C. Protect materials and work completed by others from damage while completing the work in this section.

#### **3.02 EXCAVATION, REINFORCING STEEL AND SWIMMING POOL CAST-IN-PLACE CONCRETE**

- A. Reference Section 131101 – Swimming Pool Cast-In-Place Concrete

#### **3.03 TOLERANCES FOR CONSTRUCTION**

- A. The completed structures must be constructed level and to the dimensions, elevation, depths, and thickness as shown on the plans.

#### **3.04 WATER TIGHTNESS TEST**

- A. The water tightness test described within the following section is in accordance with the Hydrostatic Tightness Testing of an Open Concrete Containment Structure as required by American Concrete Institute (ACI) 350.1-10 Section 2. Test reports must be provided and must include test locations within the structure, dates of testing, water level measurements, amounts of evaporation measured volume corrections, retest results (if applicable), actions taken, and final results.
- B. This test applies to the surge tank.
- C. The water tightness test must be completed prior to the application of the waterproofing.
- D. Water Tightness Test Procedure
  - 1. Preparation
    - a. Allow the concrete structure to set 28 days for curing purposes. Once the shell has gained sufficient strength to withstand the test load and after the outlets have been securely sealed, the surge tank must be filled with water.
  - 2. Fill: Fill and then isolate the surge tank. The water tightness test must begin after the vessel has been filled for a minimum of three (3) days. During the filling, outlets must be monitored for water tightness and concrete joints, if applicable, must be monitored for visible leakage. If visible leakage from the vessel is observed, the condition must be corrected prior to the start of the test.
    - a. After the initial fill, ground water must be removed from the pool sight sump or the pool location de-watering system. This must be completed prior to the start of the water tightness test. De-watering of the pool sight sump must be maintained during the entire duration of the test.
  - 3. 24-hour Allowable Loss
    - a. Calculate the allowable water loss from the unlined vessel. This is .1% of the total vessel volume. For the example, the vessel has a volume of 200,000 gallons, the 24-hour allowable loss will be 200 gallons.

Vessel	Total Volume (Gallons)	24-hour Allowable loss (.1% or .001 of Total Volume)
EXAMPLE	200,000 gal	200 gal
Surge Tank		

#### **4. Measurement**

- a. Measurements must be taken at the surge tank. Multiple test points with averaging are recommended for vessels which will be exposed to wind. Document the separate findings on the chart below. Repeat the measurements and document every 12 hours for a total of three (3) days. The General Contractor must check the surge tank for water loss with the Architect or Owner's representative every 12 hours. Submit photo

documentation of each measurement with the completed water tightness report.  
Example measurements are shown in the table below.

5. Evaporation Measurement Procedure

- a. Fill a floating, restrained, partially filled, calibrated, open pan with water and allow the container to float within the pool during the testing period. This will be used to measure evaporation.

Vessel	12 hrs. passed	24 hrs. passed	Day 1 TOTAL	36 hrs. passed	48 hrs. passed	Day 2 TOTAL	60 hrs. passed	72 hrs. passed	Day 3 TOTAL
Example Pool	0.021 ft	0.010 ft	0.031 ft	0.016 ft	0.019 ft	0.035 ft	0.022 ft	0.017 ft	0.039 ft
Example Pan	0.008 ft	0.006 ft	0.014 ft	0.008 ft	0.007 ft	0.015 ft	0.009 ft	0.007 ft	0.016 ft
Surge Tank									
Evaporation Pan									

6. Calculate Daily Loss

- a. Calculate the total daily water loss for the vessel and record in the table below. If a vessel has a daily water loss that is greater than the calculated 24-hour allowable loss, the vessel cannot be considered watertight.
  - 1)  $\text{Daily Loss} = 7.481 \times \text{Structure Surface Area (SF)} \times [\text{Total Water Loss per Day (FT)} - \text{Evaporation per Day (FT)}]$
- b. For the example, we have a body of water that is 200,000-gallon volume and 3,500 square feet of surface area. Measurements for this example body of water are recorded in the table above.
  - 1)  $\text{Day 1 Loss} = (7.481 \text{ gallons per cubic foot}) \times (3,500 \text{ SF}) \times [(.031 \text{ ft water loss}) - (.014 \text{ ft evaporation})] = \underline{445 \text{ gallons Day 1 loss}}$
  - 2)  $\text{Day 2 Loss} = (7.481 \text{ gallons per cubic foot}) \times (3,500 \text{ SF}) \times [(.035 \text{ ft water loss}) - (.015 \text{ ft evaporation})] = \underline{524 \text{ gallons Day 2 loss}}$
  - 3)  $\text{Day 3 Loss} = (7.481 \text{ gallons per cubic foot}) \times (3,500 \text{ SF}) \times [(.039 \text{ ft water loss}) - (.016 \text{ ft evaporation})] = \underline{602 \text{ gallons Day 3 loss}}$

Vessel	Daily Water Loss Day 1 (Gal)	Daily Water Loss Day 2 (Gal)	Daily Water Loss Day 3 (Gal)	Allowable Loss (calculated above, Gal)	Are daily values higher than the Allowable Loss? (Y/N)
EXAMPLE	445 gal	524 gal	602 gal	200 gal	Y, not watertight
Surge Tank					

7. Absorption

- a. Waiting 3 days after the initial water fill will allow the concrete to absorb water and must be sufficient to minimize the effect of absorption on the test results.

8. Evaporation

- a. Evaporation must not have a significant effect on natatoria that are completely enclosed with no air circulation during the water tightness test. However, evaporation will have a significant effect on the water level in natatoria that has air movement across the water surface or are still partially uncovered.

9. If leaks are detected, repair the vessel, and make watertight in accordance with these requirements.

### 3.05 PIPING INSTALLATION

A. General

1. Provide and erect, according to the best practices of the trade, piping shown on the drawings and required for the complete installation of these systems. The piping shown on

the drawings must be considered as diagrammatic in indicating the general run and connections and may or may not in parts be shown in its true position. The piping may have to offset, lowered, or raised as required or as directed at the site. This does not relieve 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 piping, it must be properly supported, and proper provisions must be made for expansion, contraction and anchoring of piping. Piping must be cut accurately for fabrication to measurements established at the construction site. Pipe must be worked into place without springing and/or forcing, properly clearing windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. Pipes must have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. Changes in direction must be made with fittings. Open ends of pipes and equipment must 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. Piping must 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 must be provided in the piping at connections to items of equipment. Piping must be installed to ensure noiseless circulation. Valves and specialties must be so placed to permit easy operation and access.

**B. Pipe Hangers and Supports**

1. Pipes must be adequately supported by pipe hangers and supports as specified.
2. Horizontal PVC Schedule 80 piping must be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size	Hanger Support Spacing	Minimum Rod Size for Single Rod Hanger
1-1/4" and less	5'-0"	3/8"
1-1/2" to 3"	6'-0"	1/2"
4" to 6"	8'-0"	5/8"
8" to 12"	10'-0"	7/8"

3. Round rods supporting the pipe hangers must be of the following dimensions:

Nominal Pipe Size	Rod Diameter
1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

4. Hanger rods must be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.
5. Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.
6. Provide hangers to provide a minimum of 1-inch space between finished covering and adjacent work.
7. Place a hanger within 12 inches of each horizontal elbow.
8. 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.
9. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified. Trapeze hangers must be spaced according to the smallest pipe size or provide intermediate supports according to the support spacing schedules. Provide heavier members as required for the load supported for the entire span distance. Hanger rods must be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.

10. Piping must 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. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.
  11. Attachment of piping hangers to the building structure must be provided in a manner approved by the Architect. Provide concrete inserts installed by the General Contractor in the building construction at the time the concrete is poured, and hangers must be attached to these inserts.
  12. 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.
  3. Where concrete slabs form finished ceilings, provide inserts must be flush with the slab surface.
  4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Flushing, Draining and Cleaning Pipe Systems
1. Flush out water systems with water before placing them in operation. Other systems must be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, strainer screens must be removed and thoroughly cleaned.
- E. Testing
1. Piping installation and pressure testing must be reviewed by the Owner's testing agency before commencement of backfilling. A minimum notice of one (1) week is required prior to review. Results of review must be documented.
  2. Pool related piping must be hydraulically pressure tested (with water, not air) to a pressure of not less than 50 PSI for a period of no less than two (2) hours. Pressure testing shall be conducted in accordance with ASTM D2774. The temperature of the water used for the test must be between 40°F and 90 °F.
  3. Maintain a sustained 20 PSI pressure on pool related piping throughout the course of construction.
  4. Adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

### **3.06 EQUIPMENT AND SYSTEMS INSTALLATION**

- A. Provide and assemble equipment, special parts and accessories as shown on pool drawings, specifications, and shop drawings of the equipment suppliers.
- B. Provide equipment and systems in accordance with manufacturer's directions. Equipment must be assembled and in place for final observation.
- C. Items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. Make provisions accordingly and submit shop drawings and submittals based on that data.

**END OF SECTION**

## **SECTION 13 1101 – SURGE TANK CAST-IN-PLACE CONCRETE**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
  - 1. Surge tank:
    - a. Bottom slab, walls and top slab.
- B. Related Requirements:
  - 1. Division 03 for all concrete not related to surge tank construction.
  - 2. Division 03 or Division 13 for water tightness testing.

#### **1.03 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### **1.04 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special Pool finish 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 joint-filler strips, forms and form removal limitations, anchor rod and anchorage device installation tolerances if required for equipment installation, under slab pipe encasement requirements, and concrete protection.

#### **1.05 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Engineer.
- E. Samples: For waterstops.

#### **1.06 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.

- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Waterstops.
  - 6. Curing compounds.
  - 7. Bonding agents.
  - 8. Joint-filler strips, if required.
  - 9. Repair materials.
  - 10. Dowel bar substitutes.
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

#### **1.07 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 that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 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.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

#### **1.09 FIELD CONDITIONS**

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.



3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
  1. Maintain concrete temperature below 95 deg F (35 deg 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.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE, GENERAL**

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

### **2.02 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
- 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. Void Forms (if indicated on drawings): Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

### **2.03 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

### **2.04 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. Dowel Bar Substitutes: 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.

## 2.05 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S 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 inch (25 mm) nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

## 2.06 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Sika Greenstreak.
    - b. Vinylex Waterstop & Accessories.
  2. Profile: Ribbed without center bulb, non-tapered.
  3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.
- B. Non-Expanding Plastic Adhesive Waterstops: Manufactured rectangular or trapezoidal strip, single-component, self-sealing adhesive compound, for adhesive bonding to concrete, 5/8 by 1-1/2 inch.
  1. Products: Subject to compliance with requirements, provide the following:
    - a. Synko-Flex SF302, Henry Company.
      - 1) Synko-Flex SF311 Solvent Based Primer.

## 2.07 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. BASF Corporation-Construction Systems; Confilm.
    - b. ChemMasters, Inc; Spray-Film.
    - c. Dayton Superior; AquaFilm J74RTU.
    - d. Euclid Chemical Company (The); an RPM company; Eucobar.
    - e. L&M Construction Chemicals, Inc; E-CON.
    - f. Metalcrete Industries; Waterhold.
    - g. Sika Corporation; Caltexol CIMFILM.
    - h. TK Products; TK-2120 TRI-FILM.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of pool finish.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
    - a. BASF Corporation-Construction Systems; MasterKure CC 200 WB (Pre-2014: Kure-N-Seal W).
    - b. Dayton Superior; Cure & Seal 1315 J22 WB.
    - c. Euclid Chemical Company (The); an RPM company; Diamond Clear VOX.
    - d. L&M Construction Chemicals, Inc; Dress & Seal WB.
    - e. SpecChem, LLC; Cure & Seal WB 25.
    - f. W.R. Meadows, Inc; Vocomp-20.

## 2.08 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
  - 1. Provide for cast-in-place concrete coping.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dayton Superior Corporation; Conspec Strong Bond.
    - b. Euclid Chemical Company (The), an RPM company; Flex-Con.
    - c. W. R. Meadows, Inc.; Sealtight Acry-Lok.
    - d. Kaufman Products, Inc.; Surebond.

## 2.09 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
  - 1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    - a. Xypex Concentrate.
  - 2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
  5. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.
    - a. Xypex Concentrate.
  2. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
  5. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

## **2.10 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 (ACI 301M).
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent 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 w/c ratio below 0.50.

## **2.11 CONCRETE MIXTURES FOR SURGE TANK ELEMENTS**

- A. Slabs, Walls, and Other Elements: Normal-weight concrete.
1. Minimum Compressive Strength: 4500 psi (31.0 MPa) at 28 days.
  2. Maximum W/C Ratio: 0.42.
  3. Minimum Cement Content: 600 lb/cu. yd.
  4. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
  5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

## **2.12 FABRICATING REINFORCEMENT**

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

## **2.13 CONCRETE MIXING**

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

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## **2.14 DRAINAGE FILL**

- A. Drainage Course under bottom slabs: Narrowly graded mixture of frost-free, washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

## **PART 3 EXECUTION**

### **3.01 FORMWORK INSTALLATION**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), 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 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
  2. Class D, 1 inch (25 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
  1. Comply with pool and gutter profile shown if edges not shown to be chamfered.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.02 EMBEDDED ITEM INSTALLATION**

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

### **3.03 REMOVING AND REUSING FORMS**

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50

deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent 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 are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

### **3.04 SHORING AND RESHORING INSTALLATION**

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

### **3.05 STEEL REINFORCEMENT INSTALLATION**

- 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 foreign materials that 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.
- E. Dowel bar substitutes may be used in lieu of lap splices.

### **3.06 JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  3. Locate joints for beams and slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  4. Locate horizontal joints in walls and columns at underside of slabs and beams.
  5. Vertical joints in walls shall be located at corners, and in concealed locations where possible.
  6. Use a bonding agent:
    - a. At locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
    - b. At cove joint where cove mortar is placed against hardened wall and slab.
    - c. At coping where coping is placed against hardened wall.
- C. Contraction Joints in Slabs: No contraction joints shall be placed in pool bottom slab.

D. Joints in Coping:

1. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, or, 2 feet maximum. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - b. Isolation Joints: Install vertical joint-filler strips at \_ feet.
    - 1) Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.

**3.07 WATERSTOP INSTALLATION**

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Non-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

**3.08 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
  1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
  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 (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 darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### **3.09 FINISHING FORMED SURFACES**

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

### **3.10 FINISHING SLABS AND WALLS**

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Verify all finish requirements with surge tank finish subcontractor before finishing concrete.
  1. Provide certification, with surge tank finish subcontractor, that concrete finish complies with manufacturer's recommendations for final pool finish.
- C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
  1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  1. Apply float finish to surfaces to receive trowel finish.
- E. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  1. Apply a trowel finish to surfaces exposed to view or to be covered with ceramic tile, paint, or another thin-film-finish coating system.
  2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).



### **3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION**

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

### **3.12 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 (ACI 301M) 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 (1 kg/sq. m 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 remainder of 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 (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 inches (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.
  - 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

### **3.13 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm).

- Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (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. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch (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-inch (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.
  7. Repair random cracks and single holes 1 inch (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. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### **3.14 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
  1. Steel reinforcement placement.

2. Headed bolts (if required for equipment and piping installation).
  3. Verification of use of required design mixture.
  4. Concrete placement, including conveying and depositing.
  5. Curing procedures and maintenance of curing temperature.
  6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
  8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
  10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

**END OF SECTION**

## **SECTION 13 1105 - SELECTIVE DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected pool materials and equipment.
  - 2. Salvage of existing items to be reused or recycled.
  - 3. Protection of surrounding areas.
- B. Related Requirements:
  - 1. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
- C. Related work specified in other sections:
  - 1. Section 131100 – Swimming Pools
  - 2. Section 131101 – Swimming Pool Cast-in-Place Concrete

#### **1.01 DEFINITIONS**

- A. Remove: Detach and remove items from the pool and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Store: Detach and store existing swimming pool items intended for reinstallation and/or reuse.

#### **1.02 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

#### **1.03 SUBMITTALS**

- A. Proposed Protection Measures: Submit plan and report that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Double containment and dedicated exhaust required. Indicate proposed locations and construction of barriers.

#### **1.04 CLOSEOUT SUBMITTALS**

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### **1.05 FIELD CONDITIONS**

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

### **PART 2 PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with OSHA Standards 29 CFR Part 1926 & 1910.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that all piping to remain has been plugged before starting selective demolition operations. All piping and pool equipment to remain fully drained immediately following the draining of the pool until the pool is ready to be refilled and started up for final system commissioning.
- B. Review record documents of existing construction provided by Owners Representative. Owners Representative does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
- F. Notify owner on completion of selective demolition, and obtain documentation verifying that existing surfaces have been inspected and accepted.

### **3.02 PREPARATION**

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Contractor to provide a dust control plan for review by the Owner's Representative.
  - 2. Double containment with dedicated exhaust of work area and pathway of removal is required.
  - 3. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 4. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 5. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 6. Comply with requirements for temporary enclosures and dust control.

### **3.03 SELECTIVE DEMOLITION, GENERAL**

- A. General: Demolish and remove existing pool items as described and/or indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Remove and dispose of existing vacuum sand filter from Wylie Elementary School as identified on the demolition drawings.
  - 2. Remove and dispose of existing pool pumps from Wylie Elementary School as identified on the demolition drawings.
  - 3. Remove and dispose of all unused piping in the mechanical space associated with the filter and pump from Wylie Elementary School as identified on the demolition drawings.
  - 4. Remove and dispose of existing underwater water lights from the two Wylie Elementary School pools and the one Dexter High School pool as identified on the demolition drawings.
  - 5. Remove and dispose of existing VGB Main Drain covers from the two Wylie Elementary School pools and the single Dexter High School pool as identified on the demolition drawings.
  - 6. Remove and dispose of existing vacuum sand filter valve extensions from Dexter High School as identified on the demolition drawings.
  - 7. Dispose of demolished items and materials promptly.

### **3.04 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Protect all finished surfaces during the demolition process.
  - 2. Do not allow demolished materials to accumulate on-site.
  - 3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### **3.05 CLEANING**

- A. Clean adjacent structures and improvements including but not limited to structural spaces of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION**

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**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

**1.02 SUMMARY**

- A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

**1.03 REFERENCES**

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
1. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  2. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
  3. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
  4. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
  5. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
  6. NEC - National Electrical Code
  7. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).



- a. NECA 1-2000, "Practices for Good Workmanship in Electrical Contracting (ANSI)."
8. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
9. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
10. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).

#### **1.04 QUALITY ASSURANCE**

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test, and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
  1. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
  2. The Contractor understands that the work herein described shall be complete in every detail.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State, and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.
  1. Notify the Architect/Engineer if revisions to the Drawings or Specifications are required to conform to applicable ordinances, codes, or regulations. Identify the cost associated with these revisions in the bid.
- C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county, and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Avoid interference with the work of other trades. Remove and relocate any work which in the opinion of the Owner's Representatives causes interference.

#### **1.05 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals, and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules, and regulations.
- B. Comply with rules of local utility companies. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets, and meters which will be required and include the cost of all such items and all utilities costs in proposal.
- C. All work shall be executed in accordance with the rules and regulations outlined in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction that exceed code requirements, the Drawings and/or Specifications shall govern.

#### **1.06 DRAWINGS**

- A. The Drawings show the location and general arrangement of equipment, electrical systems, and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes, and accessories as may be required to meet such conditions.
- C. Deviations from the Drawings, apart from minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades, and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### **1.07 MATERIAL AND EQUIPMENT MANUFACTURERS**

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new, be standard products of manufacturers regularly engaged in the production of electrical equipment and be of the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.
- C. Where existing equipment is modified to include new switches, circuit breakers, metering, or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third-party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

#### **1.08 INSPECTION OF SITE**

- A. Visit the site, examine, and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

#### **1.09 ITEMS REQUIRING PRIOR APPROVAL**

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information, and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
  - 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
  - 2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.

- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

#### **1.10 SHOP DRAWINGS/SUBMITTALS**

- A. Submit project-specific submittals for review in compliance with Division 1.
- B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- C. If deviations (not substitutions) from the Contract Documents are deemed necessary by the Contractor, the details of such deviations, the reason for the deviation, and the resulting changes shall be included with the submittal for approval.
- E. Submit for approval shop drawings for electrical systems or equipment indicated in other sections of electrical specs.

#### **1.11 COORDINATION DRAWINGS**

- A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

#### **1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS**

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manual shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.
- C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
  - 1. Routine maintenance procedures.
  - 2. Trouble-shooting procedures.
  - 3. Contractor's telephone numbers for warranty repair service.
  - 4. Submittals.
  - 5. Recommended spare parts list.
  - 6. Names and telephone numbers of major material suppliers and subcontractors.
  - 7. System schematic drawings on 8-1/2" x 11" sheets.

#### **1.13 RECORD DRAWINGS**

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work. Modifications to original drawings shall be marked with a contrasting color so the marks are readily apparent.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer, and Owner at their request during construction.

#### **1.14 INSTRUCTION OF OWNER PERSONNEL**

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

- C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
- D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

#### **1.15 WARRANTY**

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship, or failure to follow the contract documents.
- B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
- C. File with the Owner all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

#### **1.16 USE OF EQUIPMENT**

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

#### **1.17 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. To ensure that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions; and to maintain the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

### **PART 2 PRODUCTS (NOT APPLICABLE)**

### **PART 3 EXECUTION**

#### **3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

### **3.02 DEMOLITION WORK**

- A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items related to the existing systems that are being removed such as, but not limited to, electrical equipment, cabinets, devices, lighting fixtures, conduit, fittings, boxes, wiring, and supports. No abandoned components of the electrical systems indicated to be removed shall remain.
  - 1. Where electrically powered equipment is included in the demolition scope of other trades, disconnect electrical wiring connections and remove circuit wiring complete.
- B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.
- C. Unless specifically noted otherwise, removed materials shall not be reused in the work.
  - 1. Materials indicated to be salvaged shall be carefully removed, stored, and protected from damage.
  - 2. Salvaged materials intended to be re-used shall be thoroughly cleaned, refurbished if necessary, and determined to be fully functional prior to placing back into service.
  - 3. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items that the Owner has waived ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- D. Where equipment or fixtures are removed, outlet boxes that remain recessed in walls shall be properly blanked off, and conduits capped. After alterations are complete, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical systems remaining in service shall not be changed unless specifically indicated as part of the project scope.
- E. Reroute signal wires, lighting, and power wiring as required to maintain services that are to remain and/or unaffected by the renovations. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or the panels.
- F. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc., the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.
- G. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where specifically indicated on the drawings or approved by the Architect/Engineer.
- H. Existing lighting shall be reused where indicated on plans. Reused fixtures shall be detergent cleaned, re-lamped, and reconditioned suitable for satisfactory operation and appearance.

### **3.03 INSTALLATION OF EQUIPMENT**

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Device Location:
  - 1. Allow for wiring devices, control devices, and fire alarm devices to be relocated within a 10' radius to accommodate final coordination with furnishings and other finish elements. Devices relocated prior to installation shall be done without additional cost to the project.

### **3.04 WORK IN EXISTING BUILDINGS**

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.
- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal, or other work that is related in any way whatsoever to hazardous materials under the Contract.

### **3.05 CHASES AND RECESSES**

- A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

### **3.06 CUTTING, PATCHING AND DAMAGE TO OTHER WORK**

- A. Refer to General Conditions for requirements.
- B. All cutting, patching, and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

### **3.07 EXCAVATION AND BACKFILLING**

- A. Provide all excavation, trenching, tunneling, dewatering, and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
- C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill all excavations inside building, under drives, and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

### **3.08 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

### **3.09 CLEANING**

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

### **3.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS**

- A. Equipment and materials shall be protected from theft, injury, or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

### **3.11 EXTRA WORK**

- A. For additional electrical work which may be proposed or requested, furnish an itemized cost breakdown of material and labor required to complete the work. Proceed only after receiving a written authorization.

### **3.12 DRAWINGS AND MEASUREMENTS**

- A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor's responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

### **END OF SECTION**

## SECTION 26 0519 - CONDUCTORS AND CABLES

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### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section includes:
  - 1. Building wires and cables rated 600V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
  - 1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
  - 2. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

#### 1.03 SUBMITTALS

- A. Field Quality-Control Test Reports
- B. Submit letter of compliance (intent) for general building wire and cable. Provide product data for the following:
  - 1. Metal-Clad Cable, Type MC
  - 2. Power Cable for Variable Frequency Controlled Motors

#### 1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### PART 2 PRODUCTS

#### 2.01 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:



1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  1. Type THHN/THWN-2: Comply with UL 83.
  2. Type THW/THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  3. Type XHHW-2: Comply with UL 44.

## **2.02 ALUMINUM BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
  1. Allowed only for conductors used in feeders 100A and larger.
- B. Manufacturers:
  1. General Cable
  2. Southwire
- C. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.
- E. Conductor Insulation:
  1. Type XHHW-2: Comply with UL 44.

## **2.03 METAL-CLAD CABLE, TYPE MC**

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers:
  1. AFC Cable Systems
  2. Alpha Wire Company
  3. American Bare Conductor
  4. Belden
  5. Encore
  6. General Cable
  7. Okonite
  8. Service Wire Co.
  9. Southwire Company
- C. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Comply with UL 1569.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  1. Single circuit and multi-circuit with color-coded conductors for branch circuit distribution.
  2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors:
  1. Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated. Ground conductor sized as indicated on drawings (reduced ground conductor is not acceptable).

- G. Conductor Insulation:
  - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
  - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

## **2.04 POWER CABLE FOR VARIABLE FREQUENCY CONTROLLED MOTORS**

- A. Description: A factory assembly of three conductor cable with three symmetrical ground conductors, a continuous shield, an overall PVC jacket and a product specific connector and termination kit.
- B. Manufacturers:
  - 1. Service Wire Co.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Comply with UL 1277
  - 3. Comply with ICEA S-95-658/NEMA WC 70 for Type TC-ER Power Cable (for VFD application)
  - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  - 1. Single circuit feeder.
- E. Phase Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Bare copper.
- G. Phase Conductor Insulation: Moisture resistant, flame retardant, cross linked polyethylene (2KV RHW-2) suitable for 90 deg C conductor temperature operation in dry, damp and wet locations
- H. Shield: Helically applied minimum 5 mils thick bare copper with minimum 50% overlap.
- I. Jacket: Oil resistant PVC
- J. Connector: Water-tight and UL listed for installation on supplied TC cable (tray cable) assembly.
  - 1. Body material: nickel clad aluminum
  - 2. Connector shall provide a 360-degree electrical bonding of the copper tape shield to the connector body.
  - 3. Connection of the copper tape shield to the connector body shall be accomplished by an integral and self-retaining grounding collar that automatically provides a 360-degree connection as the connector is tightened.
  - 4. The connector assembly shall be designed to ensure against loosening of threads due to vibration.
  - 5. A UL listed chrome plated grounding and bonding locknut with a 360-degree knurled teeth connection shall be provided with each connector to secure and bond the connector to the inverter cabinet / motor termination box.
  - 6. Tinned copper braids (minimum 3/4 inches wide) with installation hardware to connect the copper tape shield to the inverter enclosure / back-panel and to the motor frame shall be provided as part of the cable system.
- K. Termination Kit: Tinned copper braids (minimum 3/4 inches wide) with installation hardware to connect the copper tape shield to cable core, to the inverter enclosure/back-panel, and to the motor frame shall be provided as part of the cable system.
  - 1. Braid width shall be determined by cable core diameter size and shall be placed at a separation of 180 degrees.

## **2.05 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## **PART 3 EXECUTION**

### **3.01 CONDUCTOR MATERIAL APPLICATIONS**

- A. Refer to application schedule on the drawings
- B. If providing aluminum feeders, contractor is responsible for providing correct feeder, equipment ground and conduit size based on voltage drop and any de-rating required.
- C. Feeders and Branch Circuits: Solid or stranded for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- D. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
- E. Use conductor not smaller than 14 AWG for control circuits,
- F. Where equipment is listed for use with copper conductors only, use copper conductors for the entire length of feeder.

### **3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Refer to application schedule on the drawings
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh strain relief device at terminations to suit application.
- C. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- D. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.
- E. Connection between Variable Frequency Controllers and Motors: Use power cable for variable frequency- controlled motors. Install and terminate according to cable manufacturer's recommendations.

### **3.03 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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 according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Provide a separate neutral conductor for each circuit unless multi-wire branch circuits are specifically indicated on the drawings.
- J. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable. Neutral conductors shall be considered current carrying conductors.
- K. Type MC cable shall be supported and secured at intervals not exceeding 4'-0" in new construction
- L. AC/MC cable shall not be used for home runs to receptacle or distribution panels.
- M. Where AC/MC cable is bundled, without spacing, the contractor shall apply the appropriate de-rating factors to the conductors.

- N. Where AC/MC cable is permitted by the specifications, AC/MC cable shall not be bundled.
- O. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
- P. Do not route conductors across roof without prior approval from engineer.
- Q. Install and terminate power cable for variable frequency- controlled motors according to cable manufacturer's recommendations.

### **3.04 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
  - 2. Use compression type terminations for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Clean conductor surfaces before installing lugs and connectors.
- E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- G. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
- H. Use insulated spring wire connectors with plastic caps (wire nuts) for copper conductor splices and taps, 10 AWG and smaller. Push-in style connectors are not permitted.
- I. Provide lugs suitable for bussing and conductor material used.

### **3.05 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### **3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260533 "Raceways and Boxes."

### **3.07 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

### **3.08 FIELD QUALITY CONTROL**

- A. Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Description: Test all feeders rated 100 A and above.
  - 2. Visual and Mechanical Inspection
    - a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
    - b. Test cable mechanical connections with an infrared survey.
    - c. Check cable color-coding against project Specifications and N.E.C. requirements.

3. Electrical Tests
  - a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
  - b. Perform continuity test to insure proper cable connection.
4. Test Values
  - a. Minimum insulation resistance values shall be not less than fifty mega-ohms.
- B. Test Reports: Prepare a written report to record the following:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

**END OF SECTION**

## SECTION 26 0526 - GROUNDING AND BONDING

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### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 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.
- B. Related Sections include the following:
1. Division 26 Section "Electrical General Requirements".
  2. Division 26 Section "Conductors and Cables".

#### 1.03 REFERENCES

- A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
- C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B 187: Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
- E. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- F. IEEE 142: Grounding of Industrial and Commercial Power Systems.
- G. IEEE 1100 – 1992: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
- H. IEEE C2: National Electrical Safety Code.
- I. NETA MTS – 2001: Maintenance Testing Specifications.
- J. NFPA 70: National Electrical Code.
- K. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
- L. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
- M. UL 467: Grounding and Bonding Equipment.
- N. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- O. UL 486B: Wire Connectors for Use with Aluminum Conductors.

#### 1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 26 "Electrical General Requirements".

### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Refer to specification section "Electrical Testing."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.
- C. Comply with ANSI/IEEE 1100 -1992 "Powering and Grounding Sensitive Electronic Equipment".

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors and Cables:
    - a. Refer to Division 26 Section "Conductors and Cables".
  - 2. Mechanical Connectors:
    - a. American Electric-Blackburn.
    - b. Burndy.
    - c. Chance/Hubbell.
  - 3. Exothermic Connections:
    - a. Cadweld.
  - 4. Compression-type Connectors:
    - a. Burndy HyGround
    - b. Blackburn EZ Ground.
    - c. Panduit.

### **2.02 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, copper unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  - 1. Bonding Conductor: Stranded copper conductor; size per the NEC.
  - 2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; size per the NEC.
  - 3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; size per the NEC.
- H. Aluminum Bonding Conductors: As follows:
  - 1. Bonding Conductor: Stranded aluminum conductor; size per the NEC.
  - 2. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; size per the NEC.

### **2.03 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 for the specific application per manufacturer's written instructions.
- D. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

## **PART 3 EXECUTION**

### **3.01 EQUIPMENT GROUNDING**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. In raceways, use insulated equipment grounding conductors. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
  - 1. Where existing branch circuits are using conduit as equipment grounding conductor and are extended, provide grounding bushing on existing conduit and provide new equipment grounding conductor with new branch circuit.
- D. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
- E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- F. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- G. Verify specific equipment grounding requirements with the manufacturer's recommendations.

### **3.02 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: Use for connections to structural steel and for underground connections, except those at test wells. 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
  - 1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
  - 2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- 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 noncontinuous 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. If manufacturer's torque values are not indicated, use those specified in UL 486A or UL 486B as applicable.



- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Connections shall be non-reversible. 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.

### 3.03 INSTALLATION

- A. Equipotential Ground: Interconnect grounding electrodes to form one, electrically continuous, equipotential grounding electrode system.
- 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. Install in conduit where routed above grade.
  - 1. Aluminum and copper-clad aluminum conductors shall not be used in direct contact with masonry, within 18 inches of the earth, or where subject to corrosive conditions.
- 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 or non-reversing compression-type 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 Pipes in direct contact with the earth for 10 feet: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to all metal water service entrances to building including fire protection water service entrance. Connect grounding conductors to 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. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- G. Bond interior metal piping systems, including any portions of metal piping systems separated by non-metal piping, and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- H. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.
- I. Bond together metal building elements not attached to grounded structure; bond to ground.
- J. Pool Structures: Provide a common bonding grid with a solid copper conductor not smaller than No. 8 AWG. Bond together the following:
  - 1. All metallic parts of the pool or fountain structure, including reinforcing steel of the pool or fountain shell, coping stones, and deck.
  - 2. All forming shells and mounting brackets of no-niche luminaries.
  - 3. All metal fittings within or attached to the pool or fountain structure that are greater than 4 inches in any dimension and penetrate the pool or fountain structure more than one inch.
  - 4. Metal parts of electrical equipment associated with the pool or fountain water circulating system, including pump motors and metal parts of equipment associated with pool covers, including electric motors.

5. Metal sheathed cables and raceways, metal piping, and all fixed metal parts including fences, awnings, door and window frames, except those separated from the pool or fountain by a permanent barrier shall be bonded that are within the following distances of the pool:
  - a. Within 5 feet horizontally of the inside walls of the pool.
  - b. Within 12 feet measured vertically above the maximum water level of the pool, or any observation stands, towers, or platforms, or any diving structure.

K. Provide a flexible braid bonding jumper at each set of columns at expansion joints.

### **3.04 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  1. Inspect grounding and bonding system conductors and connections for tightness and proper installation and for compliance with the Drawings and Specifications.
  2. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    - a. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal.
    - b. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - c. Perform tests, by the fall-of-potential method according to IEEE 81. Instrumentation utilized shall be as defined in Section 12 of IEEE 81 and shall be specifically designed for ground impedance testing. Provide sufficient spacing so that curves flatten in the 62% area of the distance between the item under test and the current electrode.
    - d. Perform ground-impedance measurements utilizing either the intersecting curves method of the slope method. (Ref. Nos. 40 and 41 in IEEE Std. 81).
    - e. Equipment Grounds: Utilize two-point method of IEEE 81. Measure between equipment ground being testing and known low-impedance grounding electrode or system.
  3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
    - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
    - c. Equipment Rated More Than 1000 kVA: 3 ohms.
    - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    - e. Manhole Grounds: 10 ohms.
    - f. The telecommunications grounding system shall have a maximum resistance of 1 ohm as measured from the TMGB ground to earth ground.
  4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### **END OF SECTION**

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**SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

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**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

**1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

**1.06 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## **PART 2 PRODUCTS**

### **2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International..
    - b. B-Line, by Eaton..
    - c. GS Metals Corp.
    - d. Pentair Electrical & Fastening Solutions.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; a part of Atkore International.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-Line by Eaton.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
  - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) B-Line by Eaton.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

## **2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with:
    - a. Two-bolt conduit clamps
    - b. Single-bolt conduit clamps
    - c. Single-bolt conduit clamps using spring friction action for retention in support channel.

### **3.02 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  2. To Existing Concrete: Expansion anchor fasteners.
  3. To Steel:
    - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
    - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
  4. To Light Steel: Sheet metal screws.
  5. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel support systems attached to substrate.
- E. Slotted support systems applications:
  1. Indoor dry and damp Locations: Painted Steel
  2. Outdoors and interior wet locations: Galvanized Steel
  3. Corrosive Environments, including pool equipment rooms: Nonmetallic

- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- H. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- I. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- J. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- K. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- L. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- M. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- N. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

### **3.03 INSTALLATION OF FABRICATED METAL SUPPORTS**

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.04 CONCRETE BASES**

- A. Provide concrete bases for all floor mounted electrical equipment.
- B. Provide concrete bases for all exterior, grade level electrical equipment, and where indicated.
- C. Base/Pad Construction:
  - 1. Construct per manufacturer's recommendations for particular equipment, including suggested piers and dowel rods.
  - 2. Interior concrete bases shall have a minimum depth of 4" unless other indicated or recommended by the manufacturer.
  - 3. Exterior concrete bases shall have a minimum depth of 8" unless other indicated or recommended by the manufacturer.
  - 4. Construct concrete bases for primary and secondary power distribution equipment per requirements of the electrical utility, where submitted for its review.
- D. Anchor equipment to base per both supports and equipment manufacturer's instructions.
- E. Coordinate conduit openings and sleeve locations in base with requirements of equipment to be supported.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

### **3.05 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**



**SECTION 26 0533 - RACEWAYS AND BOXES**

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**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.
  - 2. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC: Polyvinyl Chloride.
- I. HDPE: High Density Polyethylene.
- J. RTRC: Reinforced Thermosetting Resin Conduit.

**1.04 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

### 1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. All work in natatoriums, pool areas and fountain structures shall be in accordance with N.E.C. article 680, "Swimming Pools, Fountains, and Similar Installations."

### 1.06 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 PRODUCTS

### 2.01 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube Triangle Century.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. International Metal Hose.
  - 6. Electri-Flex Co
  - 7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
  - 9. Maverick.
  - 10. O-Z Gedney; unit of General Signal.
  - 11. Wheatland.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit, IMC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  - 2. Fittings for EMT: Steel, compression type.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

### 2.02 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American International.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corp.
  - 4. Cantex Inc.
  - 5. Certainteed Corp.; Pipe and Plastics Group.
  - 6. Condux International.
  - 7. ElecSys, Inc.

8. Electri-Flex Co.
  9. Integral.
  10. Kor-Kap.
  11. Lamson and Sessions: Carlon Electrical Products.
  12. Manhattan/CDT/Cole-Flex.
  13. RACO; Division of Hubbell, Inc.
  14. Scepter.
  15. Spiralduct, Inc./AFC Cable Systems, Inc.
  16. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- E. LFNC: UL 1660.
- F. HDPE: UL 651, ASTM D 3350, ASTM D 1248 Schedule 40.
- G. RTRC: Comply with UL 2515A and NEMA TC 14.

### **2.03 METAL WIREWAYS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 4X.
- C. Fittings and Accessories: Include 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.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Hinged type.
- F. Finish: Manufacturer's standard enamel finish.

### **2.04 NONMETALLIC WIREWAYS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Fiberglass polyester, extruded and fabricated to size and shape required, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- C. Fittings and Accessories: Include 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.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

### **2.05 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Airey-Thompson Sentinel Lighting: Wiremold Company (The).
  - b. Thomas & Betts Corporation.
  - c. Walker Systems, Inc.; Wiremold Company (The).

- d. Wiremold Company (The); Electrical Sales Division.
    - e. Mono-Systems, Inc.
  - B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Hubbell, Inc.; Wiring Device Division.
      - b. Carlon Electric Products.
      - c. Panduit Corporation.
      - d. Walker Systems, Inc.; Wiremold Company (The).
      - e. Wiremold Company (The); Electrical Sales Division.
      - f. Mono-Systems, Inc.
  - C. Types, sizes, and channels as required for each application, with fittings that match and mate with raceways.

## **2.06 BOXES, ENCLOSURES, AND CABINETS**

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2. Shall be used in corrosive areas.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.

## **2.07 SLEEVES FOR RACEWAYS**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

## **2.08 GROUT**

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

# **PART 3 EXECUTION**

## **3.01 RACEWAY APPLICATION**

- A. Provide raceways in interior and exterior locations in accordance with the "Raceway Application Matrix" included on the drawings.
- B. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
  - 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits in contact with concrete.

- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### **3.02 INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. 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.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install temporary closures to prevent foreign matter from entering raceways.
- F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  - 1. Raceways embedded in slabs shall be limited to above grade concrete decks. Embedded conduit shall be limited to servicing floor boxes and equipment located in open spaces away from accessible walls.
  - 2. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
  - 3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 4. Space raceways laterally to prevent voids in concrete.
  - 5. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 6. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 7. Conduits shall run flat. Do not allow conduits to cross.
  - 8. Change from non-metallic raceway to rigid steel before turning up out of the concrete and rising above the floor.
- L. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- U. Provide pull string and 25% spare capacity in every branch circuit conduit.
- V. Communications and Signal Cabling Systems Raceways: In addition to 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.
  - 1. Electrical conduit (LB's) are not permitted.
  - 2. Conduits shall have no more than two 90 degree bends between pull points or pull boxes.
  - 3. Conduits shall contain no continuous sections longer than 150 ft. without a pull point/box.
  - 4. Conduit for fiber cabling shall have a bend radius of at least 10 times the internal diameter.
  - 5. Conduit for copper cabling less than 2" shall have a bend radius of at least 6 times the internal diameter. Conduit for copper cabling 2" and larger shall have a bend radius of at least 10 times the internal diameter.
  - 6. All conduit ends shall have an insulated bushing.
- W. Install raceway sealing 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 boundaries of refrigerated spaces.
  - 2. Where conduits route through, to, or from a hazardous classified space (Class I or II), provide proper seal offs when exiting or entering the hazardous classified space.
  - 3. Where conduits pass between spaces that are maintained at two different vapor pressures.
  - 4. Where otherwise required by NFPA 70.
- 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 finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- Y. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

- a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Provide cover clips to cover space between connecting pieces.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- GG. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- HH. Do not route feeders across roof.
- II. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.
- JJ. Outlet boxes within hazardous locations shall be of the proper class and division as noted in the N.E.C.

### **3.03 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS**

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.



- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

### **3.04 SLEEVE-SEAL INSTALLATION**

- A. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### **3.05 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

### **3.06 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.07 CLEANING**

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

### **END OF SECTION**

## **SECTION 26 0553 - ELECTRICAL IDENTIFICATION**

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### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Warning labels and signs.
  - 4. Instruction signs.
  - 5. Equipment identification labels.
  - 6. Miscellaneous identification products.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.145.

#### **1.04 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### **PART 2 PRODUCTS**

#### **2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

## **2.02 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

## **2.03 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## **2.04 INSTRUCTION SIGNS**

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## **2.05 EQUIPMENT IDENTIFICATION LABELS**

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch .
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## **2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Telecommunication System: Green and yellow.
  - 3. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor

- according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.
- E. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
  - F. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
  - G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
    - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
    - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
    - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
  - H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
    - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      - a. Power transfer switches.
      - b. Controls with external control power connections.
    - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
  - I. Instruction Signs:
    - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
    - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
  - J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
    - 1. Labeling Instructions:
      - a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
      - b. Outdoor Equipment: Stenciled.
      - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - 2. Equipment to Be Labeled: If included on project. All items may not be on project.
      - a. Panelboards, electrical cabinets, and enclosures.
      - b. Access doors and panels for concealed electrical items.
      - c. Electrical switchgear and switchboards.
      - d. Transformers.
      - e. Electrical substations.
      - f. Emergency system boxes and enclosures.
      - g. Motor-control centers.
      - h. Disconnect switches.

- i. Enclosed circuit breakers.
- j. Motor starters.
- k. Push-button stations.
- l. Power transfer equipment.
- m. Contactors.
- n. Remote-controlled switches, dimmer modules, and control devices.
- o. Battery inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Voice and data cable terminal equipment.
- s. Master clock and program equipment.
- t. Intercommunication and call system master and staff stations.
- u. Television/audio components, racks, and controls.
- v. Fire-alarm control panel and annunciators.
- w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- x. Monitoring and control equipment.
- y. Uninterruptible power supply equipment.
- z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- aa. Breakers or switches at distribution panels.

### **3.02 INSTALLATION**

- A. Verify identity of each item before installing identification products.
- B. Location:
  - 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Grounded Conductor (Neutral): White.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Ground Conductor (Neutral): Grey.
  - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made.

Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Label information arrangement for 3 lines of text.

1. Line one shall describe the panel or equipment. Line one example: "DP-XX," RP-XX," "T-XX," "EF-XX," etc.
2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: "Fed from DP-XX," "Fed from RP-XX," etc.
3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: "First Floor Elect. Rm #XXX."
4. Line four shall include "Via T-XX" when panel or equipment is fed from a transformer.

I. Examples:

RP-1A FED FROM DP-1A ELECTRICAL ROOM A100 VIA T-1A	EF-1 FED FROM MCC-1A MECHANICAL ROOM F101	LP-1A LOCATED IN ELECTRICAL ROOM A100
---	---	---

- J. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
- K. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
- L. Degrease and clean surface to receive nameplates.
- M. Install nameplate and labels parallel to equipment lines.
- N. Secure nameplate to equipment front using screws.
- O. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- P. Identify conduit using field painting where required.
- Q. Paint bands 10 feet on center, and 4 inches minimum in width.

**END OF SECTION**

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## **SECTION 26 0999 - ELECTRICAL TESTING**

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### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections include the following:
  1. Division 26 Section "Electrical General Requirements."
  2. Division 26 Section "Conductors and Cables."
  3. Division 26 Section "Grounding and Bonding."
  4. Division 26 Section "Enclosed Switches."
  5. Division 26 Section "Enclosed Controllers."
  6. Division 26 Section "Panelboards."
  7. Division 26 Section "Fuses."

#### **1.02 SECTION INCLUDES**

- A. Engage the services of a recognized corporately independent N.E.T.A. certified testing firm to perform inspections and tests as specified herein.
- B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- C. It is the intent of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
- D. The test and inspections shall determine suitability for energization.
- E. Equipment to be tested and inspected shall be the equipment shown on the one line diagram and schedules as required by part three of each individual Specification Section.

#### **1.03 REFERENCES**

- A. All inspections and tests shall be in accordance with the latest version of the following codes and standards except as provided otherwise herein.
  1. National Electrical Manufacturer's Association - NEMA
  2. American Society for Testing and Materials - ASTM
  3. Institute of Electrical and Electronic Engineers - IEEE
  4. InterNational Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-2017
  5. InterNational Electrical Testing Association - NETA Maintenance Testing Specifications- MTS-2015
  6. American National Standards Institute - ANSI C2: National Electrical Safety Code
  7. State and Local Codes and Ordinances
  8. Insulated Cable Engineers Association - ICEA
  9. Association of Edison Illuminating Companies - AEIC
  10. Occupational Safety and Health Administration
  11. National Fire Protection Association - NFPA
    - a. ANSI/NFPA 70: National Electrical Code



- b. ANSI/NFPA 70B: Electrical Equipment Maintenance
- c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
- d. ANSI/NFPA 101: Life Safety Code

#### **1.04 QUALIFICATIONS**

- A. The testing firm shall be a corporately independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The lead, on site, technical person and at least 50% of the on site crew shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies in Electrical Power Distribution System Testing.
- D. The testing firm shall only utilize technicians who are regularly employed by the firm on a full-time basis for testing services.
- E. The terms used here within such as Test Agency, Test Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing organization.
- F. Acceptable Testing Firms:
  - 1. Northern Electrical Testing; Phone (248) 689-8980.
  - 2. Utilities Instrumentation Services; Phone (734) 424-1200.
  - 3. High Voltage Maintenance Corporation; Phone (248) 305-5596.
  - 4. Powertech Services, Inc.; Phone (810) 720-2280.
  - 5. Power Plus Engineering, Inc.; Phone (800) 765-3120.
  - 6. Premier Power Maintenance, Inc.; (517) 230-6629

#### **1.05 PERFORMANCE REQUIREMENTS**

- A. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the power requirements.
- B. The Electrical Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- C. The testing firm shall notify the Owner's Representative prior to commencement of any testing.
- D. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported to the Engineer. The Electrical Contractor shall correct all defects.
- E. The testing organization shall maintain a written record of all tests and shall assemble and certify a final test report.
- F. Safety and Precautions
  - 1. Safety practices shall include, but are not limited to, the following requirements:
    - a. Occupational Safety and Health Act.
    - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
    - c. Applicable state and local safety operating procedures.
    - d. NETA Safety/Accident Prevention Program.
    - e. Owner's safety practices.
    - f. National Fire Protection Association - NFPA 70E.
    - g. American National Standards for Personnel Protection.
  - 2. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
  - 3. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

#### **1.06 TEST INSTRUMENT CALIBRATION**

- A. Test Instrument Calibration
  - 1. The testing firm shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instruments shall be calibrated in accordance with the following frequency schedule:
  - a. Field instruments: Analog - 6 months maximum Digital - 12 months maximum
  - b. Laboratory instruments: 12 months
  - c. Leased specialty equipment: 12 months (Where accuracy is guaranteed by Lessor)
4. Dated calibration labels shall be visible on all test equipment.
5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
6. An up-to-date instrument calibration instruction and procedures shall be maintained for each test instrument.
7. Calibrating standard shall be of higher accuracy than that of the instrument tested.
- B. Field Test Instrument Standards
  1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:
    - a. Maintained in good visual and mechanical condition.
    - b. Maintained in safe, operating condition.
- C. Suitability of Test Equipment
  1. All test equipment shall be in good mechanical and electrical condition.
  2. Selection of metering equipment should be based on knowledge of the waveform of the variable being measured. Digital multi-meters may be average of RMS sensing and may include or exclude the dc component. When the variable contains harmonics of dc offset and, in general, any deviation from a pure sine wave, average sensing, average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.
  3. Field test metering used to check power system meter calibration must have any accuracy higher than that of the instrument being checked.
  4. Accuracy of metering in test equipment shall be appropriate for the test being performed.
  5. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

#### **1.07 TEST REPORTS**

- A. A test report shall be generated for each piece of major equipment or groups of equipment and shall include the following:
  1. A list of visual and mechanical inspections required by Division 26 Specification Sections in a checklist or similar format.
  2. Test reports, including test values where applicable, for all required electrical tests. Clearly indicate where test values fall outside of the limits of recommended values.
  3. Summary and interpretation of test results detailing problems located and recommended corrective measures.
  4. Record of infrared scan and photos showing potential problem locations.
  5. Signed and dated by the testing firm field superintendent stating that all required tests have been completed.
- B. Test reports shall be furnished to the Architect/Engineer within 14 days of the completion each test on an ongoing basis. Original copies of the reports shall be furnished directly to the Architect/Engineer by the testing company prior to formal submittal via the Contractors.

#### **PART 2 PRODUCTS (NOT APPLICABLE)**

#### **PART 3 EXECUTION**

##### **3.01 THERMOGRAPHIC SURVEY**

- A. Visual and Mechanical Inspection
  1. Remove all necessary covers prior to scanning.
  2. Inspect for physical, electrical, and mechanical condition.
- B. Equipment to be Scanned
  1. All components of the distribution system down to and including branch circuit panelboards and motor control centers. Return 3 months after equipment has been energized and loaded to do a final scan of all equipment.

- C. Provide report indicating the following:
  - 1. Problem area (location of "hot spot").
  - 2. Temperature rise between "hot spot" and normal or reference area.
  - 3. Cause of heat rise.
  - 4. Phase unbalance, if present.
  - 5. Areas scanned.
- D. Test Parameters
  - 1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
  - 2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
  - 3. Infrared surveys should be performed during periods of maximum possible loading but not less than twenty percent (20%) of rated load of the electrical equipment being inspected.
- E. Test Results
  - 1. Interpretation of temperature gradients requires an experienced technician. Some general guidelines are:
    - a. Temperature gradients of 37°F to 44.6°F indicate possible deficiency and warrant investigation.
    - b. Temperature gradients of 44.6°F to 59°F indicate deficiency; repair as time permits.
    - c. Temperature gradients of 61°F and above indicate major deficiency; repair immediately.

**END OF SECTION**

## SECTION 26 2416 - PANELBOARDS

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### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### 1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. AFCI: Arc-fault circuit interrupter.
- E. RFI: Radio-frequency interference.
- F. RMS: Root mean square.
- G. SPDT: Single pole, double throw.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, surge 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. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports including the following:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, 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.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

#### **1.06 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  1. Ambient Temperature: Not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  1. Ambient temperatures within limits specified.
  2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

#### **1.07 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.

- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

### **1.08 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Six spares for each type of panelboard cabinet lock.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corporation; Cutler-Hammer Products.
    - b. GE by ABB.
    - c. [Siemens Industries, Inc.](#)
    - d. Square D.

### **2.02 MANUFACTURED UNITS**

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Mounting as noted on panel schedules. NEMA PB 1, Type 1.
1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.
    - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - c. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
  2. Cabinet Front: Flush or surface cabinet as noted on the Drawings.
    - a. Eaton LTDD (Piano hinge trim)
    - b. GE – FGB (front hinge to box).
    - c. Square D – Continuous piano hinge trim.
    - d. Siemens – Figure 4 hinge to box w/piano hinge.
  3. Finishes:
    - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
  4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
  3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box as called out on panel schedules.
- D. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus Configured Terminators: Compression type.
  3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  4. Double Lugs: Mechanical type mounted at location of main incoming lugs.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

### **2.03 PANELBOARD SHORT-CIRCUIT RATING**

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

## **2.04 DISTRIBUTION PANELBOARDS**

- A. Main bus bars, neutral and ground, shall be copper and sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- C. Main Overcurrent Protective Devices: As indicated.
- D. Branch Overcurrent Protective Devices:
  - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
  - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
  - 3. Fused switches.

## **2.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Main bus bars, neutral and ground, shall be sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

## **2.06 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
    - a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.
  - 2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings with restricted access cover:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
  - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 6. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
  - 5. Shunt Trip: 120-V trip coil energized from separate circuit.
  - 6. Do not use tandem circuit breakers.
  - 7. Provide lock on devices for circuit breakers when called out on panel schedules with "LOD" designation.
  - 8. Provide GFCI circuit breaker when called out on panel schedules with "GFCI" designation.



9. Provide Arc-Fault Circuit Interrupters where indicated on panel schedule with "AFCI" designation.
10. Provide shunt trip breakers when called out on panel schedules with "STB" designation.

11. Provide smart controllable circuit breakers when called out on panel schedules with "SMT" designation.
12. Provide permanent padlockable handle for circuit breakers when called out on panel schedules with "PL" designation.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Division 26 Section "Fuses."

## **2.07 ACCESSORY COMPONENTS AND FEATURES**

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Provide permanent provisions for padlocking all overcurrent devices in Distribution Panelboards. Provisions shall remain in place whether or not lock is installed.
- C. Provide permanent provisions for padlocking overcurrent devices in Branch Circuit Panelboards that serve equipment not provided with a local, lockable disconnecting means. Provisions shall remain in place whether or not lock is installed

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
  1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### **3.02 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads or created by retrofitting. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Coordinate final directory room names and numbers with Owner.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### **3.03 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.

- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters. Perform electrical tests on all breakers and switches 200A and above or that constitute a component of an emergency distribution system. Main circuit breakers in branch circuit panelboards 225A and below are not required to be tested.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 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. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 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.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
  - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- E. Testing and Certification (Isolation Power Panels)
  - 1. Provide manufacturer's engineer or technician for final testing of Isolated Power Panel and the related system as follows.
    - a. Simulate faults at each receptacle to ascertain correct function of the L.I.M.
    - b. Check the calibration of the L.I.M. meter and record readings.
    - c. Record and date all data in permanent log book.
    - d. Certify that the system is properly installed and in correct working order.
    - e. Turn over to the hospital maintenance department a set of test equipment consisting of a ground integrity tester, current leakage tester, and plug in the L.I.M. tester.

### **3.05 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 26 2726 - WIRING DEVICES

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### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Ground-fault circuit interrupter receptacles
  - 2. Single- and double-pole snap switches.
  - 3. Device wall plates.

#### 1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. PVC: Polyvinyl chloride.
- C. RFI: Radio-frequency interference.
- D. SPD: Surge protective devices.
- E. UTP: Unshielded twisted pair.
- F. USB: Universal serial bus.

#### 1.04 REFERENCES

- A. DSCC W-C-596G: Federal Specification Connector, Electrical, Power, General Specification.
- B. DSCC W-C-896F: Federal Specification Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
- C. IEC 309-1, Part 1: General Requirements: Plugs, Socket-Outlets and Couplers for Industrial Purposes
- D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Device – Dimensional Requirements.
- G. UL 20: General-Use Snap Switches.
- H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- J. UL 498: Electrical Attachment Plugs and Receptacles.
- K. UL 943: Ground Fault Circuit Interrupters.

- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

#### **1.05 SUBMITTALS**

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations for each type of product indicated.

#### **1.06 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### **1.07 COORDINATION**

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
1. Cord and Plug Sets: Match equipment requirements.

### **PART 2 RODUCTS**

#### **2.01 GENERAL WIRING DEVICE REQUIREMENTS**

- A. Comply with NFPA 70, NEMA WD 1, NEMA WD 6, and UL498.
- B. Devices for Owner-Furnished Equipment:
1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.
- C. Device Color:
1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wall Switches: White, unless otherwise indicated.

#### **2.02 GFCI RECEPTACLES**

- A. General:
1. Comply with UL 943
- B. Tamper- and Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
2. Manufacturers: Subject to compliance with requirements, provide one of the following:
- a. Hubbell Wiring Device-Kellems: GFTWRST20
- b. Eaton/Arrow Hart Wiring Devices: TWRSGF20
- c. Leviton: GFWT2
- d. Legrand, Pass & Seymour: 2097TRWR

#### **2.03 STRAIGHT BLADE AND TWIST-LOCK RECEPTACLES, OTHER THAN NEMA 5-20R**

- A. Provide commercial specification grade straight blade and twist-lock receptacles with standard NEMA configurations in accordance with the "Special Receptacles" schedule included on the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Wiring Device-Kellems
2. Eaton/Arrow Hart Wiring Devices
3. Leviton
4. Legrand, Pass & Seymour

#### **2.04 CORD AND PLUG SETS**

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## **2.05 WALL SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems: 1220 Series
  - 2. Eaton/Arrow Hart Wiring Devices: AH1220 Series
  - 3. Leviton: 1220 Series
  - 4. Legrand, Pass & Seymour: PS20AC Series
- B. Device body: Plastic handle.
- C. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- D. Snap Switches: Heavy Duty specification grade, quiet type; rated 20A., 120-277 V AC.
- E. Provide single-pole, two-pole, three-way and four-way switches as indicated.
- F. Provide key type where indicated. Furnish four keys to Owner.
- G. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
  - 1. Switch: 20 A, 120/277-V ac.
  - 2. Receptacle: NEMA WD 6, Configuration 5-20R.

## **2.06 WALL PLATES**

- A. Manufacturers:
  - 1. Provide wall plates and corresponding wiring devices from same manufacturer.
- B. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces:
    - a. 0.035-inch- thick, satin-finished stainless steel
  - 3. Material for Unfinished Spaces:
    - a. Galvanized steel
  - 4. Material for Wet Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Extra Duty Weatherproof While-In-Use.
    - a. Manufacturers:
      - 1) Hubbell: MX3200
      - 2) Red Dot Model: CKLSVU, Thomas & Betts
      - 3) Intermatic: WP3110MXD
      - 4) Leviton: IUM1V
  - 5. Material for Damp Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Weatherproof.
    - a. Manufacturers:
      - 1) Red Dot Model CCGV, ABB Installation Products
      - 2) Eaton/Arrow Hart WLRD1
      - 3) Legrand, Pass & Seymour
      - 4) Intermatic: WP3110MXD

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
- C. Install devices and assemblies level, plumb, and square with building lines.

D. Arrangement of Devices:

1. Coordinate locations of outlet boxes provided under Division 26 Section "Raceways and Boxes" to obtain mounting heights indicated on Drawings.
  2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
  3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
  4. Install horizontally mounted receptacles with grounding pole on the left.
  5. Install GFCI receptacles so that the "Push To Test" and "Reset" designations can be read correctly. If printed in both directions, install with ground pole on top.
  6. Install switches with OFF position down.
- E. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- F. Install weather-resistant type receptacles in all damp and wet locations, including pool environments.
- G. Install weatherproof cover plates on receptacles in damp locations.
- H. Install weatherproof While-In-Use cover plates on receptacles in wet locations.
- I. Install tamper-resistant type receptacles in all locations as required by the NEC (406.12) and as indicated on plan.
- J. Use oversized plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- L. Remove wall plates and protect devices and assemblies during painting.
- M. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

**3.02 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.
- B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

**3.03 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
1. Inspect each wiring device for defects.
  2. Operate each wall switch with circuit energized and verify proper operation.
  3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
  4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

**END OF SECTION**

## SECTION 26 2813 - FUSES

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### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the following:
  1. Cartridge fuses rated 600 V and less for use in switches, panelboards, switchboards, controllers, and motor-control centers.

#### 1.03 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
    - a. Let-through current curves for fuses with current-limiting characteristics.
    - b. Time-current curves, coordination charts and tables, and related data.
    - c. Ambient temperature adjustment information.

#### 1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with:
  1. NEMA FU 1 – Low Voltage Cartridge Fuses.
  2. NFPA 70 – National Electrical Code.
  3. UL 198C – High-Interrupting-Capacity Fuses, Current-Limiting Types.
  4. UL 198E – Class R Fuses.
  5. UL 512 – Fuseholders.



### **1.05 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.

### **1.06 COORDINATION**

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. [Cooper Bussmann, Inc.](#)
  - 2. [Eagle Electric Mfg. Co., Inc.](#); Cooper Industries, Inc.
  - 3. [Ferraz Shawmut, Inc.](#)
  - 4. Tracor, Inc.; [Littelfuse, Inc.](#) Subsidiary.

### **2.02 CARTRIDGE FUSES**

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
  - 1. Feeders: Class J, time delay.
  - 2. Motor Branch Circuits: Class RK5, time delay.
  - 3. Other Branch Circuits: Class RK1, time delay.

## **PART 3 EXECUTION**

### **3.01 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.

### **3.02 INSTALLATION**

- A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.
- B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- C. Install spare-fuse cabinet(s).

### **3.03 IDENTIFICATION**

- A. Install labels indicating fuse rating and type on outside of the door on each fused switch.

## **END OF SECTION**

## **SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

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### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  1. Division 26 Section "Fuses".

#### **1.02 SUMMARY**

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  1. Fusible switches.
  2. Nonfusible switches.
  3. Molded-case circuit breakers.
  4. Molded-case switches.
  5. Enclosures.
- B. Related Sections:
  1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

#### **1.03 DEFINITIONS**

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

#### **1.04 REFERENCES**

- A. NECA 1: Practices for Good Workmanship in Electrical Contracting.
- B. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
- E. NEMA FU 1: Low Voltage Cartridge Fuses.

- F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
- I. NFPA 70: National Electrical Code.

#### **1.05 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.
  - 4. UL listing for series rating of installed devices.
  - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

#### **1.06 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### **1.07 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

## **1.08 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## **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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 FUSIBLE AND NONFUSIBLE SWITCHES**

- A. Manufacturers:
  1. Eaton Corporation; Cutler-Hammer Products.
  2. General Electric Co.; Electrical Distribution & Control Division.
  3. Siemens Industries, Inc.
  4. Square D/Group Schneider.
- B. Fusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, with clips or bolt pads to accommodate specified fuses, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
  1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.
  2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

### **2.03 TOGGLE DISCONNECT SWITCH**

- A. Manufacturers:
  1. Double Pole:
    - a. Hubbell 1372.
    - b. Leviton 6808G-DAC.
    - c. Pass & Seymour 7812.
    - d. Bryant 30102.
  2. Three Pole:
    - a. Hubbell 1379.
    - b. Leviton 7810GD.
    - c. Pass & Seymour 7813.
    - d. Bryant 30103.
- B. Description: Heavy duty, 30A, 600 volt, double or three pole as required, single throw, motor rated switch without overload protection. Provide NEMA 1 enclosure and padlock attachment.

### **2.04 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES**

- A. Manufacturers:
  1. Eaton Corporation; Cutler-Hammer Products.
  2. General Electric Co.; Electrical Distribution & Control Division.
  3. Siemens Industries, Inc.
  4. Square D/Group Schneider.

- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
  - 2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Enclosure: Provide handle capable of being locked in the open position with padlock.
  - 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
  - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

## **2.05 ENCLOSURES**

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Indoor Dry Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Install switches with off position down.
- D. Install NEMA KS 1 enclosed switch where indicated for motor loads  $\frac{1}{2}$  HP and larger and equipment loads greater than 30A.
- E. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than  $\frac{1}{2}$  HP and equipment loads 30A. and less.

- F. Install fuses in fusible disconnect switches.
- G. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" whip.
- H. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
- I. Install control wiring from early break contacts in motor disconnect switch to variable frequency controllers to shut down controller when switch is open.
- J. Install equipment on exterior foundation walls at least one inch from wall to permit vertical flow of air behind breaker and switch enclosures.
- K. Support enclosures independent of connecting conduit or raceway system.
- L. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### **3.03 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."
- C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

### **3.04 FIELD QUALITY CONTROL**

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
  - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Test all NEMA AB1, molded case circuit breakers with thermal magnetic trip or auxiliary, solid-state trip units 100A and larger. Certify compliance with test parameters.
    - a. Visual and Mechanical Inspection
      - 1) Circuit breaker shall be checked for proper mounting and compare nameplate data to Drawings and Specifications.
      - 2) Operate circuit breaker to ensure smooth operation.
      - 3) Inspect case for cracks or other defects.
      - 4) Check internals on unsealed units.
    - b. Electrical Tests
      - 1) Perform a contact resistance test.
      - 2) Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
      - 3) Perform long time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time. Make external adjustments as required to meet time current curves.
      - 4) Determine short time pickup and delay by primary current injection.
      - 5) Determine ground fault pickup and time delay by primary current injection.
      - 6) Determine instantaneous pickup current by primary injection using run-up or pulse method.
      - 7) Perform adjustments for final settings in accordance with coordination study.

- 8) For circuit breakers 800A and larger, verify all functions of trip unit by means of secondary injection in lieu of primary injection.

c. Test Values

- 1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
  - 2) Insulation resistance shall not be less than 100 megohms.
  - 3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
  - 4) All trip times shall fall within N.E.T.A. Acceptance Testing Specifications, Table 10.7 Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
  - 5) Instantaneous pickup values shall be within values shown on N.E.T.A. Acceptance Testing Specifications, Table 10.8 or manufacturer's recommendations.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

**3.05 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

**3.06 CLEANING**

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

**END OF SECTION**



**SECTION 26 2913 - ENCLOSED CONTROLLERS**

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**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
  - 1. Across-the-line, manual and magnetic controllers.
  - 2. Reduced-voltage controllers.
- B. Related Sections include the following:
  - 1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

**1.03 SUBMITTALS**

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current rating of integrated unit.
    - d. UL listing for series rating of overcurrent protective devices in combination controllers.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
  - 2. Wiring Diagrams: Power, signal, and control wiring.

- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Qualification Data: For manufacturer.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Routine maintenance requirements for enclosed controllers and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- H. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

#### **1.04 REFERENCES**

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. ANSI/UL 198C - High-Intensity Capacity Fuses; Current-Limiting Types.
- C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- D. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- E. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- F. NECA 402-2000 – Recommended Practice for Installing and Maintaining Motor Control Centers.
- G. NEMA AB 1 - Molded Case Circuit Breakers.
- H. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- I. NEMA KS 1 - Enclosed Switches.
- J. ANSI/NFPA 70 - National Electrical Code.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Prior to beginning work on any system, verify all existing conditions that affect the work and coordinate with all other trade Contractors. Determine that the work can be installed as indicated or immediately report to the Architect/Engineer errors, inconsistencies or ambiguities.

- B. Deliver products to site under provisions of Section 26 0010. Store and protect products under provisions of Section 26 0010.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift large equipment only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.
- E. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### **1.07 PROJECT RECORD DOCUMENTS**

- A. Accurately record actual locations of each contactor and indicate circuits controlled. Submit under provisions of 26 0010.

#### **1.08 PROJECT CONDITIONS**

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
  - 2. Indicate method of providing temporary utilities.
  - 3. Do not proceed with interruption of electrical service without Construction Manager's written permission.

#### **1.09 COORDINATION**

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- D. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. [ABB Power Distribution, Inc.](#); ABB Control, Inc. Subsidiary.
  - 2. [Danfoss Inc.](#); Danfoss Electronic Drives Div.
  - 3. [Eaton Corporation; Cutler-Hammer Products.](#)
  - 4. [General Electrical Company; GE Industrial Systems.](#)
  - 5. [Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.](#)
  - 6. [Siemens/Furnas Controls.](#)
  - 7. [Square D.](#)

#### **2.02 ACROSS-THE-LINE ENCLOSED CONTROLLERS**

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."

1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated.
  1. Control Circuit: 120 V; obtained from integral control power transformer with sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
  2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
  1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
  2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
  3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

## **2.03 VARIABLE FREQUENCY CONTROLLERS**

- A. Equipment furnished by other trades and installed by electrical trades.

## **2.04 ENCLOSURES**

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## **2.05 ACCESSORIES**

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights: NEMA ICS 2, heavy-duty type.
- C. Indicating Lights: Run (Red), off or ready (Green).
- D. Auxiliary Contacts: Provide two normally open (N.O.) and two normally closed (N.C.) contacts.
- E. Selector Switch: NEMA ISC 2, mounted in front cover to read "hand/off/auto," provide auxiliary contact for auto position monitoring.
- F. Control Relays: Auxiliary and adjustable time-delay relays.
- G. Elapsed Time Meters: Heavy duty with digital readout in hours.
- H. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
- I. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.
- J. Manufacturer provided nameplate shall be provided on controller enclosure. Nameplate shall contain the following information:
  1. Manufacturer's name or identification.
  2. Voltage rating.
  3. Current and/or horsepower rating.
  4. Short-circuit current rating,

## **2.06 FACTORY FINISHES**

- A. Enclosure Finish: The enclosure shall be finished with a brush finish on Type 304 stainless steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 APPLICATIONS**

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

### **3.03 INSTALLATION**

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Install freestanding equipment on concrete bases.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."
- E. Install motor control equipment and contactors in accordance with manufacturer's instructions.
- F. Select and install heater elements in motor starters to match installed motor characteristics.
- G. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

### **3.04 CONCRETE BASES**

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

### **3.05 IDENTIFICATION**

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Electrical Identification."

### **3.06 CONTROL WIRING INSTALLATION**

- A. Install wiring between enclosed controllers according to Division 26 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### **3.07 CONNECTIONS**

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."

### **3.08 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, "Motor Control - Motor Starters, Motor Control - Adjustable Speed Drive Systems." 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.

### **3.09 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### **3.10 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 1 Section "Closeout Procedures."

**END OF SECTION**